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Assessment of Pattern, Distribution, and Determinants of Ocular Morbidity among Residents Seeking Care at Medical Camps in Mathare Slums, Nairobi County, Kenya

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Ocular morbidities are considered a major contributor of disabling conditions in both low and high resourced countries. The overall global burden of eye diseases is estimated at 61.4 million Disability Adjusted Life Years (DALYs) which accounts for 4% of total Disability Adjusted Life Years. There have been strong institutional collaborations on attaining Vision 2020-right to sight, which is a global initiative aimed at reducing preventable level of blindness has enhanced institutional collaboration in fight against blindness. Some eye problems that affects people quality of life but do not result in blindness have been ignored in favor of those causing visual impairment. The residents

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of Mathare slums in Nairobi County, Kenya, seeking care at medical camps, were subjected to an objective eye examination aimed at ascertaining ocular morbidity patterns, causes, and distribution. A descriptive community-based cross-sectional study design was employed. The study persons were patients over ten years who presented with eye-related constraints at the medical camps. The period of study range was between October and November 2022. Results were displayed using descriptions and visualization techniques after data was imported into Excel 2010 for analysis. Results on the pattern indicated a majority of respondents (34.44%) were diagnosed with conjunctiva diseases. This was followed by 30.29% being diagnosed with refractive errors, 11.62% with the cornea, and 8.30% with lens diseases. On distribution, Conjunctiva disease (34.44%) affected most of the respondents, and the majority of these respondents (19.5%) aged between 10 and 20 years affirmed to have atopic Conjunctivitis. A refractive error also commonly affected 30.29% of the participants, with Presbyopia (7.46%) comprising the highest form of refractive error. Cataracts (7.05%) and dry eye syndrome (6.22%) were more evident among patients aged above 40 years. Most of the respondents (43.5%) were found to have pathologies resulting from developmental causes, followed by allergies (24.1%) and refraction errors (10.4%). Hypertension was the most common comorbidity in Mathare slum affecting 12.4% of the respondents; this was followed by peptic ulcer disease (5.4%), diabetes (4.6%), arthritis (2.5%), and lastly, HIV (0.41%). Results showed that ocular Morbidity in the Mathare slum was not associated with determinants like house structure material, number of house rooms, household population, and cooking energy source. It is recommended that health institutions within the Mathare slum and similar contexts be fully equipped with essential eye medications and integrate eye health education in the health facilities. Physical exercise, healthy eating, and medical approved supplements are also recommended to help prevent metabolic disorders and improve age-related eye disorders. Clinical control of existing comorbidities will aid in reducing some eye diseases like cataracts and diabetic retinopathy.

Keywords: Eye diseases; informal settlement; medical camp.

1. INTRODUCTION

1.1 Background of the Study

Currently, eye conditions contribute to noninfectious disabling conditions in low, mid, and high income countries [1]. A global initiative called Vision 2020 - right to sight has made it a priority to end avoidable blindness and has helped to forge a strong sense of solidarity in the fight against blindness. Even though this is crucial, it has resulted in ignoring other, non-blinding disorders that negatively impact functionality and quality of life [2]. Everyone is affected by the ocular disease; the only difference is the structure and dispersion of the condition, which depends on geographic location, ethnicity, sex, age, socioeconomic position, and climatic circumstances [3,4].

There was a study regarded as the first to attempt to quantify the burden of diseases using a unit of measurement called the disability-adjusted life year (DALY). The Global Burden of Disease (GBD) is measured using the DALY, a public health metric that combines information on death, Morbidity, and disability into a single unit [5]. A single DALY is defined as a "healthy" year of life lost to illness and the difference between the current health situation and the ultimate vision, where all individuals might survive till old age without suffering from illness or impairment. The Global Burden of Diseases study reveals the true impact of underdiagnosed disorders and diseases, most of which do not directly contribute to mortality [5].

A significant burden is caused by eye diseases, which account for 4% of total DALYs, and about 61.4 million people suffer from eye diseases globally. The notable contributors to the eye diseases burden are cataracts (17 million DALYs), ammetropia (27.7 million DALYs), maculopathies (9.3 million DALYs), trachoma (1.3 million DALYs), glaucoma (4.1 million DALYs), and Vitamin A deficiency (0.2 million DALYs) [5]. The majority of blinding eye conditions can be avoided or treated. According to the World Health Organization, 269.0 million people have low vision, 314.0 million people around the globe have visual impairment, and 45.0 million people are blind globally. The numerous eye diseases are causes of vision impairment and blindness in low- and middle-income nations where 90% of all blind and visually impaired persons live. The incidence of ocular illnesses is 15.52 percent in Kenya, and it was noted to rise with age from 6.4 percent in

children aged below five years to 52.4% in people aged over 75 [2].

A Municipal Health Assessment conducted in Bangladesh (2013) reported that people in informal settlements undergo poor physical and mental health compared to the other parts of the globe, which are better economically. Thus, it's critical to provide those people living in slums with complete eye care services [1]. Healthcare organizations in underdeveloped countries, like Kenya, frequently concentrate on treating disorders that cause blindness. While important, this method typically undervalues the burden of eye illnesses and the need for health services that it creates. According to the literature, persons who live in poverty are more likely to contract diseases because they lack access to suitable housing, food, water, healthcare, and education [1].

People perceive health as a personal issue while in trying to assure the public of health, it is necessary that the work goes beyond the focusing of health on an individual's status. Health requires a population health approach in its effective management. It is necessary to transform national health policy, which for the longest time has been based on a traditional stance of biomedical research and basing only on the health services of an individual. That will help in broadening the commitments that exist and will affirm the broader health perspective that should be adopted. Taking and handling health from a perspective of population as opposed to individual perspective commits a country to act and comprehend diseases on a full scale that positively affects the health of a generation [6]. A nation's healthcare policy design and implementation require awareness of a disease's political, social, and pattern profile [7]. This is more crucial in communities with few resources when the socioeconomic weight of illness is concentrated and basic supplies are few [8].

With the right interventions, which begins by understanding the pattern of ophthalmological diseases, the anticipated rise in global impairment to above 75.0 million by 2020 could be decreased to roughly 24 million with the right interventions [4]. In bid to address economic, social and cultural atmospheres at local and national levels then, a nation must move away from only depending on the traditional sectors which are the health care delivery sectors and government public health agencies [6]. The Institute of Medicine Committee conducted a study in bid to identify the determinants of a nation's health system and tried figuring out the strategies that should be considered in creating a national strategy that is effective in assuring its population on health [6]. The ultimate improvement and understanding the health of a population not only lies with comprehending the population perspective but also on comprehending the biological interconnectedness of domains, physical, behavioral domain, socio-environment and health ecology domains. Understanding these conditions will enable the achievement of right to

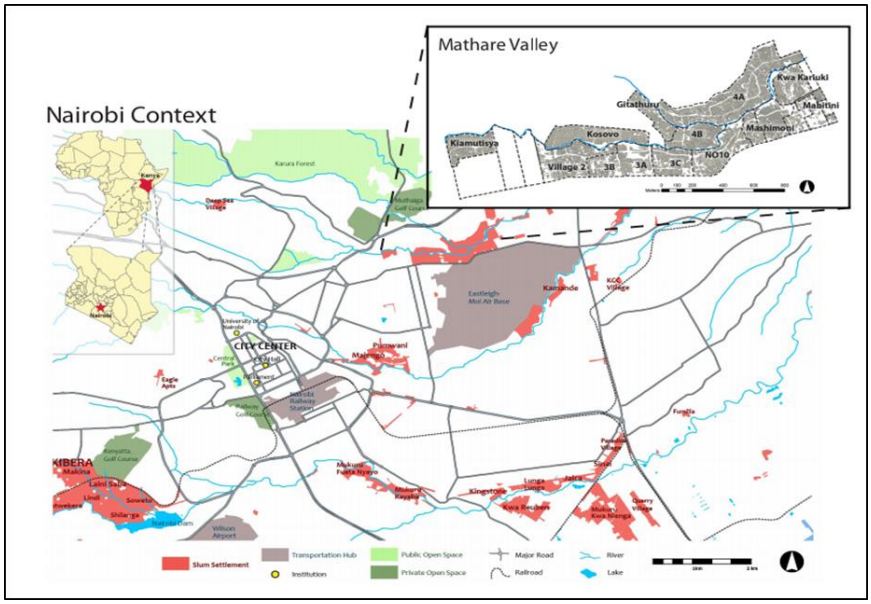

Fig. 1. MAP of Study area

sight for all according to the Vision 2020 strategies and attain the required targets and levels of risk reduction for eye illnesses; this can also be approached by describing the distribution of ocular illnesses in the Mathare slum.

This study seeks to establish the prevalence of ocular morbidity through a research study in Mathare slum. That is a population based approach in health care which seeks to move away from just depending on the number of cases registered in facilities, but to best understand the behavior and pattern of ocular morbidity from a population perspective as opposed to individual perspectives. To eradicate a medical threat to a population, it is good to look at how it occurs and whether it can be prevented. From the statistics given by the WHO [5], it is evident that ocular morbidity and visual impairments' are at sky-rocketing figures across the globe and in devolving this responsibility an enduring solution can be achieved if a public health population based approach is adopted. The first step in implementing the right to sight mandated by Vision 2020 in Kenya is describing the distribution of ocular illnesses in the Mathare slum.

2. METHODOLOGY

2.1 Research Design

We conducted a community-based descriptive cross-sectional study using a quantitative research design method. The study included the administration of questionnaires to the participants who in turn submitted back to for analysis.

2.2 Area of Study

The Mathare slum, roughly 2.5 miles from the Nairobi Central Business Area, served as this community-based study's (CBD) site. With a population of between 500,000 and 800,000 people crammed into a single square kilometer, Mathare is the second-largest slum in Kenya [9]. The average age of the population is considered to be under 30 years. The dwellings are one-room structures made of wood, mud, or tin that is crudely built. Eight individuals live in each household on Average. The greatest issues in the area are unemployment, a lack of clean water, and inadequate sanitation, which exposes the populace to infectious diseases [9].

The severely polluted Mathare River runs through the neighborhood directly in the middle, exposing the locals to water-borne infectious diseases that also impact the eyes. Three non-governmental organizations that operate level 3 hospitals and offer subsidized healthcare to Mathare inhabitants serve as the community's main sources of healthcare. Locals can also receive services from several private clinics. The only institution offering eye care services is more than 10 kilometers away, which presents a barrier to those, seeking eye health. Three medical camps were held at Heide Marie Primary School (formerly Mathare 4A). Mathare is just like many other localities within Kenya which do not have adequate facilities which specialize on eye care. The facilities available are very far and some are very expensive for the local population to afford. That is one amongst the many reasons which cause the individuals who have eye issues to assume and not get treated at all.

2.3 Target Population

The population which was targeted for the research study included both male and females of ages from 10 years and above. The study included individuals who visited the eye care center and whose records were preserved at the facility. The study involved individuals of all social cycles and with diverse cultural beliefs and those working and unemployed. So many of those seeking medical attention come to the medical outreach with sight problems or unusual eye findings.

2.4 Inclusion Criteria

1) All medical camp eye health seekers with at least six months of Mathare residency.
2) All medical camp Eye health seekers aged above ten years.
3) All eye health seekers who are physically and clinically stable to undertake a full eye examination

Exclusion Criteria

1) Eye Health seekers with less than six months' residency status or those living outside Mathare slums.
2) Very sick patients and those with unstable blood pressure and serum glucose levels.
3) All medical camp attendees are unable to coherently express themselves due to physical or mental status.

2.5 Study Period

The research study was carried out from 1st October 2022 to 1st November 2022.

2.6 Sample Size Determination

Sample size determination was found using the single population proportion formula:

$$N = \frac{(1.96)^2(0.16)(1-0.16)}{(0.05)^2} = 207$$

Prevalence of eye diseases in Kenya is 15.52%

$$Z^2 = 1.96^2$$
$$P = 0.16$$
$$d^2 = 0.05^2$$

Add 16% (34 participants) of the estimated missing data, the total number to be sampled is 241

n: Sample size
Z: Z statistics for a level of confidence
P: Expected prevalence or proportion
d: Precision

The sample size considered a confidence level of up to 95% and an error margin of 5%. In this case, P is considered as the proportion of patients (15.52%) with ocular Morbidity [2] d2 is the margin of error (0.05) [2,10]. On calculation: -

Therefore, the final sample size was 241 participants.

2.7 Sampling Procedure

A systematic sampling method was used. The researcher anticipated reviewing 725 people with eye complaints, which was arrived at using the national eye morbidity prevalence of 16% of the 4850 patients seen in a similar medical camp in 2021(German Doctors Nairobi, 2021). The sampling interval of every 3rd participant was achieved by dividing the anticipated number of 725 by the sample size of 241 participants. After signing up for the camp, new eye patients received a patient card containing their microbial information (Age, gender, name, contact information, and residence) and were then directed to the medical Centre. Vital signs were collected at the nursing station before the patient was sent to an eye doctor for consultation and examination. In the consultation room, the first participant for the day was noted as the first study participant. The sampling started by selecting the first person from the number issued at the registration point. Then, every third participant in the frame was recruited to participate in the study.

2.8 Consenting

Study protocols were explained, and the Participants were made aware of the intention to use their clinical data for research. There was no coercion, and one could opt out at any point in the study. Participants were explained clearly in the language they understood that participation is voluntary and neither material nor financial gains will be extended to them. Minors under 18 years had a right to participate in the study, of which they could opt in or out of their own free will, but their legal guardians consented. Upon agreement, their thumbprint or signature was affixed onto a questionnaire consenting section.

2.9 Research Instruments

1) Sharp vision Snellen's chart (used by readers), the Illiterate 'E' chart (by non-readers), and Lea symbols are all commonly used charts (for ages of 3 to 5 years).
2) Examination of the anterior region and adnexa using a torch
3) Anterior section eye test magnifying lens
4) Questionnaire
5) Direct ophthalmoscope for assessment of the posterior section and retina
6) Pinhole cameras and refractive lenses.
7) Near chart for evaluating near vision
8) A portable auto-refractor that can measure and describe the refractive error

2.10 Pretest

Pretest was carried out two weeks before the study. It was carried out at Baraka Health Center-Mathare; the site was chosen because it is the only health facility in the area and 10km radius that offers eye services. It serves an average of 100 eye patients weekly and is the first-choice health facility among locals due to its affordability [11]. There were 30 participants involved in the pretest (15 health workers and 15 patients). Health workers were involved in refining the questions in the questionnaire and reviewing other technical areas in the questionnaire and research instrument. The help of 15 patients evaluated patient flow and duration of the questionnaire administration. Shortfalls were identified and addressed in the process.

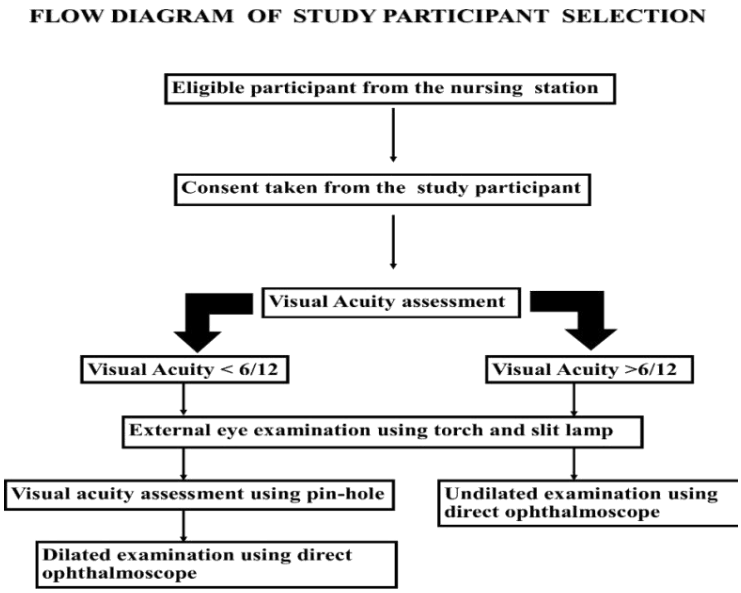

Fig. 2. Flow chart of participant recruitment and eye examination

2.11 Data Collection Procedure

The questionnaire was formulated from the literature review and based on past relatively similar studies. The research assistant underwent two-day training, and a pretest was carried out to ensure the validity and reliability of the instruments.

1) Community health volunteers carried out community mobilization. A month-long series of three medical camps are held once a week each.
2) Study When campers reported eye symptoms, they were logged in the camp registry, where bio-demographic information was recorded.
3) The nursing station, where vital signs were gathered and entered into the patient file, was where they were told to go.
4) The study participants visited the eye doctor, who conducted the following procedures:

    a) The participant's visual acuity was assessed while they were three meters away from the chart (only the eye with the best visual acuity was recorded in this study). Pinhole examinations were performed on those whose visual acuity was less than 6/18 to rule out refractive error.
    b) An optometrist examined those who had refractive errors to identify their kind of error.
    c) Poor eyesight with a pinhole required a fundoscopy to examine the retina.
    d) The anterior segment and ocular adnexa were assessed using a torch examination and a slit light.
    e) To rule out squinted eyes, the Hirschberg test was conducted.
    f) A standardized questionnaire with individual participant numbers was used to document the clinical findings.
    g) Patients who needed more in-depth testing were directed to the eye department at the main hospital.

2.12 Validity

1) Researchers and assistants: The assistant researcher was trained on the study protocols that included participants' recruitment. The principal researcher was licensed allied eye health personnel with over five years of experience diagnosing and treating eye diseases. An ophthalmologist licensed to practice in Kenya with over ten years of experience in eye care provision was present in the medical camp to validate and authenticate the diagnosis and clinical procedures. An Optometrist licensed to practice in Kenya with over three years of experience in providing eye services was present to diagnose and treat refractive disorders.
2) A pilot study was conducted 14 days before the study, during the research assistant's

training. The aim was to authenticate the questionnaire and the study instruments.

2.13 Data Reliability

- Examining instruments: The above-listed instruments were well calibrated per the Kenya medical board and Kenya bureau of standards. The instruments used were pulled from a working hospital environment and were continually used in a hospital eye department.
- Questionnaire: It was formulated as per the study objectives. The questions were developed as per the literature r eview. Pretest was performed to ensure the credibility and accuracy of the questions

2.14 Data Analysis

Data were entered into SPSS version 26, and Excel 2010 multivariate analysis was used to correlate dependent variables like causes of eye diseases, social and economic factors, and patient vulnerability factors with independent variables of ocular disease. The measure of central tendencies was used to analyze the pattern and distribution of eye diseases. The distribution of diseases by age and gender was presented in proportions and ratios. Data visualization techniques of tables, graphs, and pie charts were used in the presentation.

3. RESULTS AND DISCUSSION

3.1 General Characteristics

A total of 241 questionnaires were administered to research participants selected from study participants presenting with eye complaints at the medical camp. The purpose of demographic information in the study was to determine demographic characteristics among patients presenting with eye complaints at the medical camp. This would also give a general profile of respondents and ascertain that the study findings represent diverse experiences with ocular Morbidity based on the different demographics. In this regard, the information that was sought consisted of the respondents' respective age brackets, gender, and comorbidities. The outcomes are reported in percentages and frequencies and presented in tables, charts, and graphs. Among the respondents, there were more females (65.56%) than males (34.44%). The modal age group among the females was those above 40 years, and among the males, it was between the ages of 10-20 years.

Respondents' age brackets were recorded to determine the age distribution among patients presenting with eye complaints at the medical camp. For pediatric and adolescent respondents, consent was sought from their accompanying parents or guardians. The results were as illustrated in Fig. 3.

Findings illustrated in Fig. 3 show a majority of respondents (39.8%) were middle to old aged, affirming to more than 40 years of age, followed by 38.2% aged between 10 and 20 years of age. Further, 18.3% of respondents indicated they were adults between 30 and 40, while 3.7% were between 20 and 30. The finding implies that patients presenting with eye complaints at the medical camp were from diverse age groups, most of who were in the middle to advanced age category. Interestingly, a considerable number of patients were below 20 years old. Ocular Morbidity can thus be deemed prevalent across the ages, but mainly among middle- to old-age adults and below 20 years.

These study findings on gender and age corresponded with results from other various studies locally and across the globe like one in Dhaka city slums. The mean age was 37.9 (SD±13.30) years and over half of them were from the age of 18 to 40 years of age" [1]. A study carried out in the slum of central India also reported the same gender distribution among study subjects of male (51.43%) and female (48.57%). This might be because most developing nations have a youthful population and a positive attitude of women towards health (Khadse et al., 2014). In West Nigerian, semi-urban community, the mean age of 104 participants was 38.3±16.6 years, with 71.2% of participants being females and 28.8% males. About 30.8% of study persons were in the age range of 41-50 years [12].

In Mbeere, Kenya, a population based survey examined 56.90% and 43.1% females, the mean age of participants was 17 years [2]. At a Kenyatta National Hospital study among HIV-infected population, the modal age group was 36-45 years. There were more female (66.5%) participants than male (33.5%) [13]. Another study carried out in Korogocho slums had a mean age of 30 years; females (58%) were more than males (42%) [14].

Chart 1. Respondents' age group and gender

Age-group	Female		Male		Total (%)
	Frequency	Percentage	Frequency	Percentage	
10-20 Yrs.	32	13%	35	15%	28%
21-30 Yrs.	20	8%	5	2%	10%
31-40 Yrs.	38	16%	15	6%	22%
Over 40 Yrs.	68	28%	28	12%	40%

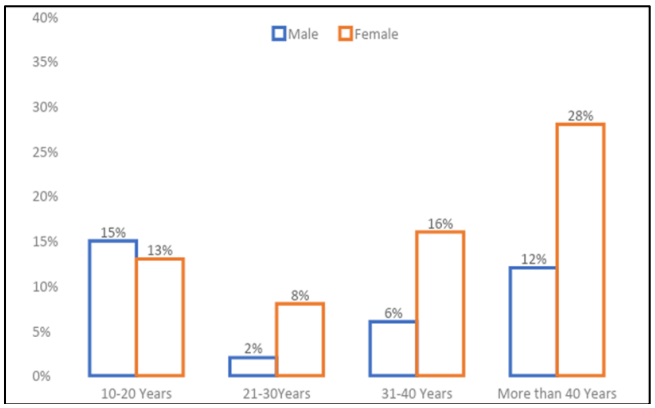

Fig. 3. Respondents' age bracket

Table 1. Social economic factor

Employment Status	**n**	**%**
Formal employment	12	5.0
Informal employment	48	19.9
Not applicable	22	9.1
Self-employment	42	17.4
Student	87	36.1
Unemployed	30	12.4
Total	241	100.0
Monthly Income	**n**	**%**
Less than Kshs15,000	88	36.7
Between Kshs15,001-25,000	69	28.6
Between Kshs25,001-50,000	46	19.1
Above Kshs50,000	38	15.6
Total	241	100.0
House Structure	**n**	**%**
Brick/stone	159	66.0
Iron sheets	71	29.5
Mud	10	4.1
Others	1	.4
Total	241	100.0
Number of Rooms	**n**	**%**
Double	41	17.0
More than 3	53	22.0
Single	147	61.0
Total	241	100.0
Windows in the House	**n**	**%**
Three or more	51	21.2
None	15	6.2
one	129	53.5
two	46	19.1
Total	241	100.0

Number of room occupants at a particular time	n	%
1-3	130	53.9
4-6	96	39.8
7 & above	15	6.2
Total	241	100.0
Cooking Energy Source	**n**	**%**
Charcoal	31	12.9
Firewood	1	.4
Kerosene	62	25.7
LPG	147	61.0

3.2 Socioeconomic Factors

In this section, the study sought to assess the socioeconomic factors among patients presenting with eye complaints at the medical camp. This would indicate the prevalence of ocular Morbidity among patients based on their socioeconomic characteristics. The findings would also indicate the socioeconomic factors resulting from ocular morbidities in Mathare slum-Kenya. The outcomes are reported in frequencies (n) and percentages (%) and presented in Table 1.

As presented in Table 1, most respondents (36.1%) affirmed to be students, followed by 19.9% indicating that they were under informal employment. This was closely followed by 17.4% being self-employed, 12.4% unemployed, and only 5.0% formally employed. Most respondents (36.7%) indicated earning less than Kshs 15,000 a month, followed by 28.6% with a monthly income of between Kshs 15,001-25,000. A further 19.1% claimed to earn between Kshs 25,001 and Kshs50,000, while 15.6% earned above Kshs50,000.

Concerning house structure, most participants (66.0%) indicated that their homes were made of stones or bricks, while 29.5% indicated that their houses were made of iron sheets. A further 4.1% indicated that they lived in mud houses. Findings illustrated in Table 2 further show that the majority (61.0%) of respondents lived in single-unit houses, distantly followed by 22.2% in houses with more than three rooms. A further 17.0% of respondents affirmed living in a double room. Similarly, most respondents (53.5%) affirmed living in rooms with only one window, while 21.2% indicated that their respective houses had three or more windows.

Most respondents (53.9%) indicated that their respective houses had one to three room occupants at a particular time, followed by 39.8% with between four and six occupants at a particular time. Only 6.2% of patients indicated that their houses had seven and above room occupants at a particular time. Concerning cooking energy sources, most respondents indicated that their main source of cooking energy was liquefied petroleum gas (LPG). This was followed by 25.7% who used kerosene as their source of cooking energy, while 12.9% used charcoal. Only 0.4% indicated that they used firewood.

The finding implies that patients presenting with eye complaints at the medical camp exhibit diverse employment statuses, most of whom were students, self-employed, and informally employed. The finding also implies that most patients presenting eye complaints at the medical camp lived in brick/stone, while many lived in houses made of iron sheets and mud. Results also imply that most patients were of low-socio-economic status; the household income of the majority was less than 15,000 Kenyan shillings, with their respective houses consisting of single-unit rooms with one window. A number of them were, however, considerably well-off with a household income of above 25,000 Kenya shillings and living in houses with more than three rooms that were well-ventilated with multiple windows.

The previous is further confirmed with most house holdings consisting of one to three room occupants at a particular time, followed by households with between four and six occupants at a particular time. While most households use LPG as their energy source, indicating a moderate socioeconomic standing, the same could be attributed to housing conditions that were unfavorable to alternative energy sources. Ocular Morbidity can thus be deemed prevalent across different socioeconomic standings as represented by employment status, housing structure, number of rooms and windows in the house, number of room occupants at a particular time, and cooking energy source.

Factors such as, type of occupation, the working environment, level of education, income and

socialization patterns considerably impact ocular health [15]. Our results corresponded with findings by Mokwuah et al. study conducted between October 2017 and March 2018 in trying to determine socio economic factors which affect ocular morbidity amongst industrial workers in a coal camp in Enugu in Nigeria [15]. There is a significant blindness and visual impairment burden which is associated with occupational and industrial activities and it is of great importance to public health. The objective of the study by Mokwuah et al. was on determining how ocular morbidity is affected by socio-economic variables. The study involved 150 volunteers; it collected data and information on socio-demographic characteristics using interviews. Results demonstrated production and manufacturing activities have had devastating contributions to the problems in the society such as ocular morbidity and in extremes have led to death.

In our Mathare slums study, we explored type of occupation aiming at reviewing risks posed by workers working in different employment categories. Informal sector is widely known to pose greatest risks to workers. Study by Isaac et al noted that industrial working environment has posed adverse effects to the ocular health of the workers in terms of illnesses such as blindness and visual impairment [15]. Working environments, specifically industrial, are key factors in the increasing rates of morbidity, which culminates in hardships and suffering of the worker and their families. It also subsequently increases the burden posed to the society since it results in increased welfare and medical services use expenditure [15].

Social economic factors and variables such as gender, age, level of income, type of occupation, time spent in a certain working environment and whether there are any eye protective gears used during the period of work impact ocular morbidity largely [15]. Occupational eye disorders show one of the most complex groups of harmful exposures, traumatic eye injuries, undiagnosed ocular illness which is not corrected, eye fatigue and strain from poorly light working conditions [16]. These cases are common in sectors such as the processing, manufacturing, production and construction sites. The great growth in population and rapid urbanization has presented patterns of risk factors which are linked to industrialization and cause morbidity including eye diseases [16].

According to studies, unequal access to effective eye care treatments may be a factor in sight problems. Various studies have noted medical inequality and social-economic determinants are important factors in ocular morbidities in slum areas [17]. Social determinants of health are broader social, political, and economic forces that affect people's lives. A Singapore-Chinese study multivariable models found men (OR (95% CI): 2.80 (1.79–4.39)), younger persons (per year decrease in age (1.03 (1.00–1.05)) and lower education levels (1.8 (1.25–2.60); comparing ≤6 years against >6 years of education) were independent determinants of ocular Trauma (Wong et al., 2018). In an Urban slum of Central India, the prevalence was significantly more in widows/widowers (73.7%) than in other groups of marital status (48.5%), upper socio–economic status (74.4%) than other groups of socioeconomic status (48.7%), joint family (56.3%) than nuclear family (40.7%) and the Muslim community (52.1%) than Hindu community (42.6) [18].

It was found in a systematic review study that some comorbidity is more closely related to ocular disorders. Several ocular illnesses coexisting are more common than thought. Notwithstanding refractive problems, glaucoma, cataracts, uveitis, age-related macular degeneration, and dry eyes can all be identified simultaneously. Ocular comorbidities are also much more common as people become older. According to Pinazo-Durán et al. (2016), certain conditions, including diabetes mellitus, high blood pressure, arthritis, hyperthyroidism, neurodegenerative disorders, hematologic malignancies, and systemic infections, are openly accepted to influence the eyes and [19]. In Cape Town, South Africa, those over the age of 80 (odds ratio (OR) 6.9 95% CI 4.6-10.6), those in the poorest socioeconomic category (OR 3.9 95% CI 2.2-6.7), and those with no formal education (OR 5.4 95% CI 1.7-16.6) had the highest prevalence of vision loss [20]. Age, education, occupation, and smoking-related behaviors are all substantially correlated with ocular morbidities in Mbeere, Kenya. Ocular morbidities are prevalent (40.38%), and age, education, occupation, and smoking substantially impact their prevalence [18]. There was no connection between employment status or educational level and ocular illness [2].

3.3 Pattern of Ocular Morbidity in Mathare Slum-Kenya

The study sought to assess the pattern of ocular Morbidity in the Mathare slum. To this end, patients presenting with eye complaints at the medical camp were examined, and their final diagnosis was indicated.

As presented in Table 2, most respondents (34.44%) were diagnosed with conjunctiva diseases. This was followed by 30.29% being diagnosed with refractive errors; 11.62% with cornea diseases; 8.30% with lens diseases; 3.32% with orbital disease, neuro-ophthalmology, and other unclassified eye diseases; 2.49% with eyelid diseases, and 1.66% with retinal diseases. Only 1.25% of patients were diagnosed with one of the eye diseases affecting more than one eye structure. The finding implies that the most prevalent ocular disease in Mathare slum is conjunctiva disease. Refractive errors, cornea and lens diseases were found to be significant eye diseases among Mathare residents. Results are summarized and presented in percentages as indicated in Table 2

The study also sought to assess the pattern of ocular Morbidity in Mathare slum based on patients' chief complaints, best eye-corrected visual acuity, eye segment affected and source of pathology. Results are presented in frequencies and percentages as indicated in Tables 3, 4.and 5.

As shown below in Table 3 most patients (29%) complained of red/itchy eyes, followed by 26.2% complaining about poor vision. A further 12.4% mainly complained of foreign body sensation, 11.9% complained of eye pain, and 9.9% complained of a headache. Other less prevalent chief complaints included sight loss (2.9%), side gaze (2.5%), tearing (1.7%), photophobia (0.8%) and others (2.5%). Table 4. indicates that most respondents with red/itchy eyes presented with conjunctiva diseases (77%), and with poor vision, 60% were diagnosed with refractive errors. Foreign body sensation was the third most common chief complaint, with most respondents (59%) presenting with dry eye syndrome classified under other diseases. Eye pain was more common among patients presenting with conjunctiva diseases (34%) and headaches among respondents with refractive errors.

Table 2. Pattern of ocular morbidity

Disease category	Age in years				Total
	10-20	21-30	31-40	above 40	%
Conjunctiva disease	21.58%	1.66%	5.39%	5.81%	34%
Refractive errors	8.72%	2.08%	5.39%	14.11%	30%
Retina disease	0.83%	0.00%	0.42%	0.42%	2%
Orbital disease	2.49%	0.00%	0.00%	0.83%	3%
Neuro-ophthalmology	2.49%	0.00%	0.00%	0.83%	3%
Lens disease	0.42%	0.00%	0.83%	7.05%	8%
Eyelid disease	0.83%	0.00%	0.83%	0.83%	2%
Others	1.25%	0.00%	0.83%	1.25%	3%
Cornea disease	1.25%	0.00%	3.32%	7.05%	12%
Multiple diseases	0.83%	0.00%	0.42%	0.00%	1%
Total	**40.67%**	**3.74%**	**17.43%**	**38.18%**	**100%**

Table 3. Patient chief complaint

Chief complaint	n	%
Eye pain	29	11.9
Foreign body sensation	30	12.4
Headache	24	9.9
Photophobia	2	.8
Poor vision	63	26.2
Red/itchy eye	70	29
Side gaze	6	2.5
Sight loss	7	2.9
Tearing	4	1.7
Others	6	2.5
Total	**241**	**100.0**

Table 4. Showing the chief complaint and final diagnosis

Chief complaint	Final diagnosis										
	conjunctiva	cornea	Eye lid	lens	Multiple diagnosis	Neuro ophthalmology	orbital	others	Refractive error	Retina	Total
Eye pain	34%	3%	3%	7%	0%	3%	10%	17%	21%	0%	100%
Foreign body sensation	24%	7%	0%	0%	3%	0%	0%	59%	7%	0%	100%
headache	8%	4%	0%	0%	0%	0%	0%	59%	7%	0%	100%
others	50%	17%	0%	0%	0%	17%	17%	0%	0%	0%	100%
photophobia	50%	0%	0%	0%	0%	0%	0%	0%	50%	0%	100%
Poor vision	2%	3%	0%	24%	2%	3%	0%	2%	60%	5%	100%
Red/itchy eye	77%	1%	4%	3%	1%	0%	0%	8%	4%	0%	100%
Side gaze	0%	0%	0%	0%	0%	67%	0%	0%	17%	17%	100%
Sight loss	0%	0%	0%	57%	0%	0%	0%	0%	0%	43%	100%
tearing	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%

Table 5. Best eye-corrected visual acuity

Category	n	%
Blind (3/60 or 0.05)	7	2.9%
Mild (6/12 or 0.5)	40	16.6%
Moderate (6/18 or 0.3)	37	15.4%
Normal (6/6to 6/9 or 1.0 to 1.2)	139	57.7%
Severe (6/60 or 0.1)	18	7.5%
Total	**241**	**100.0%**

Table. 6 Eye segment affected

Eye segment affected	n	%
Conjunctiva	102	42.4
Cornea	9	3.7
Eyelid	9	3.7
Lens	23	9.5
Neurological	2	.8
Orbit	6	2.5
Refractive Error	74	30.6
Retinal	9	3.7
Uvea	4	1.7
None	3	1.2
Total	**241**	**100.0**

The finding indicates that the most prevalent complaints among patients with ocular Morbidity in Mathare slum include a red/itchy eye, an indicator of conjunctiva diseases. A complaint of Poor vision was more common among respondents with refractive errors, and foreign body sensation was common among those with a diagnosis of dry eye syndrome, classified among other diseases. Rare chief complaints included sight loss, side gaze, tearing and photophobia.

As presented in Table 5, most respondents (57.7%) recorded normal (6/6 to 6/9 or 1.0 to 1.2) corrected visual acuity. This was followed by 16.6% who had mild (6/12 or 0.5) corrected visual acuity, then moderate (6/18 or 0.3) (15.4%). Only 7.5% recorded severe (6/60 or 0.1) corrected visual acuity, and 2.9% were blind (3/60 or 0.05). The finding implies that most patients had the best-corrected vision of normal (6/6 to 6/9 or 1.0 to 1.2). Other less prevalent best-corrected visual acuity included mild (6/12 or 0.5) and moderate (6/18 or 0.3). In contrast, the least prevalent best-corrected visual acuity among patients with ocular Morbidity included severe (6/60 or 0.1) and blind (3/60 or 0.05).

As shown in Table 6, most respondents (42.4%) had conjunctiva pathology. This was followed by 30.6% having refractive error and 9.5% having lens pathology. A further 3.7% had their cornea, eyelid or retina with some pathology. Other defects included orbital (2.5%), uvea (1.7%), neurological (0.4%) and brain pathology (0.4%). The findings showed that conjunctiva pathology and refractive error were the most commonly affected eye segments. This is in tandem with the most prevalent diagnosis. Other less prevalent eye segments affected included the lens, cornea, eyelid and retina. The least common eye ailments were orbital, uvea and neurological pathology.

The pattern of eye disease involvement amongst Mathare study population corresponded with other studies in the continent, like in Ghana cross sectional study which ranked most prevalent eye disorders as conjunctivitis (39.70%), cataract (24.40%), glaucoma (9.70%) and refractive errors (8.90%) [3]. The results mentioned in our study further agree with other researches which indicated that corneal ulcers, cataracts, uveitis, Conjunctivitis, glaucoma, refractive errors, and Presbyopia were the most prevalent eye illnesses [4,7,10,21]. In another Nigerian study, in the occupation sectors which were considered for the study included 12 females and 138 males which are 8% and 92.0% respectively. The study recorded the highest prevalence as pterygium at 25.33% which was then followed by cases of presbyopia (22.6%), cataract registered at a rate of 10.6% and allergic conjunctivitis registered 14.00%. The group between 41-48 years recorded the highest prevalence of ocular morbidity at 25.3% then the age group of workers between 49-56 years at a rate of 22.6%, ages

33-40 registered a rate of 16% and the workers in the age group between 25-32 years at 12%. The younger population of ages between 17-24 had the least prevalence of ocular morbidity [15].

Similar results were recorded in Ethiopia where Amblyopia (14.3%), refractive error (47.1%), ocular Trauma (11.8%), and corneal opacity (16%) were found to be the most prevalent ocular problems in children in a rural hospital-based descriptive research in Ethiopia [22]. Presbyopia (25.11%) was found to be the most common ocular condition among participants over 35 years old in a Kenyan population-based survey conducted in Mbeere, followed by lens pathologies (32.5%) and conjunctiva pathologies (31.31%) [2].

3.4 Distribution of Ocular Morbidity in Mathare slum-Kenya

The study sought to determine the distribution of ocular Morbidity in the Mathare slum. To achieve this, the study sought to distribute ocular morbidity diagnosis by age, gender and comorbidities. Results are presented in frequencies and percentages as indicated in Tables 7, 8 and 9. As shown below in Table 10, Conjunctiva disease (34.44%) affected most of the respondents, and the majority of these respondents, 19.5%, aged between 10 and 20 years, affirmed to have atopic Conjunctivitis. A refractive error also commonly affected 30.29% of the participants, with Presbyopia (7.46%) comprising the highest form of refractive error.

Cataracts (7.05%) and dry eye syndrome (6.22%) were more evident among patients aged above 40 years. The findings indicate that, while ocular Morbidity is distributed across age categories in Mathare slum, some morbidity are more prevalent in certain age-groups. Conjunctivitis (19.5%), myopia (3.74%) and hypermetropia (2.08%) are, for instance, more prevalent in children below 19 years of age, while cataract (7.05%), Presbyopia (7.46%) and the dry eye syndrome (6.22%) are more prevalent in older populations aged above 40 years. These statistics were significant at a Pearson Chi-Square value of .014 (<.05) and a likelihood ratio of .008(<.05).

Table 7. Distribution of ocular morbidity by age

Disease category	Disease subcategory	Age in years			
		10-20	21-30	31-40	above 40
Conjunctiva disease					
(34.44%)	Atopic conjunctivitis	19.50%	0.83%	1.66%	1.66%
	Conjunctiva cyst	0.00%	0.00%	0.42%	0.00%
	Conjunctiva mass	0.00%	0.00%	0.42%	0.00%
	Mucopurulent conjunctivitis	1.25%	0.42%	0.42%	1.25%
	Pingueculitis	0.00%	0.42%	0.42%	0.42%
	Pterygium inflammation	0.00%	0.00%	2.08%	2.08%
	subconjunctival hemorrhage	0.83%	0.00%	0.00%	0.42%
Refractive errors					**30.29%**
(30.29%)	asthenopia	0.42%	0.42%	0.00%	1.25%
	Astigmatism	2.49%	1.25%	2.91%	2.49%
	Hypermetropia	2.08%	0.00%	0.83%	2.08%
	Myopia	3.74%	0.42%	1.25%	0.83%
	Presbyopia	0.00%	0.00%	0.00%	7.46%
Retina disease					
(2.49%)	Choroiditis	0.00%	0.00%	0.42%	0.00%
	Diabetic retinopathy	0.00%	0.00%	0.00%	0.42%
	glaucoma	0.00%	0.00%	0.00%	0.83%
	optic nerve atrophy/neuropathy	0.00%	0.00%	0.00%	0.83%
	retinal coloboma	0.42%	0.00%	0.00%	0.00%
Orbital disease					
(1.66%)	dermoid cyst	0.42%	0.00%	0.00%	0.00%

Disease category	Disease subcategory	Age in years			
		10-20	21-30	31-40	above 40
	endophthalmitis	0.00%	0.00%	0.00%	0.42%
	orbital cellulitis	0.42%	0.00%	0.00%	0.00%
	orbital oedema	0.00%	0.00%	0.42%	0.00%
Neuro ophthalmology **(3.32%)**	3rd nerve palsy	0.00%	0.00%	0.00%	0.42%
	Cerebral Visual impairment	1.25%	0.00%	0.00%	0.00%
	lagophthalmos	0.00%	0.00%	0.00%	0.42%
	nystagmus + Squint	1.25%	0.00%	0.00%	0.00%
Lens disease **(8.30%)**	Cataract	0.00%	0.00%	0.83%	7.05%
	pseudophakia	0.42%	0.00%	0.00%	0.00%
Eyelid disease **(2.08%)**	Blepharitis	0.42%	0.00%	0.42%	0.83%
	chalazion	0.00%	0.00%	0.42%	0.00%
Cornea disease **(3.32%)**	Cornea foreign body	0.00%	0.00%	0.42%	0.42%
	corneal opacity	0.00%	0.00%	0.00%	0.42%
	keratitis	0.00%	0.00%	0.42%	0.42%
	keratoconus/keratocornea	1.25%	0.00%	0.00%	0.00%
Others **(12.86%)**	Dry eye syndrome	0.42%	0.00%	3.32%	6.22%
	eye injury	0.00%	0.00%	0.00%	0.42%
	Uveitis	0.00%	0.42%	0.42%	0.42%
	normal eye	0.83%	0.00%	0.00%	0.42%
Multiple disease **(1.25%)**	keratoconjunctivitis	0.42%	0.00%	0.00%	0.00%
	blepharokeratoconjunctivitis	0.42%	0.00%	0.42%	0.00%

Chi-Square Tests of all ocular morbidity by age

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	20.754[a]	9	0.014
Likelihood Ratio	22.327	9	0.008
Linear-by-Linear Association	2.314	1	0.128
N of Valid Cases	241		

As shown below in Table 10 and Table 11, Conjunctivitis was the commonest eye disease affecting both males (28.66%) and females (29.27%) in almost equal measures. Astigmatism was more among male (12.1%) than female respondents (3.66%) though the result is not significant at $p < .05$. ($X2$ (1, N = 22) = 6.9567, p = .138196). Among the five most common ocular Morbidity, there was no significant relationship between gender and eye diseases at $p < .05$. ($X2$ (1, N = 151), p = .138196). While most ocular morbidities seem to have a higher prevalence among females (60%) compared to males (40%), this could be attributed to the difference in the response rate, with female patients recording a higher rate. There is also a pattern in the prevalence between both genders, particularly in cataracts, Conjunctivitis and Presbyopia. This implies that the distribution of ocular Morbidity in the Mathare slum is not dependent on gender. This is confirmed by the Pearson Chi-Square value of .478 (>.05) and a likelihood ratio of .474(>.05). This implies that the prevalence of Ocular Morbidity is not significantly influenced by gender.

Table 8. Distribution of ocular morbidity by gender

Final Diagnosis	Male		Female	
	Frequency	%	Frequency	%
3rd Nerve Palsy	1	0.64	0	0
Asthenopia	4	2.55	1	1.22
Astigmatism	19	12.1	3	3.66
Blepharitis	2	1.27	2	2.44
Cataract	12	7.64	10	12.2
Cerebral Visual Impairment	1	0.64	2	2.44
Chalazion	1	0.64	0	0
Choroiditis	0	0	1	1.22
Conjunctivitis	45	28.66	24	29.27
Cornea Foreign Body	1	0.64	2	2.44
Dermoid Cyst	0	0	1	1.22
Diabetic Retinopathy	0	0	1	1.22
Dry Eye Syndrome	19	12.1	5	6.1
Endophthalmitis	1	0.64	0	0
Eye Injury	0	0	1	1.22
Glaucoma	2	1.27	1.22	0
Hypermetropia	9	5.73	3	3.66
Keratitis/ Keratoconus	1	0.64	4	4.88
Lagophthalmos	1	0.64	0	0
Myopia	10	6.37	4	4.88
Normal Eye	1	0.64	2	2.44
Nystagmus	1	0.64	0	0
Optic Neuropathy	2	1.27	1	1.22
Pingueculitis	1	0.64	2	2.44
Presbyopia	10	6.37	7	8.54
Pseudophakia	0	0	1	1.22
Pterygium	9	5.73	1	1.22
Retinal Coloboma	0	0	1	1.22
Squint	1	0.64	1	1.22
Subconjunctival Hemorrhage	1	0.64	2	2.44
Uveitis	2	1.27	1	1.22
Totals	**157**	**100%**	**84**	**100%**
Chi-Square Tests of all ocular morbidity by gender				
	Value	**df**	**Asymptotic Significance (2-sided)**	
Pearson Chi-Square	2.487[a]	3	0.478	
Likelihood Ratio	2.505	3	0.474	
Linear-by-Linear Association	2.408	1	0.121	
N of Valid Cases	241			

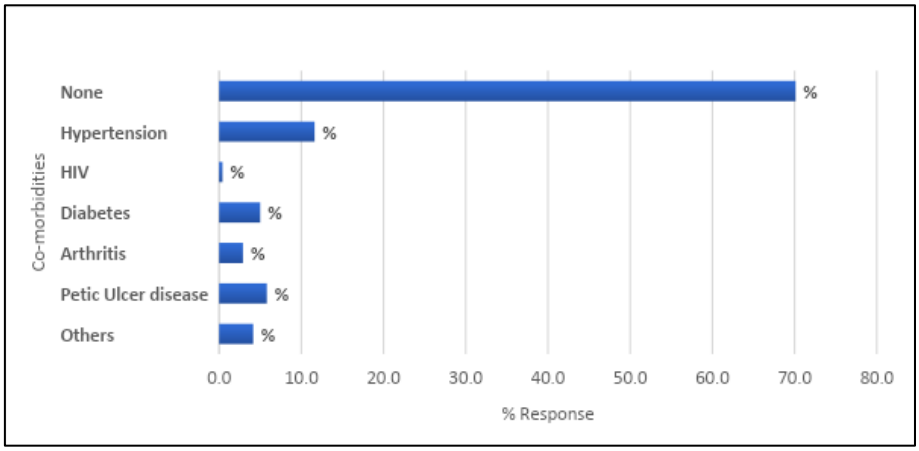

Fig. 4. Comorbidities

Table 9. Chi-square test of selected commonest ocular morbidity by gender

Chi-square test of selected commonest ocular Morbidity by gender			
	Male	**Female**	**Row Totals**
Astigmatism	19 (15.30) [0.90]	3 (6.70) [2.04]	22
Cataract	12 (15.30) [0.71]	10 (6.70) [1.62]	22
Conjunctivitis	45 (47.98) [0.19]	24 (21.02) [0.42]	69
Dry eye syndrome	19 (16.69) [0.32]	5 (7.31) [0.73]	24
myopia	10 (9.74) [0.01]	4 (4.26) [0.02]	14
Column Totals	105	46	**151 (Grand Total)**

3.5 Comorbidities

Respondents' individual comorbidities were recorded. This ensured that the study findings represented the diverse comorbidities in ocular Morbidity among patients presenting eye complaints at the medical camp. Results were as illustrated in Fig. 4.

Findings illustrated in Fig. 4 shows that most respondents (70.1%) had no comorbidities, followed distantly by 11.6% of respondents who had Hypertension. Further, 5.8% of respondents had peptic ulcer disease, while 5.0% had diabetes. Only 2.9% affirmed having arthritis, while 0.4% had HIV. The finding implies that comorbidities are not prevalent among most ocular morbidity patients. However, Hypertension was a common comorbidity among some patients.

As evident among Mathare residents in this study, some eye diseases are common among participants with advanced age. Chukwuka et al noted; growing older is a significant risk factor for blindness and visual impairment since over 82.0 % of blind persons are over 50, the population is burdened socioeconomically and in terms of public health [23]. The causes of blindness in the middle-aged population are believed to be cataracts, diabetes, glaucoma, and refractive errors. Accidents and injuries happen to people of all ages, but people in their second to fourth decades are more likely to experience these eye diseases [18]. Our study findings were replicated by Khadse et al on commonest eye diseases among children and adolescent included refractive errors, conjunctivitis, vitamin A insufficiency, and trachoma [18].

Relating to gender, prospective studies indicated that more women than men are examined for ocular illnesses. This may result from women's attitudes, cultures, or socioeconomic issues. In many cultures, women are known to be more concerned with their health than males. They may be forced to seek medical care before health problems develop since they are economically disadvantageous compared to men. Some stronger evidence suggests that females are generally 40% more likely than males to experience vision impairments and blindness [12]. A study with 432 participants was conducted in the slums of Dhaka city. Almost half were between 18 and 40, and the mean age was 37.9 (Standard Deviation of 13.30) years [1].

Following a study conducted in the slums of central India, the survey's participants were equally split between male (51.43%) and female (48.57%) genders. This may be due to the young population in most developing countries and the supportive attitudes of women toward health [18]. The average age of the 104 participants in the West Nigerian semi-urban settlement was 38.316.6 years, with 71.2% female and 28.8% male. About 30.8% of participants in the study were between 41 and 50 [12]. A study was carried out at the University of Benin Teaching Hospital to determine the eye disease pattern between July 2004 and June 2008. The study included a total number of 7,220 patients. The males were 3,583 (49.6%), and the females represented 50.4% which is 3,637 making the ratio of female to male 1:1. According to age, patients were selected from 5 days to 96 year olds. 22% of the participants were patients under the age of 20 years, for patients between 20 and 40 years represented 28% and the remaining 50.4%represented participants over 41%. It was found that about 1,671 (23.1%) suffered from refractive error which was the commonest disease affecting eyes. Subsequently, 1,555 (21.5%) patients suffered from conjunctivitis and cataracts followed by 1,471 (15.9%) patients. The other diseases which were found from the participants included glaucoma (11.9%) representing 857 participants, trauma was found in 351 patients which is a 4.9% and lastly, uveitis was found in 3.4% which is 245 patients. Allergic conjunctivitis was found to be the most common type of conjunctival illnesses. It was seen in 19.9% representing 1,440 patients. Furthermore, it was followed by bacterial conjunctivitis in 1.1% of the participants representing 82 patients and viral conjunctivitis in 33 patients Pterygium was found in 282 patients which is 3.9%. Maculopathy was found present in 315 patients which is 4.4% and 213 (3%) of the patients were found to suffer from age related macular degeneration [4].

In a demographic study conducted in Mbeere, Kenya, the mean age of participants was 17 years, and 56.90% of those investigated were female [2]. The modal age range in a study conducted by Kenyatta National Hospital was 36 to 45 years old among HIV-positive people. Participants were more likely to be women (66.5%) than men (33.5%) [13]. Another study conducted in the Korogocho slums had a mean age of 30 years, with more girls (58%) than males (42%) in the study [14].

3.6 Determinants Associated with Ocular Morbidities in Mathare Slum-Nairobi County, Kenya

The study explored the determinants resulting from ocular morbidities in the Mathare slum. To this end, the researcher indicated their respective sources of pathology. Results are presented in frequencies and percentages in Table 10.

As shown above, in Table 11, most respondents (43.9%) were found to have developmental pathology; developmental disorders are nervous system disorders, sensory-related disorders, metabolic disorders and degenerative disorders, grouped into this category. This was followed by 24.1% affirming allergies as their source of pathology while 10.4% due to refraction. Furthermore, 8.7% had an infection, 5.0% had Trauma, and 4.6% had pathologies due to environmental causes. Other causes were neurological (1.6%) and congenital (0.4%). It can be deduced from the finding that the most common source of pathology among patients with ocular Morbidity in the Mathare slum is developmental (43.9%). Other less prevalent sources include allergies (24.1%) and refraction (10.4%), while the least common include neurological (1.6%) and congenital (0.4%).

A cross-tabulation of the respondents' socioeconomic factors and ocular morbidities was conducted. This aimed to find comorbidities as determinants associated with factors resulting in ocular morbidities in the Mathare slum. Results are shown in Tables As shown below in Table Hypertension was the commonest comorbidity in Mathare slum affecting 12.4% of the respondents; this was followed by peptic ulcer disease (5.4%), diabetes (4.6%), arthritis (2.5%) and lastly HIV (0.41%). Most respondents (69.7%) did not have any comorbidity. Cataract respondents, representing 2.5% (6), were equally affected by Hypertension and diabetes, while 2.1% (5) of presbyopia patients had Hypertension too. It was found that 2.9% (7) of dry eye patients had Hypertension. The finding implies that ocular Morbidity is not particularly associated with particular comorbidities. This is confirmed by the Pearson Chi-Square value of .338 (>.05) and a likelihood ratio of .223(>.05). This implies that comorbidities do not significantly influence the prevalence of Ocular Morbidity.

From this study, ocular morbidities are not significantly influenced by comorbidities, but the

distribution of chronic diseases was even among eye patients in Mathare. The distribution of chronic diseases reported was openly acknowledged to have affected the eyes and vision, such as diabetes mellitus, Hypertension, blood pressure, arthritis, hyperthyroidism, neurodegenerative disorders, hematologic malignancies, or systemic infections. These findings concur with Pinazo et al. (2016), who found comorbidities common among eye patients. It is crucial not to ignore illnesses that could result in loss of vision, such as ocular comorbidities and eye involvement in the context of systemic disorders [19].

Table 10. Source of pathology

Pathology Source	frequency	%
Allergies	58	24.1
Congenital	1	.4
Developmental	106	43.9
Environment	11	4.6
Infective	21	8.7
Neurological	4	1.6
None	3	1.2
Refraction	25	10.4
Trauma	12	5.0
Total	**241**	**100.0**

Table 11. Distribution of Ocular Morbidity by Comorbidities

Final Diagnosis	Arthritis	Diabetes	HIV	Hypertension	None	Peptic Ulcer
3rd Nerve Palsy				1		
Asthenopia				1	4	
Astigmatism				1	19	1
Blepharitis					2	1
Cataract	3	6		6	7	
Cerebral Visual Impairment						
Chalazion					1	
Choroiditis					1	
Conjunctivitis		1		1	56	2
Cornea Foreign Body & Opacity				1	2	
Dermoid Cyst					1	
Diabetic Retinopathy		1				
Dry Eye Syndrome	1	1		7	12	2
Endophthalmitis				1		
Eye Injury					1	
Glaucoma				2		
Hypermetropia	1		1		8	2
Keratitis					3	
Keratoconus/ Keratocornea					3	
Lagophthalmos					1	
Mucopurulent Conjunctivitis	2				5	
Myopia		1			12	
Normal Eye					2	1
Nystagmus						
Orbital					1	
Pingueculitis				1	2	
Presbyopia				5	11	1

Final Diagnosis	Arthritis	Diabetes	HIV	Hypertension	None	Peptic Ulcer
Pseudophakia					1	
Pterygium		1		2	5	2
Retinal Coloboma					1	
Squint					2	
Subconjunctival Hemorrhage					1	1
Uveitis					3	
Total	**6(2.5%)**	**11(4.6%)**	**1(0.41%)**	**30(12.4%)**	**168 (69.7%)**	**13 (5.4%)**

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	13.441[a]	12	.338
Likelihood Ratio	15.340	12	.223
Linear-by-Linear Association	.057	1	.811
N of Valid Cases	241		

Table 12. House structure

Disease category	Brick/Stone		Iron/Sheet		Mud		Others	
	n	%	n	%	n	%	n	%
Conjunctiva disease	52	33.21%	29	39.50%	1	100%	1	100%
Refractive errors	50	31.93%	17	23.16%	2	0.00%	0	0.00%
Retina disease	3	1.92%	2	2.72%	1	0.00%	0	0.00%
Orbital disease	3	1.92%	0	0.00%	1	0.00%	0	0.00%
Neuro-ophthalmology	3	1.92%	4	5.45%	1	0.00%	0	0.00%
Lens disease	14	9.19%	5	6.81%	2	0.00%	0	0.00%
Eyelid disease	4	2.69%	4	5.73%	0	0.00%	0	0.00%
Others	5	3.19%	4	5.73%	0	0.00%	0	0.00%
Cornea disease	19	12.13%	7	9.54%	2	0.00%	0	0.00%
Multiple diseases	2	1.28%	1	1.36%	0	0.00%	0	0.00%
Missing	1	0.64%	0	0.00%	0	0.00%	0	0.00%
Total	**157**	**100.00%**	**73**	**100.00%**	**10**	**100%**	**1**	**100%**
Chi-square value			23.10113					
p-value			0.81108					
df			30					

Table 13. Numbers of rooms

Disease category	Number of rooms occupied					
	1		2 to 3		Above 4	
	n	%	n	%	n	%
Conjunctiva disease	43	33.3%	34	35.1%	6	40.0%
Refractive errors	44	34.1%	27	27.8%	3	20.0%
Retina disease	3	2.3%	3	3.1%	0	0.0%
Orbital disease	2	1.6%	2	2.1%	0	0.0%
Neuro-ophthalmology	3	2.3%	4	4.1%	1	6.7%
Lens disease	14	10.9%	5	5.2%	1	6.7%
Eyelid disease	1	0.8%	4	4.1%	1	6.7%
Others	4	3.1%	4	4.1%	0	0.0%
Cornea disease	14	10.9%	11	11.3%	3	20.0%
Multiple diseases	1	0.8%	2	2.1%	0	0.0%
Missing	0	0.0%	1	1.0%	0	0.0%

Disease category	Number of rooms occupied					
	1		2 to 3		Above 4	
	n	%	n	%	n	%
Total	**129**	**100.0%**	**97**	**100.0%**	**15**	**100.0%**
Chi-square value			13.39492			
p-value			0.859804			
df			20			

Results presented in Table indicates that the prevalence of conjunctiva diseases among those living in brick/stone (33.21%) was less than those living in iron sheets (39.5%) houses but more than those living in mud houses (10%). There was low and rather random distribution among the other morbidities concerning housing structure. The statistics are also in tandem with the corresponding response rates by housing structure. Therefore, it can be deduced that ocular morbidities in the Mathare slum cannot be associated with socioeconomic determinants concerning patients' housing structures $p < .05$. ($X2$ (1, N = 241) = 23.10113, p = .81108.

Results presented in Table 14 shows that conjunctiva disease was the most common ocular disease, and the majority of the respondents lived in more than four-roomed houses (40%), 2 to 3 rooms (35.1%) and single rooms (33.3%). Refractive errors were common among patients living in single units (34.1%). Most cornea (10.9%) and lens diseases lived in single-roomed houses (10.9%). There were low and rather random distributions among the other morbidities concerning the number of rooms. The statistics are also in tandem with the corresponding response rates by the number of rooms. Therefore, it can be deduced that ocular morbidities in Mathare slum, Kenya, cannot be associated with socioeconomic determinants concerning patients' houses' number of rooms $p < .05$. ($X2$ (1, N = 241) = 13.39492, p = .859804.

Results presented in Table show that among patients suffering from conjunctiva diseases, kerosene (36%) was the commonest cooking energy. An equal number of respondents (26%) with conjunctiva and refractive errors preferred using charcoal as cooking energy. Most patients with lens pathology (10%) preferred cooking using charcoal. There was low and rather random distribution among the other morbidities concerning energy sources for cooking. The statistics follow the corresponding response rates by energy source for cooking, and it can thus be deduced that ocular morbidities in the Mathare slum cannot be associated with socioeconomic determinants concerning patients' energy source for cooking $p < .05$. ($X2$ (1, N = 241) = 136.2812, p =1.7065).

The results contradict those of Sutradhar et al. (2019), who concluded that the effects of poverty—including insufficient food, poor housing, and lack of access to healthcare, water, education and good sanitation—make disadvantaged people susceptible to illness. Similarly, a 2013 urban health survey in Bangladesh found that residents of informal settlements have worse physical and mental health conditions than the general population. It is crucial to provide comprehensive eye care services to those who live in slums [1]. Ogbeanu et al. (2016) noted that establishing and carrying out healthcare policies within a nation require an awareness of a disease's socio-demographic and pattern profile [7]. This is more crucial in communities with few resources when the socioeconomic burden of illness is concentrated, and basic supplies are few [24]. According to studies, unequal access to effective eye care treatments may be a factor in sight problems. Various studies have noted medical inequality and social-economic determinants are important factors in ocular morbidities in slum areas [17]. Social determinants of health are broader social, political, and economic forces that affect people's lives. Similar results to Mathare were witnessed in a Singapore-Chinese study multivariable models that found men (OR (95% CI): 2.80 (1.79–4.39)), younger persons (per year decrease in age (1.03 (1.00–1.05)) and lower education levels (1.8 (1.25–2.60); comparing ≤6 years against >6 years of education) were independent determinants of ocular Trauma [25].

Contradicts to our study were found in a systematic review study that found some comorbidity are more closely related to ocular disorders. Several ocular illnesses coexisting are more common than thought. Notwithstanding refractive problems, glaucoma, cataracts, uveitis, age-related macular degeneration, and dry eyes can all be identified simultaneously. Also found in our study, some ocular comorbidities are also much more common as people become older [19]. According to Pinazo-Durán et al. (2016),

Table 14. Energy source for cooking

	Cooking Energy Source							
Disease	**Charcoal**		**Firewood**		**Kerosene**		**LPG**	
category	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Conjunctiva disease	8	26%	0	0%	22	36%	52	35%
Refractive errors	8	26%	0	0%	20	33%	46	31%
Retina disease	1	3%	0	0%	2	3%	3	2%
Orbital disease	2	6%	0	0%	2	3%	0	0%
Neuro-ophthalmology	1	3%	0	0%	1	2%	6	4%
Lens disease	3	10%	0	0%	4	7%	13	9%
Eyelid disease	2	6%	0	0%	1	2%	3	2%
Others	1	3%	0	0%	2	3%	5	3%
Cornea disease	5	16%	0	0%	6	10%	17	12%
Multiple diseases	0	0%	2	100%	0	0%	2	1%
Missing	0	0%	0	0%	1	2%	0	0%
Total	**31**	**100%**	**2**	**100%**	**61**	**100%**	**147**	**100%**
Chi-square value			136.2811727					
p-value			1.70646E-15					
df			30					

certain conditions, including diabetes mellitus, high blood pressure, arthritis, hyperthyroidism, neurodegenerative disorders, hematologic malignancies, and systemic infections, are openly accepted to influence the eyes and vision [19]. In Cape Town, South Africa a similar trend to that one witnessed in Mathare slums was witnessed, those over the age of 80 (odds ratio (OR) 6.9 95% CI 4.6-10.6), those in the poorest socioeconomic category (OR 3.9 95% CI 2.2-6.7), and those with no formal education (OR 5.4 95% CI 1.7-16.6) had the highest prevalence of vision loss [20]. One factor of age was also a significant determinant in Mathare as it was in Mbeere survey that found age, education, occupation, and smoking-related behaviors are all substantially correlated with ocular morbidities in Mbeere, Kenya [2]. Ocular morbidities are prevalent (40.38%), and age, education, occupation, and smoking substantially impact their prevalence [18]. Also recorded in our study, there was no connection between employment status or educational level and ocular illness in Mbeere survey [2].

4. CONCLUSION

Based on the initial findings, it is concluded that the distribution of ocular disease in Mathare slum-Kenya is conjunctiva diseases, refractive errors, cornea diseases and lens pathology. Among the conjunctiva diseases, the commonest were atopic Conjunctivitis and pterygium, in that order. Presbyopia was the commonest refractive error, while cataract was the commonest lens pathology.

The study also concludes that while ocular Morbidity is distributed across age categories in Mathare Slum-Kenya, some morbidities are more prevalent in certain age-groups. Conjunctivitis is, for instance, more prevalent in children below 19 years of age, while cataracts, Presbyopia and dry eye syndrome are more prevalent in older populations aged above 40 years. It is also concluded that while most ocular morbidities seem to have a higher prevalence among female patients compared to their male counterparts, the same could be attributed to the difference in the response rate, with female patients recording a higher rate due to their higher attendance at the medical camp. This implies that the distribution of ocular Morbidity in Mathare Slum-Kenya is not dependent on gender. Based on the same deduction, it also concluded that other systemic individual comorbidities like Hypertension, diabetes etc., do not particularly influence ocular Morbidity.

It is further concluded that the most prevalent source of pathology among patients with ocular Morbidity in Mathare slum is developmental. Other less prevalent sources include allergies and refraction, while the least prevalent include neurological, congenital and dry-eye syndrome. Regarding socioeconomic factors resulting from ocular morbidities in Mathare slum, the study concludes that ocular morbidities in Mathare

slum cannot be associated with socioeconomic factors concerning patients' housing structure, number of rooms and energy source for cooking. This owes to the cross-tabulation statistics being in tandem with the corresponding

5. RECOMMENDATIONS

The study established that the most prevalent ocular diseases in Mathare Slum-Kenya include conjunctiva diseases, refractive errors and lens diseases. Therefore, all public health institutions within Mathare slums and in similar contexts should integrate eye health education on conjunctiva diseases, refractive errors and cataracts to patients. This will aid in the identification and encourage prompt health-seeking behavior, which will act as a public health intervention in reducing preventable blindness.

The second objective was determining ocular morbidity distribution in Mathare slum, Nairobi County, Kenya. It was found that while ocular Morbidity is distributed across age categories in Mathare Slum-Kenya, some morbidity are more prevalent in certain age groups, especially children and the elderly. To address this, it is recommended that among persons aged less than 19 years, conjunctiva diseases of allergic cause were common. Most under 19 years old are still in school; in collaboration with the division of eye services, the ministry of education should formulate policies encouraging early identification of eye allergic diseases, congenital eye diseases and refractive errors. This can be done by asking for mandatory preschool enrollment eye evaluation reports being submitted in schools with eye specialists' recommendations. Public health intervention of early and prompt accessibility to eye care among school-going 0- to 19-year-old individuals will avert poor development of visual function and improve educational achievement.

The third objective was to explore determinants associated with ocular morbidities in Mathare slum-Nairobi County, Kenya. Most eye diseases have developmental (nervous system disorders, sensory-related disorders, metabolic disorders and degenerative disorders) causes. Physical exercise, healthy eating and medical approved supplements will help prevent metabolic disorders and improve age-related eye disorders. Clinical control of existing comorbidities will aid in reducing some eye diseases like cataracts and diabetic retinopathy.

6. SUGGESTIONS FOR FUTURE STUDIES

The present study has determined ocular morbidity pattern, distribution and causes in Mathare Slum-Kenya. The main limitation faced in the study was the inability to generalize the study findings to all residential contexts outside of Mathare slum and similar settings. Different residential contexts may have patient populations and experiences significantly different from the Mathare slum. As such, this study recommends that future research replicate this study in

CONSENT AND ETHICAL APPROVAL

The National Council of Science, Technology, and Innovation (NACOSTI) (Appendix 1) and the Mount Kenya University Ethics Review Committee were consulted for ethical approval and approval to carry out the study, respectively. Participants in the study were asked for their consent to utilize their medical records. The created data was password-protected and kept in a computer folder.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ipsita S, Priyanka G, Mehedi H, Das GR, Tapash R, Malabika S. Eye diseases: The neglected health condition among urban slum population of Dhaka, Bangladesh. BMC Ophthalmol. 2019;19(1):38. DOI:10.1186/s12886-019-1043-z
2. Kimani K, Lindfield R, Senyonjo L, Mwaniki A, Schmidt E. Prevalence and causes of ocular morbidity in Mbeere District, Kenya. Results of a Population-Based Survey. PLoS One. 2013;8(8). DOI:10.1371/journal.pone.0070009
3. Mireku Felix A. Pattern of ocular conditions among patients attending an eye clinic in Ghana. Optom Open Access. Published online; 2017. DOI:10.4172/2476-2075.1000122
4. Ukponmwan CU. Pattern of ocular morbidity in Nigeria. Asian Pacific J Trop Dis. Published online; 2013. DOI:10.1016/S2222-1808(13)60064-X
5. Ono K, Hiratsuka Y, Murakami A. Global inequality in eye health: Country-level analysis from the global burden of disease study. Am J Public Health. 2010; 100(9):1784-1788. DOI:10.2105/AJPH.2009.187930

6. Century I of M (US) C on A the H of the P in the 21st. The future of the public's health in the 21st Century. Futur Public's Heal 21st Century. Published online; 2002. DOI:10.17226/10548
7. Ogbeanu A, Chukwuma D, Kenneth C, et al. Ocular morbidity in rural communities in Imo State South East Nigeria. Open J Ophthalmol. Published online; 2016. DOI:10.4236/ojoph.2016.63026
8. Priti Singh RA. Pattern of ocular morbidity amongst patients of elderly age group in Central India. Panacea J Med Sci. Published online; 2020. DOI:10.18231/2348-7682.2018.0008
9. Muthoka B, Malu J. Participation in upgrading programmes: The case study of mathare 4A slum upgrading programme in Nairobi, Kenya. University of Nairobi; 2005.
10. Sewunet A, Afework E. Pattern of ocular diseases among patients attending ophthalmic outpatient department: A cross-sectional study. Int J Clin Exp Ophthalmol. 2020;4(2):049-053. DOI:10.29328/journal.ijceo.1001033
11. German Doctors Nairobi. Mathare Medical Camp Data; 2021.
12. Onyinye C, Ireju A, Awoyesuku E. Pattern of ocular disorders in a semi-urban community in Rivers State, Nigeria. - Implications for Eye Care Planning and Budgeting. Acta Sci Ophthalmol. 2020; 3(3):01-05. DOI:10.31080/asop.2020.03.0101
13. Omoto A, Shadrack A. Ocular disease burden among HIV infected adults in an Urban Kenyan Hospital. 2021;10(1): 25-31. DOI:10.9790/1959-1001012531
14. Nyaga G. Magnitude and pattern of eye disease in korogocho slum; 2010. Accessed February 9, 2021. Abailable:http://erepository.uonbi.ac.ke/bitstream/handle/11295/11588/Nyaga_Magnitude and pattern of eye diseases in Korogocho Slum Nairobi.pdf?sequence=3&isAllowed=y
15. Isaac M, Ndidiamaka O, Juliet I, et al. Socio economic factors affecting ocular morbidity among industrial workers: A case study of coal camp Enugu, Nigeria. Int J Healthc Sci. 2017;5:222-228. Accessed September 7, 2023. Available:www.researchpublish.com
16. Carpenter DM, Sayner R, Blalock SJ, et al. The effect of eye drop technique education in Patients With Glaucoma. Health Commun. 2016;31(8):1036. DOI:10.1080/10410236.2015.1020263
17. Roghayeh H, Gharebaghi R, Heidary G. Social determinants in ocular diseases. Clin Optom. Published online 2010;119. DOI:10.2147/opto.s15290
18. Khadse DA, Narlawar DU, Humne DA, Ughade DS, Dhanorkar DA, Wankhede DK. Prevalence of ocular morbidities and its correlates in an urban slum of central India. Published online; 2014.
19. Pinazo-Durán MD, Zanón-Moreno V, García-Medina JJ, Arévalo JF, Gallego-Pinazo R, Nucci C. Eclectic ocular comorbidities and systemic diseases with eye involvement: A review. Biomed Res Int. 2016;2016. DOI:10.1155/2016/6215745
20. Cockburn N, Steven D, Lecuona K, et al. Prevalence, causes and socio-economic determinants of vision loss in Cape Town, South Africa. PLoS One. 2012; 7(2):e30718. DOI:10.1371/JOURNAL.PONE.0030718
21. Senyonjo L, Lindfield R, Mahmoud A, Kimani K, Sanda S, Schmidt E. Ocular morbidity and health seeking behaviour in Kwara State, Nigeria: Implications for Delivery of Eye Care Services. DOI:10.1371/journal.pone.0104128
22. Mehari ZA. Pattern of childhood ocular morbidity in rural eye hospital, Central Ethiopia. BMC Ophthalmol. Published online 2014. DOI:10.1186/1471-2415-14-50
23. Chukwuka I, Pedro-Egbe C, Onua A. Ocular problems among public service retirees in a Southern Nigerian Metropolitan City. Niger J Ophthalmol. Published online; 2016. DOI:10.4103/0189-9171.179916
24. Chadha S, Kumar S, J S, S S, Baijal V, Raghav S. Prevalence of ocular morbidities and its socio-demographic correlates in an urban slum of western Uttar Pradesh, India. undefined. Published online; 2016.
25. Wong MYZ, Man REK, Gupta P, et al. Prevalence, subtypes, severity and determinants of ocular trauma: The Singapore Chinese Eye Study. Br J Ophthalmol. 2018;102(2):204-209. DOI:10.1136/BJOPHTHALMOL-2017-310564

APPENDIX

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