

Epidemiological and Demographic Trends of Snakebites in Mwingi Sub-County, Kenya

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ABSTRACT

Snake envenomation remains a public health problem in Mwingi Sub-County, Kenya. This study analysed the epidemiological and demographic trends of snakebites in the sub-county. A cross-sectional mixed-methods design was used. Structured questionnaires were used to collect quantitative data from 100 snakebite survivors, and interviews were conducted with 40 purposively selected key informants to provide qualitative data. Quantitative data were analysed descriptively (descriptive statistics), and qualitative data were analysed thematically. The results revealed high exposure to snakes, with most participants reporting 1 bite; however, some also reported multiple bites.

The findings identified cobras as the most commonly reported snake species involved in snakebite incidents in Kitui County. Few incidents were reported, with higher rates at home and in the afternoon, and increased occurrence during the dry season. All age groups were affected; sufferers were mostly over 55, with males outnumbering females. The study found that the distribution of snakebites in the Mwingi area is detectable, i.e., demographic, geographical, temporal and seasonal patterns exist. The study also recommends targeted community awareness, surveillance, and prevention measures that focus on high-risk populations and environments.

Keywords: Snakebite envenomation; epidemiological trends; demographic patterns; snakebite incidence; Mwingi Sub-County; Kenya; seasonality; snakebite surveillance.

INTRODUCTION

Snakebite envenomation is an under-recognised, underutilised, neglected tropical disease that disproportionately affects disadvantaged and rural populations (World Health Organisation, 2023). Globally, approximately 5.4 million people are bitten by snakes each year, and more than 100,000 of these bites result in death, with long-term disability a significant issue among victims (Gutiérrez et al., 2022). The burden is greatest in the tropics and subtropics, where contact with snakes is common. The epidemiology varies across geographical areas, work environments, seasons, and population size. Identifying populations at higher risk and prioritising specific prevention and surveillance measures is crucial and requires understanding who is affected, where, and when snakebite incidents occur (Harrison et al., 2022). Epidemiological data are a crucial input into designing context-specific snakebite prevention and health burden reduction strategies.

Snakebite envenomation is a significant global problem, with India among the countries with the highest burden of snakebite-related deaths. Between 2000 and 2019, an estimated 1.2 million deaths were attributed to snakebites, averaging about 58,000 deaths per year (Suraweera et al., 2020). There was high susceptibility among the agricultural population and economically active adults, with deaths mostly occurring in rural areas. These findings demonstrate a strong relationship between snakebite occurrence, rural residence and occupational exposure. The incidence is also higher in the southern provinces of China, including Guangdong, Guangxi, Yunnan, Fujian, and Hainan, with an estimated 100,000 cases each year (Li et al., 2021). The geographic variation highlighted above underscores the need for analyses of geographic and demographic patterns when evaluating snakebite burden.

Snakebite epidemiology in Australia differs markedly from that in many developing countries. Between 2000 and 2019, snake bites caused about 3000 hospital admissions, with one to two deaths each year (AIHW, 2022). Although several species of venomous snakes are present, comparatively low mortality rates indicate differences in outcomes across geographical areas. Accordingly, patterns of snake venom envenomation are influenced not only by venomous snakes but also by population exposure, geographic distributions, access to health services, and other factors. Public education and surveillance have also been instrumental in increasing the number of recorded snake bites, thereby improving recognition and reporting (Isbister et al., 2022). These variations underline the need for local epidemiological information.

Snakebite constitutes a significant public health problem in the African region, with marked inter-country and inter-population variability. Nigeria has a recorded annual incidence of about 43,000 snakebite envenomation cases, with particularly high rates in the northern parts of the country, where there are significant farming and farming-related activities, such as livestock farming (Habib et al., 2015; Chippaux, 2023). An estimated 8,000 to 10,000 snakebites occur in Uganda, East Africa, every year, especially affecting farmers, herders, and children (Longbottom et al., 2018). Tanzania also reports 13,000 to 14,000 snakebite cases each year, with significant exposure among pastoral and rural communities (Longbottom et al., 2018). These patterns suggest that occupation, rural living status, and demographic factors are significant contributors to snakebite exposure in African populations. Snakebite envenomation is a major concern in the dry and semi-arid counties of Kenya, including Kitui, Turkana, Baringo, Taita Taveta and West Pokot. Between 2020 and 2024, 1,939 snakebite cases were reported in Kitui County, with Mwingi North and Mwingi Central among the affected sub-counties (TEPHINET, 2023). A survey of patients admitted to Mwingi Level IV Hospital between 2018 and 2023 identified 305 snakebite cases, with nearly equal numbers of male and female victims and a median age of 22 years (University of Nairobi, 2023). The results indicated that snakebites affect various demographic subpopulations in Mwingi; thus, there is a need to closely investigate the victims' characteristics and their predisposition to bites.

Although the burden of snake bites is significant in Mwingi Sub-County, in-depth epidemiological and demographic data for the county are scarce. Available data include seizure incidence and some general characteristics of victims, but are limited in their ability to provide information about the distribution of incidences by time (day/night), location, age, gender, and season. This is relevant to recognizing populations exposed at higher rates and/or in specific situations. Therefore, this study examines the epidemiological and demographic trends of snakebites in Mwingi Sub-County, including their frequency, characteristics, and distribution, as evidence to guide targeted public health, prevention, and surveillance interventions.

AIM

The aim of this study is to analyse the epidemiological and demographic trends of snakebites in Mwingi Sub-County, Kenya.

THEORETICAL FRAMEWORK

The study is underpinned by two theories, the Health Systems Theory and the Health Security Theory, which complement each other in highlighting the epidemiological and demographic trends of snakebites in Mwingi Sub-County. The Health Systems Theory provides insights into the role of health information systems and access to essential medicines in snakebite diagnosis and management, whilst the Health Security Theory conceptually expands on the roles of surveillance, preparedness, and response in addressing snakebite as a public health threat. These theories serve as a basis for interpreting the occurrence and distribution of snakebites in the study area.

Health Systems Theory

Health Systems Theory is a framework that views healthcare as a whole system comprising health systems, the health workforce, health information systems, essential medicines, financing, and leadership and governance (WHO, 2007). The theory is used in this study to understand the interactions between health

information systems and snakebite service delivery, and their impact on the identification, documentation, and reporting of cases. Reliable health information can provide evidence on the frequency and distribution of incidents by age, gender, location, and timing. For the purposes of epidemiological and demographic pattern analysis, Health Systems Theory is therefore pertinent, as proper reporting and documentation allow the identification of affected populations and locations and facilitate an evidence-based understanding of the snakebite burden in Mwingi Sub-County.

Variations in patterns of reptile envenomation across population categories and geographic distributions are better understood through Health Systems Theory. Snakebites may not be well documented or reported due to weak health information systems, restricted access to health care facilities, and variations in use (de Savigny & Adam, 2009). However, the theory has drawbacks because its systems perspective does not consider environmental, cultural, and behavioural factors that may affect snake exposure. Thus, this study used the theory to understand how health system structures can affect the discovery, recording, and reporting of epidemiological and demographic patterns of snakebite incidents, and acknowledged that other environmental and behavioural factors might also influence the observed distribution of incidents.

Health Security Theory

According to Health Security Theory, health security is achieved through the prevention, surveillance, preparedness, and response of populations to health threats (Fidler, 2007; Aldis, 2008). This study is relevant to the theoretical aspect because snakebite envenomation is a public health threat that can lead to morbidity, disability and mortality, especially among vulnerable groups exposed to the bite of the organism. The theory is used to analyse snakebites in Mwingi Sub-County, based on age, gender, geographical location, frequency, timing and seasonality. These characteristics strengthen surveillance by identifying circumstances and populations at higher risk of exposure. Therefore, the theory can be used to analyse epidemiological and demographic data, which are essential for understanding the distribution and occurrence of snakebites in the study area.

The Health Security Theory also calls for evidence-based surveillance to provide information on population vulnerability to health threats and to enhance preparedness (WHO, 2021). The theory was used to make sense of findings on who is affected, where snake bites occur, whether bites are more likely during a specific season, and whether snake bites tend to occur at a consistent time. It could inform prevention, surveillance, and preparedness activities in Mwingi Sub-County, which are planned to address the situation. However, local behavioural, cultural, and environmental factors may affect exposure to snakes, and the theory may not capture these (Aldis, 2008). These factors are thus taken into account when interpreting the epidemiological and demographic results, and the theory is mainly applied to the snakebite health-security hazard, which requires systematic monitoring and preparedness.

METHODOLOGY

Research Design

The study used a mixed-methods (parallel convergent) design with a cross-sectional study design. The quantitative part provided epidemiological and demographic information on snakebite incidents, and the qualitative data provided contextual information on participants' experiences and observations related to snakebite incidents. The cross-sectional design enabled the study to examine the pattern of snakebites among residents in Mwingi Sub-County at a specific point in time, without manipulating the study variables. The use of mixed methods enabled the triangulation of the quantitative and qualitative results and an overall better understanding of the occurrence and distribution of snakebites in the study area.

Target Population

The target population comprised snakebite survivors in Mwingi Sub-County who had been bitten during the study period, as well as selected participants who could provide contextual information on snakebite

occurrence. The estimated number of snakebite victims and their survivors during 2020-2024 was approximately 1000 cases. The primary population for the quantitative component was snakebite survivors, as they provided first-hand information on the epidemiological and demographic characteristics of snakebite incidents.

Sample Size Computation

The quantitative sample was estimated from a population of around 1,000 snakebite survivors in Mwingi Sub-County for the period 2020 – 2024. Yamane's formula was applied using a 9.5% margin of error:

$$n = \frac{N}{1 + N(e)^2}$$

where n represents the required sample, N the population size and e the margin of error. Substitution gives:

$$n = \frac{1000}{1 + 1000(0.095)^2}$$

$$n = \frac{1000}{10.025}$$

$$n = 99.75 \approx 100$$

Therefore, the quantitative survey included 100 snake-bite survivors. For the qualitative component, 40 purposively selected Informants (15 caregivers, 10 healthcare workers, 5 traditional healers, 5 administrators/policymakers and 5 CHVs) were selected. Thus, the overall number of participants was 140.

Sampling Strategy

The study employed several sampling techniques to select participants who met the predefined eligibility criteria. The identification of snakebite survivors was conducted using three sources: (1) Health Facilities records, (2) Community Health Volunteers (CHVs), and (3) snowball sampling to identify additional eligible survivors. Key informants were selected through purposive sampling, based on their knowledge and experience of snakebite occurrence and management. The quantitative analysis is limited to the 100 snakebite survivors included to examine demographic and epidemiological data – age, gender, frequency, location, time, and season of occurrence.

Research Instruments

The research tools used for data collection were a structured questionnaire and a semi-structured interview guide. The questionnaire collected quantitative data on snake bites, including incident frequency, victim characteristics, snake species, geographic data, time of occurrence, and seasonal variation. Qualitative data on experiences and observations of snake bite incidents were obtained through interviews with selected participants. These instruments were used during a pre-test with 14 non-study patients at Kyuso Sub-County Hospital. Content and construct validity were assessed, and Cronbach's alpha was used to measure the questionnaire's reliability, with a coefficient ≥ 0.70 considered acceptable.

Data Analysis

Data were analysed and processed in SPSS version 26 for quantitative analysis. Epidemiological and demographic data on snakebite incidents were summarised using descriptive statistics, including frequencies, percentages, means, and standard deviations. This analysis was limited to variables considered relevant to the Article published in the Journal, such as respondents' age, gender, frequency of snakebite incidents, snake species, recency, geographical location, time of occurrence, and seasonal variation. Qualitative interview data were analysed to identify themes that complemented the quantitative findings and provided insight into

common experiences or observations. Quantitative and qualitative data were integrated, thereby aiding the triangulation of evidence on snakebite patterns in Mwingi Sub-County.

Ethical Considerations

The study was approved by the Kenya Defence Forces Institutional Scientific and Ethics Review Committee (KDF-ISERC), and a research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI). Participants were informed of the study's objectives, procedures, risks and benefits, and were given the right to withdraw voluntarily at any time. Prior informed consent was obtained, and the informed consent information was translated from English into Kiswahili and Kamba as needed. To ensure confidentiality and anonymity, no personal data was collected, and research data was kept secure.

FINDINGS

Bites' Epidemiological and Demographic Patterns

The objective of this study was to analyse the epidemiological and demographic trends of snake bites in Mwingi sub-county. To address this objective, structured questions were asked, and the results are presented in the following subsections.

Experience with Snakebite Incidents

Respondents were asked to indicate whether they had experienced a snakebite, and the results are presented below;

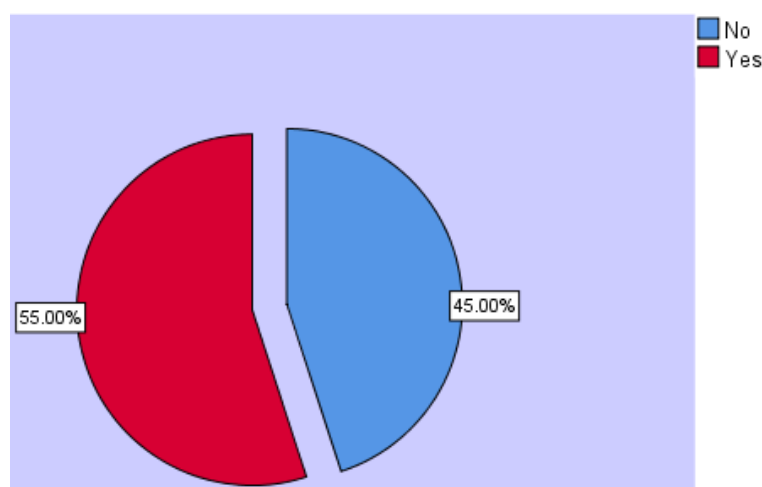


Figure 1: Experience with Snakebite Incidents

Source: Researcher (2025)

Figure 1 shows that most respondents (n=55; 55%) reported that they or someone they knew had been bitten by a snake, while n=45 (45%) reported no snakebite experience. This suggests that snakebite cases are not uncommon in the study area, as over half of respondents were directly or indirectly affected. The results indicate that snakebite exposure is common in Mwingi sub-county, underscoring its importance as a public health problem in the community. These results are further supported by qualitative findings, as respondents in their narratives described common snakebite incidents and difficulties accessing timely medical care. One caregiver stated:

“Many people are bitten by snakes. I have observed that patients are forced to travel long distances to receive treatment, and by the time they reach the hospital, the poison has already spread throughout the body.” (Caregiver, Interview Respondent 1)

The integration of quantitative and qualitative results indicates that snakebite exposure in Mwingi Sub-County is not only widespread but also worsened by structural barriers to healthcare access.

Frequency of Snakebite Incidents Among Respondents

The study sought to assess the Frequency of Snakebite Incidents Among Respondent, and the results were as highlighted below;

Table 1: Frequency of Snakebite Incidents among Respondents

	Frequency	Percent
Once	70	70.0%
Three times or more	12	12.0%
Twice	18	18.0%
Total	100	100.0%

Source: Researcher (2025)

Table 1 indicates that most respondents (n=70; 70%) had experienced one snakebite; n=18 (18%) had experienced two snakebites; and n=12 (12%) had experienced three or more snakebites. This suggests that, despite the prevalence of snakebite incidents in the study area, most people perceive them as one-off events. Nevertheless, the percentage of respondents who reported experiencing them more than once indicates ongoing, repeated exposure to the risks of snakebites, especially among those who live or work in high-risk areas. The qualitative results also depict the recurrence of snakebite attacks in the community. One caregiver explained:

“There are many snakes here, and people are bitten from time to time. I have witnessed instances where one is bitten more than once because we live near bushes and farms.” (Caregiver, Interview Respondent 2)

These results indicated that although snakebites occur as isolated events in the lives of many individuals, a large proportion of people become victims of snakebites due to environmental and occupational conditions.

Types of Snake Species Involved in Snakebite Incidents

Respondents were asked to indicate the type of snake species involved in snakebite incidents, and results were as presented below;

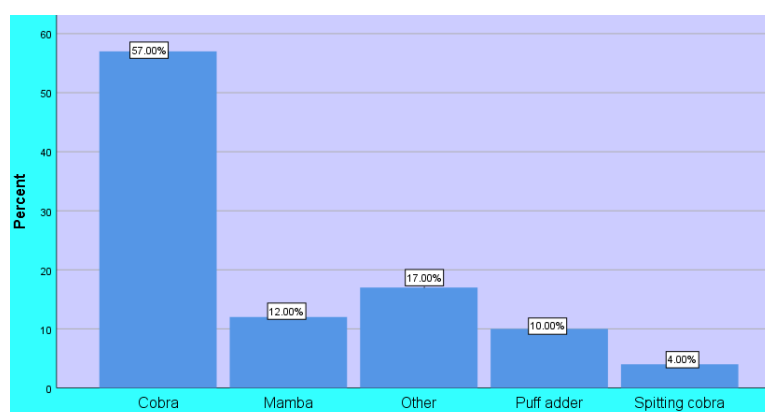


Figure 2: Types of Snake Species Involved in Snakebite Incidents

Source: Researcher (2025)

Figure 2 shows that the most commonly reported snake species in snakebite cases was the cobra, accounting for 57% of cases (n=57). This was closely followed by other unspecified snake species at n=17 (17%), black mambas at n=12 (12%), puff adders at n=10 (10%), and spitting cobras at n=4 (4%). The results show that the most common cobra bites occur in Mwingi Sub-County, which may imply greater exposure of the population to this specific species. The region's ecological diversity and the risks posed to the community are further demonstrated by the presence of many snake species.

These results are also supported by qualitative findings, in which respondents recounted their experiences with various kinds of snakes in their surroundings. One respondent explained:

“The snakes here are numerous and of various kinds. Some are red, some are like the soil, others are green and abide in the trees. You are seated, and there is a snake above you, even though you do not know.” (Community Member, KII Interview Respondent 3)

These results imply that Mwingi Sub-County is home to a wide range of snake species, with cobras being the most prevalent in terms of bites. This variety complicates snakebite management, as different species require specific treatment strategies.

Recency of Snakebite Occurrences Among Respondents

Respondents were asked when the most recent snakebite occurred, and their responses are shown in Table 2 below.

Table 2: Recency of Snakebite Occurrences Among Respondents

	Frequency	Percent
1-3 months ago,	64	64.0%
3-6 months ago,	12	12.0%
More than 6 months ago	15	15.0%
Within the last month	9	9.0%
Total	100	100.0%

Source: Researcher (2025)

Table 2 indicates that most respondents (64%) reported that the most recent snakebite occurred within the past 13 months. This was followed by 15% who said the incident had been more than 6 months ago, 12% between 3 and 6 months ago, and only 9% in the past month. These results indicate that snakebites are neither old nor uncommon in the study area, with a large percentage of respondents reporting or having observed cases in recent times. The same trend is also supported by qualitative findings, in which respondents highlighted the frequent occurrence of snakebite cases in their villages. One respondent explained:

“Snakebites occur periodically here.... it is not something that occurred many years ago; even recently, people are still bitten due to the presence of snakes in this place....” (Caregiver, Interview Respondent 4)

The results indicate that snakebite cases in Mwingi Sub-County are not only widespread but also recent and ongoing, suggesting a long-term public health problem.

Geographical Context of Snakebite Occurrences

Respondents were asked to indicate where the snakebite occurred, and the results are shown in the Table.

Table 3: Geographical Context of Snakebite Occurrences

	Frequency	Percent
At home (indoor)	63	63.0%
At home (outdoor)	14	14.0%
In the field/farm	8	8.0%
Other	8	8.0%
While herding livestock	7	7.0%
Total	100	100.0%

Source: Researcher (2025)

Table 3 shows that a majority of snakebites were reported in residential areas, with 63% of cases occurring in homes and 14% in home compounds. However, there were fewer occurrences in the workplace, such as on farms (8%) and when herding livestock (7%), and 8% were not specified.

These findings indicate that the threat of snakebites is not confined to outdoor or occupational environments but also extends into the domestic environment, posing a risk to all individuals, even in perceived safe settings. This trend can also be explained by qualitative observations, as respondents reported shared experiences with snakes in residential settings. One respondent narrated:

“I was sitting at home when bitten by the snake. It was in the grass outside the house, and I was not able to see it. I simply felt it bite me, and that is when I knew what had happened.” (Survivor, Interview Respondent 5)

These findings indicate that snakebite vulnerability in Mwingi Sub-County is ingrained in daily living conditions and not limited to any high-risk occupations.

Time of Snakebite Incidents

The study sought to examine the time of day that the snakebite occurred, and the results are presented below;

Table 4: Time of Day of Snakebite Incidents

	Frequency	Percent
Afternoon	66	66.0%
Evening	6	6.0%
Morning	15	15.0%

Night	13	13.0%
Total	100	100.0%

Source: Researcher (2025)

Table 4 shows that snakebites mostly occurred in the afternoon, accounting for 66% of reported incidents. Morning cases accounted for 15%, and night and evening cases accounted for 13% and 6%, respectively. This pattern indicates that snakebite incidence is closely linked to periods of high outdoor human activity, particularly during the daytime, when people are farming, herding, and engaging in other livelihood activities. Qualitative descriptions provide further context for these results, underscoring how day-to-day activities expose people to snake-related experiences. One respondent explained:

“During the day, I was working in the garden and was bitten by it. I did not notice the snake because it was hidden in the grass.” (Survivor, Interview Respondent 6)

This finding revealed that the risk of snakebites in Mwingi Sub-County is highly dependent on human behavioural patterns, especially during daytime agricultural activities. Snakebite incidents are usually associated with work-related exposures during working hours. Most snake attacks occur when a person unknowingly disturbs snakes during their normal routine. Thus, the results indicate that preventing snakebites requires specific precautionary measures, including protective clothing and awareness during peak activity, to reduce the number of snakebites.

Age Distribution of Snakebite Victims

The study sought to examine the snakebite victims' age, and the results were as noted below;

Table 5: Age Distribution of Snakebite Victims

	Frequency	Percent
Between 18 and 24 years	17	17.0%
Between 25 and 34 years	16	16.0%
Between 35 and 44 years	18	18.0%
Between 45 and 54 years	15	15.0%
55 years and above	22	22.0%
Below 18 years	12	12.0%
Total	100	100.0%

Source: Researcher (2025)

Table 5 shows a fairly even distribution of snakebite victims across age groups, with the largest share, 22%, among those aged 55 years and above, followed by 18-24 years (17%) and 35-44 years (18%). Ages between 25-34 years accounted for 16%, ages between 45-54 years for 15%, and the lowest percentage, 12%, was for individuals below 18 years. This trend shows that snakebite cases cut across all age groups, but older adults are slightly more prone to this phenomenon, which may be explained by longer exposure to risky environments and activities.

Participant accounts also illuminate age as a source of vulnerability, especially in active and mobile people. One respondent recounted:

“At the time it happened, I was robust and working on the farm. I was not expecting it, but since I am always in the fields, I believe that is how I got bitten.” (Survivor, Interview Respondent 7)

The analysis indicates that exposure and daily activities have a greater impact on the risk of snakebites than age does. Although cumulative exposure may go unnoticed in older people, economically active groups are also highly vulnerable because they engage in outdoor activities.

Victim's Gender

Respondents were asked to indicate the gender of victims, and results were as presented below;

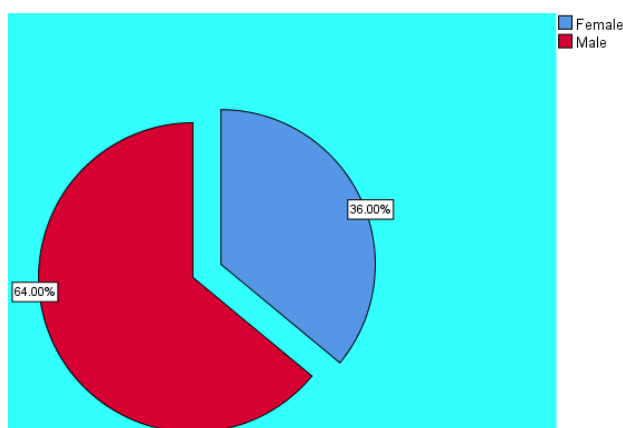


Figure 3: Victim's Gender

Source: Researcher (2025)

Figure 3 shows that male victims accounted for 64%, while female victims accounted for 36%. This trend indicates that exposure to snakebites is gendered, as men are more prone to it than women. The difference can also be explained by differences in roles and everyday activities, especially the greater engagement of men in outdoor activities such as farming, herding, and manual labour, which increases the likelihood of snake exposure. Qualitative evidence also demonstrates this trend, with respondents associating snakebite accidents with common outdoor activities. One participant explained:

“Most of us men spend a lot of time in the farms and bushes.... that is where we meet these snakes, so it is not surprising that many of the victims are men...” (Community Member, Interview Respondent 8)

The quantitative and qualitative results indicate that gender differences in snakebite incidence are strongly related to socio-economic roles and exposure patterns rather than biological factors.

Seasonal Variation in Snakebite Incidence

Respondents were asked to indicate whether there is a specific season when snakebites are more common and specify the season. Results were as presented below;

Table 6: Seasonal Variation in Snakebite Incidence

Response Category	Frequency	Percentage (%)
Yes	72	72.0%

No	28	28.0%
Total (All Respondents)	100	100.0%
Dry Season (n = 72)	58	80.6%
Rainy Season (n = 72)	14	19.4%
Total (Yes Responses)	72	100.0%

Source: Researcher (2025)

Table 6 shows that a large proportion of respondents (72%) reported that snakebite incidents were seasonal, while 28% observed no seasonal variation. Among those reporting a seasonal trend (n = 72), a majority (80.6%) reported that snakebites were more prevalent during the dry season, while only 19.4% reported higher incidence during the rainy season. This suggests that snakebite incidence in Mwingi Sub-County is generally highest during the dry season. Qualitative data provide further explanation for these seasonal patterns, particularly the tendency of snakes to move more often in dry weather. One respondent explained:

“During the dry season, snakes come closer to homes looking for water. That is when we see more cases of people being bitten by snakes...” (Community Member, Interview Respondent 9)

Based on the findings, seasonal changes in snakebite incidence are directly associated with environmental and ecological factors. The increased incidence during the dry season could be explained by snakes being more active in search of water and shelter, and by humans being more active outdoors.

Respondents' Perceptions on Snakebite Patterns and Management

Respondents were asked to indicate their perceptions of Snakebite Patterns and Management using a Likert scale, where 1 represented Strongly Disagree, 2 represented Disagree, 3 represented Neutral, 4 represented Agree, and 5 represented Strongly Agree. Results are shown below.

Table 7: Respondents' Perceptions on Snakebite Patterns and Management

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dev
Snakebites are more common during the dry season in Mwingi	26.0% (26)	23.0% (23)	12.0% (12)	15.0% (15)	24.0% (24)	2.88	1.55
The majority of snakebites happen in rural and farming areas of Mwingi	25.0% (25)	20.0% (20)	16.0% (16)	21.0% (21)	18.0% (18)	2.87	1.46
Snakebite victims are usually younger (under 40 years old)	20.0% (20)	20.0% (20)	17.0% (17)	21.0% (21)	22.0% (22)	3.05	1.45

Men are more likely to be bitten by snakes than women	18.0% (18)	15.0% (15)	24.0% (24)	29.0% (29)	14.0% (14)	3.06	1.32
Snakebites occur more frequently in the morning and evening	22.0% (22)	15.0% (15)	18.0% (18)	23.0% (23)	22.0% (22)	3.08	1.47
The availability of healthcare and antivenom is a major factor in snakebite survival	23.0% (23)	17.0% (17)	24.0% (24)	16.0% (16)	20.0% (20)	2.93	1.44
Average	—	—	—	—	—	2.98	1.45

Source: Researcher (2025)

Table 7 indicates that respondents had moderate perceptions of snakebite patterns and management in Mwingi Sub-County, with moderate overall agreement (Mean = 2.98; SD = 1.45). In this instance, there was no consensus among respondents on whether snakebites are more common in the dry season (43% agreed or strongly agreed) or the wet season (49% disagreed or strongly disagreed). Similarly, 47% reported that most snakebites occur in rural and farming areas, while 45% reported the opposite, suggesting that experiences vary. There was more consensus on demographic patterns: 43% agreed that younger people are victims, and 43% agreed that men are more affected. Moreover, 45% agreed that snakebites occur at certain times of day, and the importance of healthcare was moderately agreed upon (36% agreement).

The qualitative results give a better understanding of the seasonal processes. One respondent stated:

“Snakes approach homes in search of water during the dry season, and it is in this season that most of the people are bitten by snakes...” (Community Member, Interview Respondent 9)

This response describes the perceived link between snake movement and the environment. During dry periods, snakes come into closer contact with humans due to a lack of water. The respondent's explanation is grounded in the ecological reality of competing with snakes for limited resources (water and shelter). However, the split quantitative answers (43% agreement vs 49% disagreement) indicate that these experiences may not be consistent across all places. This implies that the risk may vary from season to season, depending on the micro-environment, settlement, and the community's environmental awareness.

Another Respondent pointed to the issue of gender related exposure:

“The working men are the ones who work in the farms and bushes, thus the ones who are bitten more frequently than the women...” (Community Member, Interview Respondent 8)

This statement underscores the role of socio-economic factors in snakebite susceptibility. In most rural areas, males engage in more outdoor activities (farming, herding, land clearance) and are therefore exposed to direct contact with snake habitats. This is confirmed by the quantitative results, which showed that 43% of participants agreed that men are more likely to be bitten.

A degree of consistency between qualitative and quantitative findings revealed a relatively high level of agreement about gendered exposure. The results further emphasise that the snakebite problem is behavioural rather than biological, making it imperative to take special measures for vulnerable groups.

A third respondent said that access to healthcare was an issue:

“When treated early, and the antivenom is there, it is possible to save their lives, but without it most of the people die...” (Caregiver, Interview Respondent 10)

This underscores the importance of timeliness in medical care for snakebite treatment. The respondent's attitude indicates knowledge of the antivenom's life-saving role and of the medical care system. However, quantitative results indicate that the level of agreement (36%) is moderate, with not everyone agreeing or prioritising this. This gap may be attributed to a lack of awareness, the use of traditional remedies, or unequal access to health care in the region. The difference shows that whilst some within the community recognise the importance of medical treatment, others may bring it into disrepute, which is one of the main concerns of medical education among the people.

DISCUSSIONS

The study determined that snakebite envenomation is a public health issue in Mwingi Sub-County. The respondents had either experienced a snakebite or had a family member who had one. The Yes group accounted for more than half (55%), while the No group was 45%. Furthermore, 70% reported experiencing 1 snakebite, 18% reported experiencing 2, and 12% reported experiencing 3 or more, indicating that some community members were exposed to multiple snakebites. Repeated snakebites were attributed by participants in the interview to the proximity of farms/bushes to homesteads and snake habitats. This aligns with reports by Ochola et al. (2018), the World Health Organisation (2020), and Harrison et al. (2021), namely that climatic conditions expose people to repeated snakebites and to poor access to services in rural areas. These results complement other findings, indicating that snakebite still constitutes a significant public health problem that demands continuous vigilance and preventive measures.

The study also revealed that the highest percentage of reported snakebite cases was attributed to cobras (57%), followed by black mambas (12%), puff adders (10%), spitting cobras (4%), and others (17%). The region's ecological diversity was also confirmed when respondents were asked about other venomous snakes that infested their homes or farms. This study corroborates the findings of Given (2020), who found that the commonest venomous snake species in the arid and semi-arid regions of Kenya were cobras, mambas, and puff adders. On the same note, Habib et al. (2015) noted that different snake species have distinct venom effects on injuries, and therefore diagnosis and treatment are complicated. They revealed that species identification, the availability of appropriate antivenom, and the importance of ongoing training for health workers are essential.

The findings further revealed that snakebite remains a public health problem in Mwingi Sub-County. The majority of respondents (64%) indicated that the last incident of snakebite occurred within the past 1-3 months. 72% thought snakebites occurred at a certain time of year, and 80.6% identified the dry season as the period of greatest vulnerability. Interviewees reported that, during the dry season, snakes come closer to houses in search of water and shelter. The findings align with research by the World Health Organization (2020), Longbottom et al. (2018), and Luiselli et al. (2020), which indicate that climatic conditions affect snake behaviour and interactions with humans. The results indicate that initiating and enhancing preparedness and targeted prevention campaigns before and during the dry season will be beneficial.

Additionally, the research revealed that snake bites mainly occurred at home. In particular, 63% of snake bites occurred at home, 14% in the home compound, 8% on farms, and 7% within the home compound while herding livestock. Interview respondents reported frequent exposure to snakes in their homes, indicating that such exposure is not limited to work-related activities. The findings align with those of Gutiérrez et al. (2017), who found that housing quality and proximity to snake habitat were important factors affecting the risk of household venomous snake bites. A secondary finding from Harrison et al. (2020) is that the greater the encroachment of vegetation around houses, the more likely humans are to encounter snakes. The results highlight the importance of improving the urban environment in terms of housing, sanitation, and vegetation management to minimise the risk of snakebite.

Regarding demographic characteristics, the study confirmed that all age groups were affected by snakebite, with the largest group of victims aged 55 years and above (22%), followed by those aged 35–44 years (18%) and 18–24 years (17%). Additionally, there were more male-reported victims (64%) than female-reported victims (36%). Interview respondents believe this difference is due to greater involvement of males in farming, herding and other outdoor activities. The higher incidence among males aligns with Chippaux (2017), which reported higher snakebite incidence among males due to occupational exposure. Similarly, Longbottom et al. (2018) and Habib et al. (2015) found that occupation and environmental risk factors are more significant than age in determining snakebite risk. The findings indicate that high-risk occupational groups would need to be targeted for prevention programmes, but these programmes would need to include all age groups.

The study also revealed that respondents' perceptions of the pattern and management of snakebite were moderate, with an overall mean score of 2.98 (SD = 1.45). While opinions on seasonal occurrence and geographical distribution varied, many respondents expressed views on the vulnerability of males and on a particular time of day for snakebite. Other factors that positively affect survival, such as environmental conditions, occupational activities and timely use of antivenom, were also highlighted by the interview participants. The reported finding corroborates that of Harrison et al. (2020), who found that people's perceptions of snakebite vary with their experiences and environmental conditions. Gutiérrez et al. (2017) demonstrated that low awareness and delayed treatment contribute to poor snakebite outcomes. These results therefore eloquently reinforce the importance of continuing to educate the community in the prevention, early treatment and environmental protection measures needed to reduce risk.

CONCLUSION

The study findings show that snakebite envenomation is an ongoing public health problem in Mwingi Sub-County, with established epidemiological and demographic trends. Snakebite exposure was prevalent, and repeated exposure to snakes occurred in a significant proportion of the population. The cobra was the most commonly reported species. Most incidents occurred at home, especially in the afternoon, and there was some seasonal fluctuation. During the dry season, more incidents were reported. Snakebites occurred across all age groups, with adults overrepresented. Male victims were reported more often than females, reflecting differences in occupational and outdoor exposures. In summary, the results highlight the environmental, daily activity, seasonality and demographic factors associated with snakebite risk in Mwingi.

RECOMMENDATIONS

The study recommends improved community-based snakebite prevention, surveillance and awareness in Mwingi Sub-County. Public education should focus on snake identification, indoor safety, precautions when working outdoors and around farmland, and immediate medical care. High-risk groups, including men, older adults, farmers and herders, should be targeted for prevention. The study further recommends that routine documentation of snakebite victims by age, gender, location, time and season be enhanced to inform targeted messages in the fields of prevention and preparedness.

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