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Snakebite envenomation through a gender intersectionality lens in low- and middle-income countries

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Snakebite envenomation continues to affect lives globally, with >1.2 million envenomations and approximately 120 000 annual mortalities. Unfortunately, low- and middle-income countries (LMICs) contribute to >80% of these global statistics. With different targets set to minimize the impact of snakebite envenoming, such as halving the envenoming cases by 2030 from the World Health Organization (WHO), multiple initiatives are inevitable. Gender intersectionality and tropical disease research for infectious diseases of poverty, developed by the WHO, has championed the exploration of neglected diseases, stratifying them using gendered domains. However, minimal research using the gender intersectionality framework has been conducted to explore snakebite envenoming, especially among LMICs. Exploring snakebite envenomation through a gendered lens is critical in developing gender-specific interventions for the prevention and treatment of envenomation. This narrative review explores the available literature about snakebite envenomation in LMICs through a gender intersectionality lens. It provides insights into the existing gaps, especially regarding research using intersectionality frameworks and the gendered matrix. It further proposes avenues of research using these domains to understand snakebite envenomation, especially through the intersectionality lens.

Keywords: female, gender intersectionality, gender matrix, gendered roles, male, snakebite envenomation

Introduction

Globally, snakebite envenomation, a neglected tropical disease (NTD), continues to present significant public and global health challenges. Currently the World Health Organization (WHO) estimates approximately 2.7 million envenomings with >120 000 associated mortalities and morbidities occurring globally.¹ Further, a global estimate of >3.5 million years of life are lost following snake envenomation.² Most of these years are lost due to the associated disability, e.g. following amputation or paralysis of the affected limb. Sub-Saharan Africa (SSA) disproportionately contributes to the global statistics concerning envenomings, with >70% of the cases.² Further, individual countries in SSA are independently affected, especially because of the numerous different snake species. For example, mortality estimates from Nigeria showed >1400 cases, compared with 499 deaths in Ethiopia

and 545 deaths in The Democratic Republic of Congo between 1990 and 2019.² Further, the evidence showed the greatest number of envenoming deaths in India, a low- and middle-income country (LMIC), at >51 000 cases through 2019. These statistics demonstrate the significant burden of this NTD and its impact on the countries affected. Through strategic engagements, the WHO has developed a strategy and goal to halve the overall global mortality and envenoming cases by 2030.³ However, achieving this target requires various initiatives, including understanding the gendered predispositions and perspectives concerning envenomation.

Gender is a critical concept defining the perceptions and expectations of different individuals in society from their biological sex perspective. Significantly, sex and gender intersections may determine an individual's susceptibility to developing an NTD, such as snakebites.⁴ Often, this can involve the different

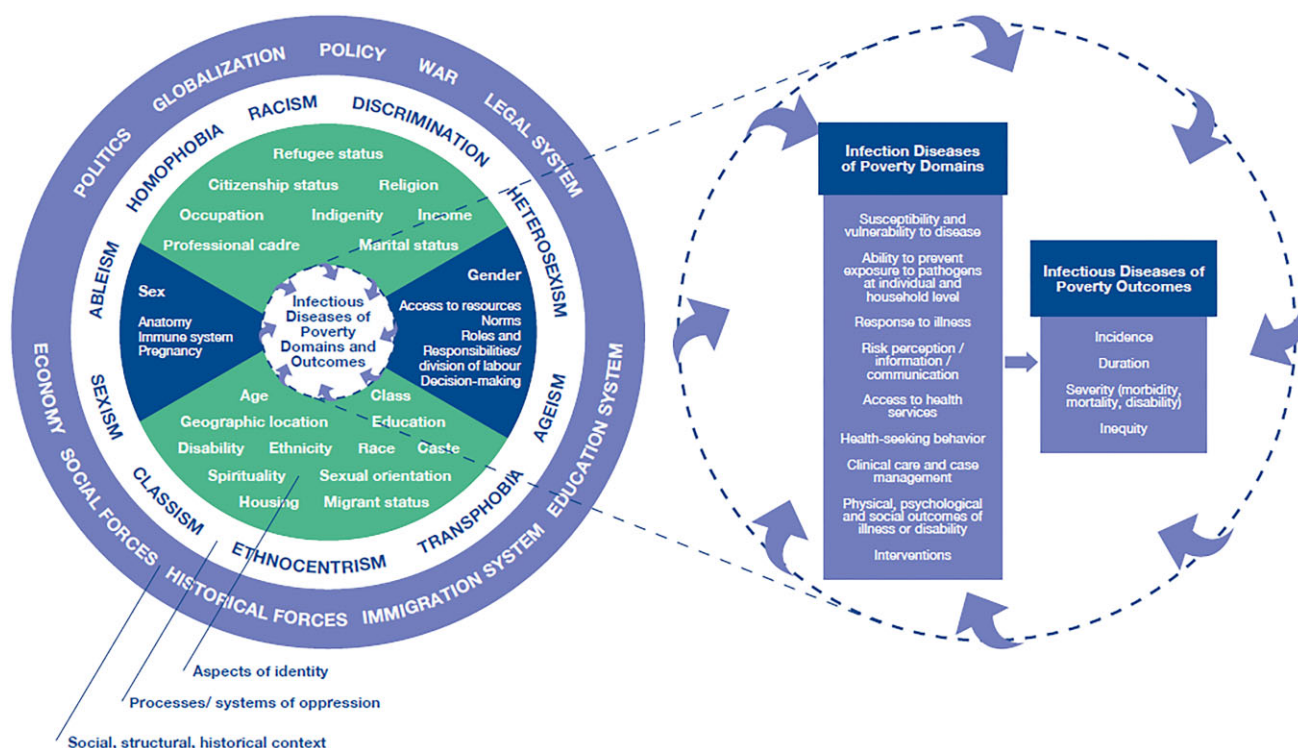


Figure 1. An illustration of the intersectionality framework showing different gender risk factors.

roles, beliefs, characteristics and norms assigned by society. Intersectionality is a concept that aims to explore the different overlapping avenues in beliefs and roles of different individuals with their gender considerations.⁴ Gender intersectionality and its relationship with snakebite envenomation in LMICs has not been extensively explored to understand the different predispositions to envenomation, mortality, morbidity and disability.⁵ Understanding gender intersectionality can provide information concerning specific gender risk factors predisposing to snake envenomation and mortality, especially through the intersectionality framework as elaborated in Figure 1.⁵ Also, the information obtained can critically inform technical experts regarding the different gender-specific interventions that can minimize envenomation predisposition, thus achieving the WHO global target. This narrative review explores the available literature about gender intersectionality and snakebite envenomation, providing highlights about the gender-specific strategies to minimize this NTD in the low-income countries affected. Additionally, it aims to answer concerns about what is currently known about snake envenomation through a gender intersectionality lens.

Gender intersectionality and snake envenomation

Gender predispositions to snakebite envenomation are different due to the various vulnerabilities despite the general effect noted among individuals. A study in Mozambique and Rwanda demonstrated that snakebite envenomation incidence

was higher among women compared with men.⁶ Another study conducted in the Rawalpindi district in Pakistan demonstrated a male:female ratio of 4:1 among individuals affected by snakebite envenomation.⁷ A global estimate of mortality following snakebite envenomation among males and females showed that males had a higher predisposition compared with their female counterparts, with 0.9 and 0.7 per 100 000 deaths, respectively.² In Brazil, an exploration of snakebite incidence in the Amazon showed that 78.6% of all snakebite cases were men.⁸ These statistics demonstrate an unequal impact of snakebite envenomation among individuals of each gender. Further evidence demonstrates that women have a higher risk of experiencing NTDs such as snakebite envenomation compared with their male counterparts.⁹ However, the variation in the number of males and females affected by snakebite envenomation has also been variable, depending on the victim's location. For example, an evaluation of snakebites in Cameroon demonstrated variable gender results across different villages. In Mengang village, seven female and three male snakebite victims were noted, Edou had seven male and six female victims, Zalom had four male and seven female victims and Akoua had five male and two female victims.¹⁰ These results further demonstrate a distinction in snakebite envenomation among the different genders, implying the presence of distinct predisposing gender-specific factors. In The Democratic Republic of Congo, mortalities following snakebites were higher among women compared with men, estimated at 5.53% and 4.62%, respectively.¹¹ These studies demonstrate a greater variability of envenomation impact among individuals of different genders, but the distinction in envenomation vulnerability is not uniform across various geographical locations.

Gender and sex intersectionality have an interplay with the different health determinants among the different population groups with their respective locations. Health determinants such as education level, livelihood activities, socio-economic status, geographical location and poverty can significantly determine the spread and exposure of envenomation.¹² The occurrence of snakebites may correspond to the time when the workers are in the field, thus outdoor places are associated with snakebites compared with residential areas. Low-income labourers who work in high-risk environments and without proper personal protective equipment and inadequate shelter are also at a higher risk of snakebite envenomation.¹³ For example, evidence from Tanzania demonstrated a higher incidence and prevalence of snakebites among adult men working outdoors, especially on cattle farms.¹³ Moreover, other individuals, irrespective of their gender, working in outdoor spaces such as cattle grazing areas and other types of farms were also at a higher risk of snakebite envenomation compared with those on closed homesteads.¹⁴ Therefore, individuals who are socially obliged to conduct various activities in outdoor spaces could be at higher risk of snakebites. However, the different intersecting factors, such as education and socio-economic status, and their intersectionality with snakebite envenomation have rarely been explored, hindering the provision of effective strategies to combat this NTD.

Gender intersectionality with snakebite envenomation expands to impact the economic, cultural and societal perceptions and influences. Even though most of these gendered experiences have been explored among NTDs such as schistosomiasis, malaria, Buruli ulcer and Chagas disease, a perspective about snakebites is still deficient. Moreover, there is minimal information concerning the economic impact of snakebite envenomation stratified by gender across numerous low-income countries.¹⁵ Most evidence explores the context of snakebite envenomation on families and households. For example, evidence from Ghana demonstrated an approximate overall cost of US\$159 on households, including medical and non-medical fees, in managing envenomation victims over 4 y.¹⁵ Often, these fees are eventually reflected in the national expenditure impacting the financial streams. In Burkina Faso, >US\$506 000 was spent annually on managing envenomation victims.¹⁶ These studies have rarely explored the economic impact of snakebite envenomation on individuals of a specific gender. Yet, evidence has demonstrated that exposure to NTDs can influence different aspects such as health-seeking behaviour, which is gender specific.^{12,17} Additionally, symptomatology often takes a variable manifestation following gender-specific exposure, such as during pregnancy.¹⁸ The different gender-specific exposures have been explored across different NTDs such as schistosomiasis, unlike snakebite envenomation.¹⁷ The absence of this crucial information hinders the delivery of appropriate remedies and affects gender-specific economic planning to alleviate the disease. Thus there is a greater need to explore the different perspectives concerning gender intersectionality to offer gender-specific interventions and guidelines. This initiative augments the WHO 2030 target of halving snakebite envenomation and its impacts.

Economic Impact on Gendered Populations

Snakebite envenomation economically impacts the gendered workforce differently, mostly arising from the occupational risks

for the different genders. Ochola et al.⁹ showed that biological differences predispose men and women to various gender roles that also reflect on their income. However, other factors such as family dynamics, extra income, gendered roles and the number of relationships may impact the income of different individuals. The impact of these factors can also be reflected in the payment of medical requirements. Financial constraints may also be reflected among the different genders due to the variation in the snakebite exposure risk.¹⁰ For example, women, who are primarily responsible for household chores, agricultural labour and childcare, may abandon their work to take care of children who have experienced envenomation.⁹ The impact of abandoning their work is reflected in their economic stature, such as earning and taking care of the home, since some of this work is their only source of livelihood. Some vulnerable populations, such as pregnant mothers, are affected differently by snakebite envenomation. Envenomation in pregnancy, although rare, can present with multiple maternal and foetal complications, including foetal demise, ranging between 43% and 58% among those affected.¹⁸ Symptomatology among pregnant mothers includes premature delivery, hypotension, haemorrhage, placenta abruption, anaemia and disseminated intravascular coagulation.^{19,20} Still, one of the immediate management strategies of envenomation during pregnancy is antivenom administration. Management can be challenging due to the complexity of the physiologic changes occurring during pregnancy.²¹ However, minimal evidence has been evaluated concerning the economic impact of snakebites on the pregnant population. Most of the information concerning snakebites during pregnancy from the African perspective is available in the form of case reports.^{18,19,22} The availability of this information is critical in understanding the toll that snakebite envenomation takes on the affected victims. However, we acknowledge the scarcity of snakebites within this population, which points to the need for data curation from different hospital databases.

The disabilities resulting from snakebites can exacerbate existing gender inequalities by limiting women's ability to engage in income-generating activities and participate in decision-making processes within the household. In Nepal, an evaluation of the economic impact of snakebite envenomation revealed a median loss of US\$22.70 following absenteeism from work for a household member.²³ Additionally, the study demonstrated an average loss of US\$67.70 for a household following different healthcare costs. While these reports are critical in informing the magnitude of the economic impact of snakebite envenomation on households, there remains a significant gap in understanding the particular loss on a particular gender in a household. Snakebite envenomation often leads to significant healthcare expenses, including hospitalization, antivenom therapy, medication and rehabilitation. In many regions, especially in rural areas of developing countries, access to healthcare facilities and antivenom may be limited or expensive.¹⁵ Women, particularly in patriarchal societies, may face additional barriers to accessing healthcare due to factors such as a lack of decision-making power, financial dependency or cultural restrictions on mobility.¹⁵ In Ghana, evidence shows that female snakebite victims spent approximately US\$226.88 less than male victims, who spent US\$255.65 per individual following envenomation.¹⁵

This evidence offers insights into the financial impact of snakebite envenomation based on gender, thus offering a

Infectious diseases of poverty domains	Biological and social stratifiers					Gender relations domains			
	Sex	Age	Race/ethnicity	Income	Disability	Access to resources	Distribution of labour and roles	Norms and values	Decision-making power
Vulnerability to disease/illness	X	X	X	X	X		Women care for sick family members. Women wash clothes outdoors.	Boys permitted to swim in infected bodies of water	
Ability to prevent exposure		X		X		Women lack knowledge of how to prevent exposure.	Men unable to reach health facilities during opening hours due to employment.		Men decide whether to buy bed nets.
Response to illness		X		X		Women lack access to financial resources to access health facilities.			

Figure 2. An illustration of the gender intersectional matrix.

potential opportunity for the development of gender-targeted interventions against the disease. However, the context of the economic impact of snakebite envenomation on gendered populations has not been extensively investigated in other LMICs, such as those in SSA, especially using the intersectionality framework. Using some of the WHO recommendations about the integration of intersectionality in diseases of poverty research, such as the intersectional gender analysis matrix, gender relation domains and gender-sensitive indicators can offer critical information concerning the economic impact within LMICs.²⁴

Gendered Cultural and Social Perspectives About Snakebites and Snakebite Envenomation

Different societies across LMICs have diverse perspectives concerning snakebite envenomation. Various studies have evaluated the cultural and social perspectives of snakebite envenomation, however, they have not included the gendered aspect to establish the casual relationship.^{25–27} For example, an evaluation of the cultural perspective on snakebites in Brazil showed that task shifting among health workers during the management of snakebites is critical for better outcomes, and attending to indigenous caregivers can offer better outcomes.^{25,27} It should be noted that the link between gender and snakebites can be influenced by cultural beliefs and social roles. Many individuals in local communities still seek traditional healers and indigenous caregivers when encountering snakebites.²⁶ These individuals believe that traditional healers have supernatural power against the snake venom

and can communicate with the snake, enhancing the healing process.²⁸ However, other reasons for seeking traditional healers include long distances to the health facilities, stigma from health workers, higher costs of treatment in the health facilities and the belief that snakebites must not be treated in health facilities because treatment requires one to come with a live snake.^{26,29–31} However, the gendered perspective in the cultural seeking of traditional healers has not yet been explored in LMICs.

Some cultural perspectives consider snakes as spiritual entities, offering worship (ophiolatry) and sacrifice to different species. For example, in India, the King Cobra is mostly associated with the god Shiva in the Hindu Pantheon.³² The consideration of snakes as part of the deity may impact the overall belief in society and thus hinder effective management. Other gendered beliefs among cultures may encompass women as more susceptible to snake attacks due to associations with fertility and temptation (think Eve and the serpent),^{32,33} while other cultures may perceive snakebites as a punishment for female transgressions against societal norms.³⁴ These myths, perspectives and beliefs may significantly impact health-seeking behaviours to minimize mortality, morbidity and disability among snakebite victims. Further, sociocultural beliefs may impact health outcomes following snakebite envenomation among various communities. Men might hold more power in treatment decisions, impacting a woman's access to antivenom or medical care.³¹ However, these concepts have not been fully explored, especially using a gender-intersectional framework, hindering the development of gender-targeted initiatives. Thus, exploring the specific cultural beliefs about snakes and gender in particular regions across LMICs is critical in contributing to achievement of the 2030

target. Additionally, investigating the impact of these beliefs on snakebite statistics for men and women and addressing gender disparities during snakebite treatment can improve health outcomes following exposure to snakebites.

Gender-Responsive Snakebite Policies and Interventions

The Universal Declaration of Human Rights (UDHR) of 1948 states that everyone has the right to medical care, food, housing and clothing. Also, the Maputo Protocol^{5,6} and Sustainable Development Goal 3 emphasize the highest attainable physical and mental health and empowering women and girls.³⁵ Also, the WHO strategy of 2019 seeks to ensure safe, quality and effective treatment, resources, partnerships and coordination to reduce snakebites and their burden by 50% by 2030.³⁶ Furthermore, the strategy focuses on empowering communities to minimize snakebites and equipping local health systems to effectively manage snakebite patients.³⁷ Incorporating gender-responsive initiatives in community empowerment and health systems, strengthening mandates of gender equality, translate into the recruitment of both female and male key players.³⁸ Some of these initiatives may include creating gender-balanced programs empowering both men and women to make decisions following snakebite exposure, increasing awareness and advocacy programs involving both men and women and training women in basic first aid measures. Unfortunately, no government is applying a gender lens to universal health coverage globally to achieve quality essential healthcare services and access to safe, effective, quality and affordable medicine for snakebite envenomation.³⁹ Tailoring some research initiatives, such as sex-disaggregated data collection, which predominantly involves collecting snakebite data categorized by gender, must be prioritized.²⁴ This initiative enables the development of gendered attributes, such as the intersectional gender analysis matrix and gender analysis questions. For example, the intersectional gender analysis matrix explores different domains concerning infectious diseases of poverty, such as snakebite envenomation, including biological stratifiers, gender domains, response to illness and disease vulnerability, as elaborated in the intersectionality matrix in Figure 2.²⁴ Amplifying these domains in the context of snakebite envenomation enables the exploration of intersecting variables that can help during the development of gender-specific interventions. Notably, the integration of these gendered frameworks necessitates the participation of key players such as government health agencies, ministries of health, non-governmental organizations and individuals from the local communities. By addressing gender disparities in snakebite risks and treatment, these policies and interventions can contribute to a more equitable healthcare system and improve health outcomes for both men and women.

Conclusions

Multiple initiatives are still necessary to achieve the global strategy of halving snakebites by 2030. The absence of information from LMICs about snakebite envenomation and gender intersectionality still poses a great challenge in achieving the set

target. Notably, gender intersectionality offers a highly sensitive approach to evaluating the impact of snakebites on both men and women independently. Through the development of gender-sensitive indicators and using the gendered domains, the different disparities, beliefs and customs among societies concerning men and women about snakebite envenomation can be addressed. Furthermore, guided by the intersectionality framework, multiple indicators, risk factors and preventive strategies against snakebite envenomation among men and women can be developed to mitigate the burden of snakebite envenomation. However, achievement of this strategy requires the participation of key players such as governments, ministries of health, individuals in the community and non-governmental organizations. This initiative can significantly contribute to halving the burden of snakebites and their impact by 2030.

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