URBAN SLUMS MORBIDITY SPECTRUM: A CROSS SECTIONAL STUDY ON KOROGOCHO SLUM, KENYA

Abstract: - Community health outreach is part of community-based health care, an extension of facility-based primary care services used to reach the underserved. Slums population in sub-Sahara Africa has been growing by 9 million persons per year making slum occupancy to form more than 56% of urban settlements. A slum is characterized by inadequate access to safe water, inadequate access to sanitation and infrastructure, poor structural quality of housing, overcrowding, and insecure residential status. People in slums due to their environment are more vulnerable to communicable diseases, respiratory diseases, malnutrition and accidents. The main objective was to identify the 10 top most prevalent diseases in Korogocho slums. A cross-sectional study design was applied. Study period was between January 2021 and December 2021. Data was collected through a series of 12 Community health outreach sessions at Korogocho slums in Nairobi, Kenya. Secondary data was extracted and analyzed using SPSS version 25.A total of 3699 individuals were treated, there were more females (67.96%) than males (32.01%) and at least 1 person was identified as a transgender. Age group of 0 to 59 months (472 patients) had more males than females while 19 to 59 years old (1413 patients) females formed majority of Community health outreach attendants. Modal age group was 19 to 59 years among females and 0 to 59 months among males representing 45.28% of the total patients. An average of 308 patients was seen per session. Respiratory tract infections (44.8%), skin diseases (13.8%), abdominal diseases (13.2%), musculoskeletal disorder (7.86%), eye conditions (4.75%), genitourinary diseases (4.18%), ENT diseases (3.9%), hypertension (3.36%), dental problems (2.1%) and wounds and injuries (2.05%) respectively formed the 10 most prevalent diseases in Korogocho slums. Public health intervention of wearing of medical face mask to prevent allergens and airborne infections is highly recommended, prompt and timely treatment of respiratory diseases will help in reducing respiratory related complications. Cost effective and sustainable water treatment options should be availed to the locals to help in improving water quality so as to reduce infective abdominal-diseases.

Key terms: **Community health outreach, informal settlement, disease epidemiology**

BACKGROUND OF THE STUDY

The health condition in the poor communities in the third world cities is alarming as thousands of children still die every day from preventable diseases related to the inadequate provision of water and sanitation[1]. In order to meet the outcomes in the New Urban Agenda and Sustainable Development Goals to improve health for slum-dwellers a better understanding is needed of each individual slum environment and the factors contributing to poor health out-comes [2]. This paper was proposed in order to identify disease trends in terms of time and demographic aspect in Korogocho slums for timely health intervention during German doctor's community outreaches.

Urbanization

Urbanization is an important aspect of public health as it acts as a determinant of health status. The world is fast becoming urban, of the projected increase of 1·1 billion in the world population between 2010 and 2025, virtually all will be urban dwellers[3]. In the year 2014, over half (54%) of the world's population lived in urban areas and it is projected by 2050 this proportion is expected to increase to 66%. There will be an addition of approximately 2.5 billion new urban dwellers, of whom 90% will be in Asia and Africa[2]. Urbanization has historically been presumed to lead to mortality reduction due to economic prosperity and increased access to modern medical care. However, this has not been the case for most developing countries where evidence suggests that quality of life in some urban areas is even worse than in rural areas mainly due to high levels of poverty in pockets of the urban population[4].

In the last three decades rural urban migration with the intention of improving economic status has led to mushrooming of the urban slums. Kenya is a lower middle-income country with a total population of slightly over 55 million [5] and 41.9%[6] poverty head- count ratio at national level. In the year 2014, life expectancy in the country was about 62 years. A quarter of the total population of Kenya lives in urban areas. Kenya is home to one of the largest slums in the world, the Kibera slum. Nairobi which is the capital city has more than 40 areas designated as slums and about 56% of the country's urban population lives in slums[7]. In the last decades, the population in Nairobi has exponentially grown despite the area in square kilometers remaining the same. This rapid population increase has led to sprouting of slums which occupy 5% of the residential area yet housing 60% of the population in Nairobi. Nairobi County has 9 slums, Korogocho which is located in Ruaraka Sub County is one of the largest slums in Nairobi.

Challenges in Korogocho slum areas

Slum areas illustrate high rates of poverty, illiteracy, poor health status, low earnings and limited job opportunities. The slum residents have limited formal education facilities hence they are mostly engaged in informal labor in harmful environment such as scavenging through which they cannot earn much[8]. In Nairobi, the informal sector employs two-thirds of the city's labor force and a considerable share of the city's income is produced and consumed in the slum[9].

The impact of lack of basic amenities like sanitation, garbage disposal, and potable water on health on one hand, and availability, accessibility and quality issues of health facilities on the other, make the urban poor vulnerable to health shocks[10]. In Nairobi, only 1 in 5 homes is connected to electricity, which is available for fewer than 12 hours a day. Only 4% of households has individual piped water connection, with the vast majority relying on water kiosks. Most slum dwellers rely on shared toilet facilities or use open areas or

plastic bags. Functional solid waste disposal system barely exists forcing most residents to dispose waste in the trenches and the Nairobi river that passes in Korogocho. Buying and cooking nutritious food is costly hence they buy the cooked junk foods that are readily available.

Health status in Korogocho slums

Korogocho Slum is located near the biggest garbage dumpsite in Nairobi, factories, open sewerages and the polluted Nairobi river thus rendering their inhabitants vulnerable to high burden of diseases. Limited access to water and toilets has impacted frequent and increased cases of diarrheal diseases. They are exposed to the dumpsite and industrial pollution; this environment is not good for health; it causes a number of communicable diseases among which respiratory diseases are very common[8].They are prone to non-communicable diseases and triple burden of malnutrition (under nutrition and micronutrient deficiency among children and overweight in adults) due to consumption of readily available and affordable cooked junk foods as nutritious food is costly to purchase and prepare. In addition, they are exposed to greater risk of accidents at work[8] especially the ones who scavenge at the dumpsite without any protective gear. High poverty index and limited formal education has also led to teenage pregnancies, gender-based violence and child abuse cases.

Community based health care as an intervention

Community based health care includes services delivered by a broadly defined community health workforce, according to their training and capacity. It encompasses a range of health workers, lay and professional, formal and informal, paid and volunteers, as well as facility-based personnel who support and supervise them and provide outreach services and campaigns. Community outreach is part of community-based health care. It is an extension of facility-based primary care services used to reach the underserved. The Astana Global Conference 2018, on Primary Health Care, established community level as an integral platform for primary health care, key to the delivery of services and essential public health functions, and to the engagement and empowerment of communities in relation to their health[11]. In Kenya, community outreach programs have been an integral part of healthcare. It has been used widely in screening of various diseases and providing health care in far reach areas that are not services with hospitals. These outreaches have been commonly organized by politicians, religious centers, hospitals and companies as part of cooperates' social responsibility.

Study justification

Study on spectrum of diseases within slum areas is important in forming the baseline data that will be of help to health care policy makers and implementers. It will guide budgeting when it comes to medical products

consumables purchase and also it will aid public health specialist in designing appropriate interventions to be employed in disease prevention.

Specific objectives

1. To identify the 10 top most prevalent diseases in Korogocho slums, Nairobi
2. To identify the trends of the 10 top most prevalent diseases in Korogocho slums, Nairobi.

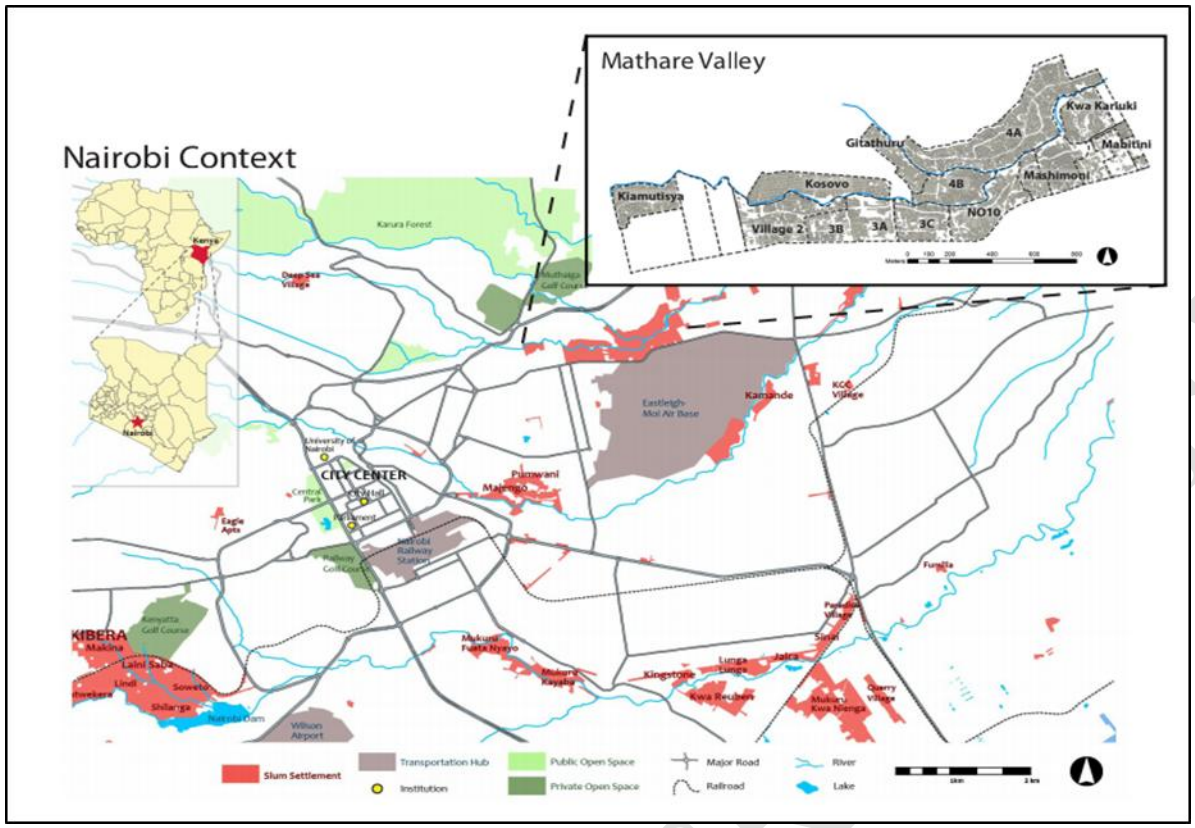
Research questions

1. What are the 10 top most prevalent diseases in Korogocho slums, Nairobi?
2. What are the trends of the 10 top most prevalent diseases in Korogocho slums, Nairobi?

METHODOLOGY

The study adopted a descriptive Cross sectional study, secondary data of the community outreach data was used in analysis. The study was conducted in Korogocho slum which is in Nairobi County. Korogocho slum is one of the largest slums in Nairobi, located in Ruaraka subcounty, with an estimated population of about 34,152 people on approximately 50 hectares of land owned by the Government of Kenya (Ministry of Local Government [MOLG], 2010). Korogocho is composed of eight villages: Korogocho A, Korogocho B, Grogan A, Grogan B, Nyayo, Gitathuru, Kisumu Ndogo and Highridge. It borders the largest dumping site in Nairobi i.e. Dandora [1].

MAP 1: STUDY AREA



Target group was all residents of Korogocho slums in search of health service at community outreach programs organized monthly at designated areas. We included patients of all age groups presenting with health related complaints at the Community health outreach. We excluded all Individuals presenting with non-medical complaints at the Community health outreach and Patients from other parts of Nairobi other than Korogocho. Study period was from January 2021 to December 2021 and convenient sampling technique was used to include all subjects into the study. All patients attending the Community health outreach in search of healthcare were examined and their medical status recorded in electronic medical record.

Research instruments

1. Health workers (nurses, nutritionist, clinical officers, doctors, Lab technicians, pharmacy technicians, health information officer). Clinicians had varied specialties ranging from pediatricians, general practitioners, ophthalmologist and surgeons.
2. Samsung Android tablets with data collection software
3. Weighing scale machine
4. Digital Blood pressure machines
5. Stethoscope, torch

6. Patella hummer
7. medicines
8. Otoscope
9. Direct ophthalmoscope
10. Random blood sugar machine
11. Urinalysis strips

Data collection procedure

A total of 10 Community health outreaches were carried out in the year 2021. Community health volunteers were involved in community mobilization and sensitization. On the material day, attending patients were registered in the registration book and issued with numbers. Vital signs, weight and BMI were noted. Patients were sent to the consultation unit where medical examination and diagnosis were made. Examining clinicians ordered the relevant lab test as per their clinical findings. Patients' records were taken back to the registration desk for diagnosis recording by the health information officer. Tablets with data capturing software were used by the clinicians to feed and store data of the patients

Variables

The study calculated independent variables which included frequencies of age, gender, patients attending the medical camp and time in months. The dependent variable which is the spectrum of disease was presented in frequency table and analysis was done by checking at distribution of disease over time in months, Gender, and number of patients. This is displayed in **figure 1**

Data analysis

Data was fed into an android tablet installed with data collection software. There was no missing data since the fillable sections in the software are mandatory hence you cannot move to the next patient without completing data collection of the current patient. Data captured were age, gender and diagnosis. The data collected using tablets were grouped into manageable subjects and arranged then sorted and analyzed using Statistical Package for Social Science Programme (SPSS) version 25. The unbiased data was presented in visual displays that helped to bring out underlying patterns and trends, which were used to answer research questions. Trends of diseases in terms of age, gender and seasonality was assessed using descriptive statistic.

RESULTS

General Characteristics

The socio-demographic characteristics of patients are presented in **table 1**. A total of 3699 individuals were treated at Korogocho slums Community health outreaches. There were more females (67.96%) than males (32.01%) and (0.03%) persons were identified as transgender. The modal age group was that of 19 to 59 years among females and 0 to 59 months among females. This can be explained by the fact that females forming the majority of medical camp attendees come along with their children forming the better part of male population. As evidenced in **Table 2**, Respiratory tract infection was the most common diagnosis affecting 44.8%. Skin disease 13.8%, abdominal disease 13.2% came in second and third respectively. Whereas diagnosis of Wound/Injury/Burn/Fracture was the least common among the 10 most prevalent diseases in Korogocho slum affecting 2.05% of the participants **(Table 2).** Females with specific disease were more as compared to males; this can be attributed to the difference in camp attendance as explained earlier in the text. The disease prevalence per gender is displayed in **Figure 1**. On camp attendance per month as displayed on Table 3, the month of May saw the highest number of Community health outreach attendants at 660 people, then July 565 people and February 425 people, came in second and third respectively. November saw the least number of patients 236 people. We did not have any medical camps in April and March due to the surge of COVID-19 infections in Kenya[13].

Discussion

Urbanization is an important aspect of public health as it acts as a determinant of health status. Rural urban migration with the intention of improving economic status has led to mushrooming of the urban slums which have poor structural housing quality, ventilation, sanitation and limited access to hospitals and other social amenities. All these factors predispose the residents to general poor health and susceptibility to infections.

A total of 3699 patients were treated at Korogocho slums Community health outreaches, 67.96% were females whereas 32.01% were male. This shows the health seeking behavior of the female population is higher than for the male population. The patients' ages ranged from as low as a few days old to 70 years. The modal age was 19-59 years among the female were as 0-59 months was the most frequent age group among the male population. This data shows the older the male patients grow the less they seek medical services. May and July were the months that had the highest number of patients attending the camp at 660 and 565 respectively this was because Community health outreaches were done twice within these two months. The average number of patients per Community health outreach was 308 though the month of February surpassed the average by 117 patients this could have been attributed to vigorous mobilization and sensitization of patients to attend the Community health outreach by the community health workers.

The most common infectious disease among the top ten prevalent diseases was the upper respiratory tract infection and the least common was the Ear, nose and throat infections such as tonsillitis among others. Our

findings contradicted a world health organization (2020) report on health of urban poor in South East Asia which indicated, the rates of malnutrition and communicable diseases in children, as well as infant and under-5 mortality are high in the slums of

the Region [14]. Among adults, however, there is evidence of an epidemiological transition, with rising rates of overweight, obesity, and risk factors for chronic diseases, and a continuing prevalence of communicable disease imposing a dual burden of illness on the urban poor.

Limited safe water in the households reduces the quantity and quality of drinking water. Water sources are not found within the homestead this further exposes the water to contamination during transportation and storage. Inadequate access to safe drinking water is a source of water borne diseases and as evidenced from the above data, abdominal diseases and diarrheal diseases rank second and seven respectively among the commonest morbidities in Korogocho slums. Nairobi River which transverse in the midst of Korogocho slum is heavily polluted and it is also a source of infective abdominal diseases. This is in line with WHO (2020) report about slums in South East Asia which highlighted several cities slums in the region experienced disease outbreaks given the deficient facilities for safe water, sanitation, effluent-treatment and hazardous waste processing, and the overcrowding in slums, the high rates of water-borne and vector-borne diseases and disorders attributable to toxic exposures were significantly high [14]. Our findings were also in tandem with Taffa et al (2005) study that reported Cough, fever, diarrhea, skin problems and eye diseases made up the top five causes of child morbidity among the slums of Nairobi residents (Taffa,2005). The most common non communicable diseases were musculoskeletal diseases, non-infectious skin disease and hypertension.

Frequent burning of garbage from the biggest dumpsite in Nairobi that lies next to Korogocho slums, once the smoke from the burning garbage enters the house there is indoor air pollution for the houses with poor aeration. Poor ventilation and structural quality of housing predisposes Korogocho residents to respiratory diseases. Respiratory infection was most prevalent in both children and adults; among the adults it was more common in the female population. This prevalence is in tandem with the Kenya Demographic and Health Survey (2022) which states 82% of children with acute respiratory infection symptoms were most often taken to a health facility or provider from treatment or advice[15]. Moreover as per Kenya's Ministry of Health report (2020), Upper respiratory tract infections and other respiratory illnesses had remained the leading cause of morbidity in children under 5 years from 2016 to 2020 with 38% of Out Patient Department diagnoses being due to respiratory tract illnesses[16]. Chronic obstructive pulmonary airway diseases like asthma and bronchitis which ranks eighth is a significant cause of morbidity in Korogocho. Poor ventilation has seen a notable number of pulmonary tuberculosis cases as noted in the Community health outreaches. This was also evident in WHO report (2020) which noted overcrowding and poor air quality in informal

settlements was the main cause of tuberculosis, asthma and chronic obstructive pulmonary diseases which are notable diseases of concern[14].

Diseases of the skin was ranked second among the top ten prevalent diseases with a caseload of 439, most of which were noninfectious. Infectious skin diseases were common among the female patients whereas scabies infection was prevalent among children 0- 59 months. This corroborates a midterm review report by MOH,2020 where skin diseases was ranked among the top three out- patient disease diagnosis in Kenya among children 0-59 months[16]. In 2020, a midterm review statistical report stated arthritis as being one of the non-communicable diseases on the rise in the last few years. Musculoskeletal diseases were ranked at number four with more women than men presenting with this condition[16]. Eye diseases rank among top five diseases in Korogocho slum, this can be attributed to poor air quality and contaminants in the environment that maybe a major cause of allergic eye conditions. The air quality is compromised by the neighboring largest dumpsite in Nairobi where garbage is frequently burnt leading to smoke filling the air in Korogocho and its environs. Cataract was noted among patients with diabetes and those in advanced ages. Ear Nose and Throat conditions were ranked as the seventh most prevalent condition with 3.9% of the patients presenting with this complain. Children aged 0-59 months commonly presented with complains of tonsillitis and ear infections during the month of October when respiratory tract infections were also highest. In 2020 a midterm review by the Ministry of health ranked ear infections as the eighth cause of morbidity in children[16].

Hypertension was ranked as one of the most prevalent non communicable disease with 107 patients having Hypertension, 72% being female. The triple burden of malnutrition where children are under nourished while adults are overweight and Inadequate access to readily available healthy foods predisposes patients to non-communicable diseases. MOH, 2020 reported hypertension prevalence has been rising over the past few years[16]. Genitourinary diseases were ranked sixth most prevalent disease during the Community health outreach with 133 patients. However, among the male patients it was the least prevalent disease with only 16 male patients diagnosed with genitourinary complains. Dental problems were also ranked among the top ten most prevalent conditions during the Community health outreach. Sixty-seven patients mostly above 5 years had dental complain and was least prevalent among the male population. For infants and young children, the consumption of sweet foods and beverages increased the risk of dental caries[17].

Dandora dumping site is the largest waste disposal point in Nairobi city, Korogocho's proximity to the biggest dumping site predisposes dwellers to unintended injuries and disease-causing vermin. High crime rate and armed robberies is a major cause of injuries and accidents which affected a considerable proportion of Korogocho residents. Wounds and injuries were ranked as the tenth most prevalent diagnoses during the Community health outreach s, 44.6% of male patients had complains of wounds and injuries. Poor human

waste disposal is also an important source of diseases such as typhoid which in this study was allocated an independent category. Malnutrition and Intestinal worm infestation were prevalent in children 0 -59 months.

Conclusion

Upper respiratory tract infections, skin diseases, abdominal diseases, musculoskeletal disorder, eye conditions, genitourinary diseases, ENT diseases, hypertension, dental problems and wounds and injuries respectively formed the 10 most prevalent diseases in Korogocho slum. Traditionally, diarrheal diseases were known to be the major cause of morbidity in slum areas but in these study respiratory diseases reigned supreme.

Recommendations

1. Respiratory diseases were the most prevalent diseases in Korogocho slums and public health intervention of wearing of medical face mask to prevent allergens and airborne infections is highly recommended among Korogocho residents.
2. Prompt and timely treatment of respiratory diseases will help in reducing respiratory related complications hence health facilities within the areas should have enough resources to handle respiratory diseases.
3. Cost effective and sustainable water treatment options should be availed to the locals to help in improving water quality so as to reduce infective abdominal diseases

Ethical Approval

German Doctors-Nairobi has been carrying out monthly Community health outreaches is slum areas within Nairobi. Permission from administration was sought by the researcher to use data generated from the Community health outreaches.

Figure 1: Conceptual frame works

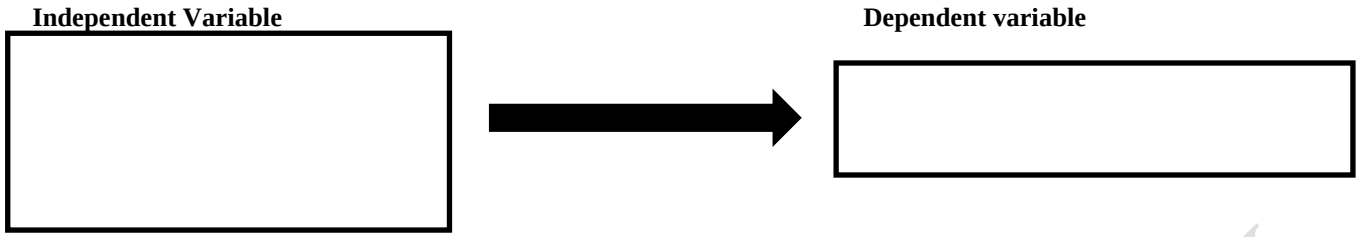


Table 1: Socio demographic characteristics of patients

Variable		Male	Female	Non defining	Total
Gender of participant		32.01%	67.96%	0.03%	100%
Age distribution	0 -59 months	472	432		904
	5- 18	401	605		1006
	19 – 59	261	1413		1674
	≥ 60	49	61		110
Modal age		0-59 months	19 – 59 years		

Table 2: Frequency of Top ten diseases

Disease	**Frequency**	**Percentage%**
Respiratory Tract Diseases	1424	44.8
Skin Disease	439	13.8
Abdominal Disease	418	13.2
Musculoskeletal Disorder	250	7.86
Eye Diseases	151	4.75
Genito-urinary Diseases	133	4.18
ENT - Diseases	124	3.9
Hypertension	107	3.36
Dental Problems	67	2.1
Wound/Injury/Burn/Fracture	65	2.05
Total	**3178**	**100**

Table 3: Number of patients treated per month

Month	**Frequency**
January	317
February	425
March	0
April	0
May	660
June	300
July	565

August	296
September	333
October	300
November	236
December	267
Total	**3699**

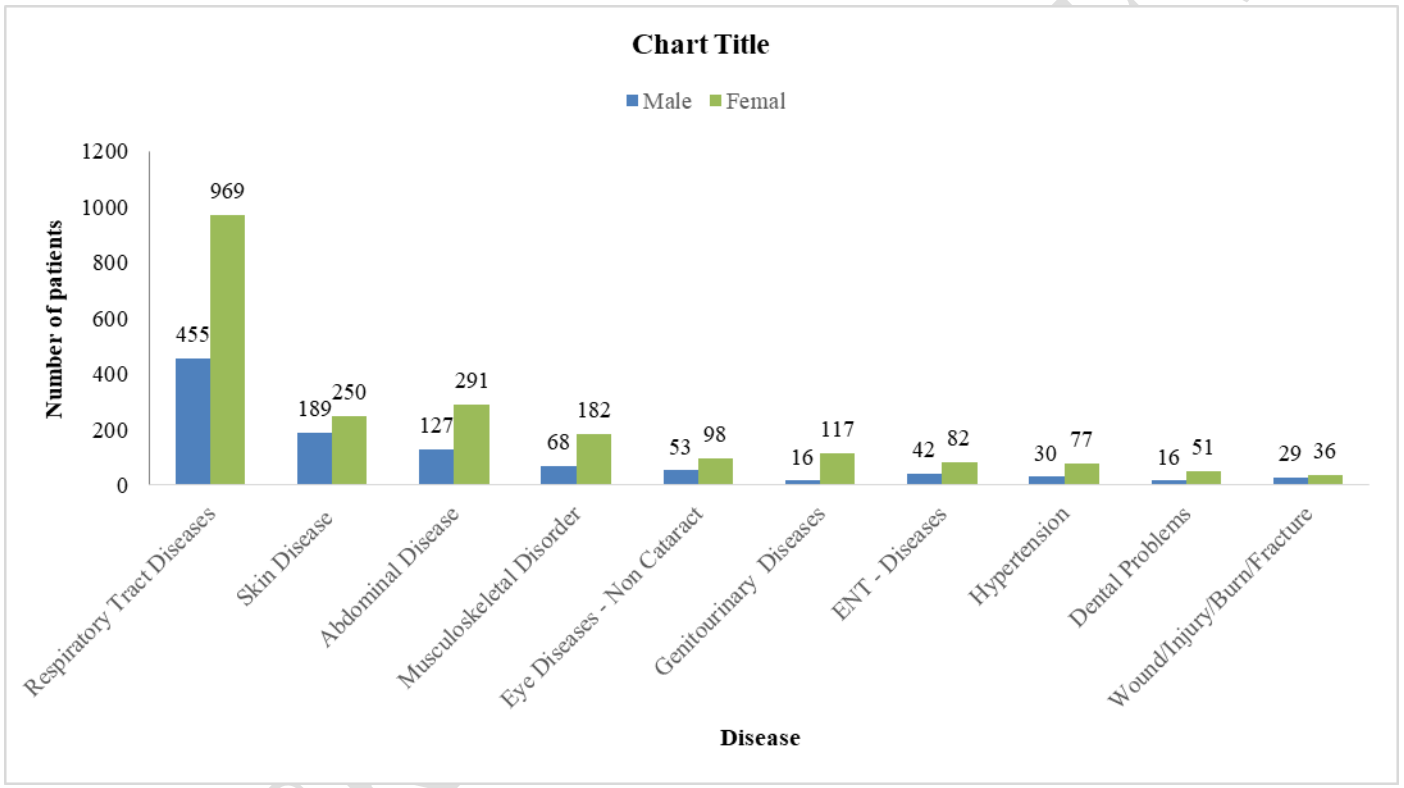


Figure 2: Disease prevalence per gender

REFERENCES

1. Nairobi, IFRA. Korogocho Slum Upgrading Programme. *http://journals.openedition.org/eastafrica*. 2011;(44):159-166. doi:10.4000/EASTAFRICA.541
2. Crocker-Buque T, Mindra G, Duncan R, Mounier-Jack S. Immunization, urbanization and slums - A

systematic review of factors and interventions. *BMC Public Health*. 2017;17(1):1-16. doi:10.1186/s12889-017-4473-7
3. Alabaster GP. *For Further Information, Please Contact: Chief, Section I, Water Sanitation and Infrastructure Branch Human Settlements Financing Division United Nations Human Settlements Programme UN-HABITAT*.
4. Gupta I, Guin P. Health Status and Access to Health Services in Indian Slums. *Health (Irvine Calif)*. 2015;07(02):245-255. doi:10.4236/health.2015.72029
5. Bank W. *Socioeconomic Impacts of COVID-19 in Kenya on Households*. World Bank, Washington, DC; 2021. doi:10.1596/35173
6. Kenya Population (2021) - Worldometer. Accessed December 27, 2021. https://www.worldometers.info/world-population/kenya-population/
7. Kenya: poverty headcount ratio 2005-2020 | Statista. Accessed December 27, 2021. https://www.statista.com/statistics/1227122/poverty-headcount-ratio-in-kenya/
8. Latif MB, Irin A, Ferdaus J. Socio-economic and health status of slum dwellers of the Kalyanpur slum in Dhaka city. *Bangladesh J Sci Res*. 2016;29(1):73-83. doi:10.3329/bjsr.v29i1.29760
9. Mberu BU, Haregu TN, Kyobutungi C, Ezeh AC. Health and health-related indicators in slum, rural, and urban communities: A comparative analysis. *Glob Health Action*. 2016;9(1). doi:10.3402/GHA.V9.33163
10. Kenya Ministry of Health. National Strategic Plan for Tuberculosis, Leprosy and Lung Health 2019-2023. *Moh*. Published online 2019. https://www.nltp.co.ke/download/national-strategic-plan-2019-2023/
11. Naveed MM, Anwar MM. Socio-Economic Condition and Health Status of Urban Slums : A Case Study of Jogo Chak , Sialkot. *Asian J Soc Sci Humanit*. 2014;3(4):279-284. Accessed December 26, 2021. www.ajssh.
12. Sample Size in Statistics (How to Find it): Excel, Cochran's Formula, General Tips - Statistics How To. Accessed December 29, 2021. https://www.statisticshowto.com/probability-and-statistics/find-sample-size/
13. WHO. Kenya: WHO Coronavirus Disease (COVID-19) Dashboard With Vaccination Data | WHO Coronavirus (COVID-19) Dashboard With Vaccination Data. 2023. Accessed October 26, 2023. https://covid19.who.int/region/afro/country/ke
14. Brier J, lia dwi jayanti. No Covariance structure analysis of health-related indicators for elderly people living at home with a focus on subjective sense of health Title. Vol 21.; 2020. http://journal.um-surabaya.ac.id/ index.php/JKM/article/view/2203
15. KNBS. Demographic and Health Survey 2022. *Demogr Heal Surv 2022*. Published online 2023:1-23.
16. Ministry of Health [Kenya]. Kenya Health Sector Strategic Plan. *KHSSIP MOH Kenya*. 2018;(July 2018):1-152. https://www.health.go.ke/wp-content/uploads/2020/11/Kenya-Health-Sector-Strategic-Plan-2018-231.pdf
17. Van De Vijver S, Oti S, Oduor C, et al. Challenges of health programmes in slums. *Lancet*. 2015;386(10008):2114-2116. doi:10.1016/S0140-6736(15)00385-2
18. Ministry of Health K. National Guidelines For Control And Management Of Sickle Cell Disease in Kenya. 2020;
19. Kanter J, Telen MJ, Hoppe C, Roberts CL, Kim JS, Yang X. Validation of a novel point of care testing device for sickle cell disease. BMC Med [Internet]. 2015 Sep 16 [cited 2023 Jul 13];13(1):1–8. Available from: https://link.springer.com/articles/10.1186/s12916-015-0473-6
20. McCormick M, Osei-Anto HA, Martinez RM. Addressing sickle cell disease [Internet]. Addressing Sickle Cell Disease. National Academies Press (US); 2021 [cited 2023 Jul 15]. 1–496 p. Available from: https://www.ncbi.nlm.nih.gov/books/NBK566461/
21. Habitat U. Informal settlements' vulnerability mapping in Kenya facilities and partners mapping in

Nairobi; The Case of Mathare. 2020;1–24.
22. Owade VD. Sickle Cell Awareness [Internet]. 2022 [cited 2023 Jul 20]. Available from: https://germandoctorsnairobi.co.ke/sickle-cell-awareness/
23. Wanjiku CM, Njuguna F, Asirwa FC, Mbunya S, Githinji C, Roberson C, et al. Establishing care for sickle cell disease in western Kenya:achievements and challenges. Blood Adv [Internet]. 2019 Dec 12 [cited 2023 Jul 20];3(Suppl 1):8. Available from: /pmc/articles/PMC7034116/
24. Old J, Harteveld CL, Traeger-Synodinos J, Petrou M, Angastiniotis M, Galanello R. HAEMATOLOGICAL METHODS. 2012 [cited 2023 Jul 21]; Available from: https://www.ncbi.nlm.nih.gov/books/NBK190583/
25. Kakou Danho JB, Atiméré YN, Koné D, Yéo DD, Couitchéré L. Feasibility Study of the "hemoTypeSC" Test for the Rapid Screening of Sickle Cell Disease in Côte D'Ivoire. Adv Hematol. 2021;2021.