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IMPACT OF SNAKEBITE AND SNAKEBITE ENVENOMING ON PUBLIC HEALTH AND LIVELIHOODS IN FARMING COMMUNITIES: AN EXPLORATORY STUDY IN ODUKPANI, CROSS RIVER STATE, NIGERIA

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Abstract

Snakebite envenoming is a neglected tropical disease with substantial but poorly quantified public health and economic impacts in rural Nigeria. This study evaluated the epidemiology, health-seeking behaviour, surveillance gaps, and livelihood consequences of snakebite in Odukpani Local Government Area, Cross River State. A descriptive cross-sectional survey of 100 adults in Adiabo community was conducted using structured questionnaires, alongside a retrospective review of primary healthcare records (2014–2025). Survey data (99% response rate) showed that 32.3% of households reported snakebite experience, with adult males (65.7%) and farmers (92.9%) disproportionately affected. Most bites occurred on farmlands (70.2%) and during the dry season (74.4%), indicating occupational and seasonal risk patterns. However, only one snakebite case was documented at the health facility over ten years, demonstrating critical underreporting and weak routine surveillance. Despite eight recent community deaths, perceived public health importance remained low. Snakebite incidence was significantly associated with livelihood disruption ($r = 0.462$, $p < 0.01$). Strengthening community-based surveillance, improving antivenom availability, and integrating community cultural practices into formal healthcare strategies are imperative to reduce preventable morbidity, mortality, and economic loss.

Keywords: Snakebite, Envenoming, Public health impact, Farming, Odukpani

1.0 Introduction

Snakebite envenoming is a toxin-related neglected tropical disease (NTD), resulting from venom injection into the victim's tissues during a snakebite. It is a serious public health problem, especially in tropical and subtropical regions where rural people work in agriculture and spend time outdoors. Each year, around 5.4 million people worldwide are bitten by snakes, leading to 1.8 to 2.7 million cases of envenoming and approximately 81,410 to 137,880 deaths (World Health Organization [WHO], 2023).

Envenoming can cause severe health issues, such as paralysis, bleeding, kidney failure, and lasting disabilities. These effects not only harm health but also reduce economic productivity and community well-being. Agricultural workers, herders, young people, and children are particularly affected due to outdoor exposure in rural areas and limited access to timely and effective medical care (WHO, 2023; WHO, 2025).

Sub-Saharan Africa has one of the highest rates of snakebite, which is most common in the savanna and rainforest regions where snake habitats overlap with human settlements and agricultural activity, with estimates suggesting up to one million bites and tens of thousands of deaths each year. However, these figures are likely under-reported due to poor monitoring and the frequent use of traditional healers (WHO, 2025). In many rural communities, victims delay or avoid formal healthcare in favor of traditional remedies, which increases the risk of serious complications and death. Nigeria's healthcare system struggles with challenges like limited antivenom supply, poor distribution to rural facilities, and insufficient training in treating snakebites. These challenges hinder proper care and worsen health outcomes (Chippaux, 1998; Habib, 2013; WHO, 2023).

Snakebites in Nigeria have remained underreported due to poor health infrastructure, reliance on traditional medicine, and absence of consistent epidemiological surveillance. However, existing data rate Nigeria among the countries with the highest incidence of snakebites in Africa (Chippaux, 2017); and among the worst affected, globally (Longbottom *et al*., 2018). Common venomous species include *Echis ocellatus* (saw-scaled viper), *Naja* spp. (cobras), and *Bitis arietans* (puff adders). Their presence in various ecological zones leads to significant illness and death among farmers and rural residents. Comprehensive national statistics are lacking, but regional studies indicate high incidence rates, especially in rural areas. While the Middle Belt and parts of the North have well-documented snakebite hotspots, the forested southern areas, such as Cross River State, also harbor a range of venomous snake species including black-necked spitting cobra (*Naja nigricollis*), puff adder (*Bitis arietans*), forest cobra (*Naja melanoleuca*) and vipers; with significant but less-documented snakebite incidence (Eniang & Ijeomah, 2011).

Household surveys indicate that up to 80% of victims in Africa may turn to traditional care instead of seeking formal medical treatment. This choice often leads to delays and worse health outcomes, which are often worsened by limited resources, poverty, and weak healthcare infrastructure (Gutiérrez *et al*., 2017; WHO, 2023). A study in Northeastern Nigeria linked increased complications in pediatric snakebite cases to delays in reaching healthcare facilities and slow antivenom treatment; highlighting the need for quick access to care (Hamman *et al*., 2025 a). Studies have indicated high prevalence of harmful first aid practices among farming communities in sub-Saharan Africa, such as application of tight tourniquets, making incisions at the bite site, attempt to suck out snake venom, and application of herbs or local mixtures (Habib *et al*., 2020). Owuor *et al*., (2017) reported the use of non-medical

treatments for snakebites by 76% of rural farmers in Kenya. Data from the Snakebite Treatment and Research Hospital in Kaltungo, Gombe State show seasonal trends in snakebites, with more cases occurring during farming in the rainy seasons (Hamman *et al*., 2025 b). Economic studies indicate that antivenom treatment in Nigeria can be cost-effective for preventing deaths and reducing disabilities; underpinning the need for improved access to quality antivenoms as a vital intervention (Habib *et al*., 2015).

Beyond its impact on health, snakebite envenoming greatly affects the economy of families and communities. The loss of working days, high healthcare costs, and long-term disabilities can reduce household income, disrupt farming activities, and contribute to food shortages (InfoNTD, 2025; Habib, 2013). These economic impacts become even more severe when snakebites occur during crucial farming seasons or when victims are primary income earners for their families.

While global and regional research highlights the various effects of snakebite envenoming, more localized studies are essential in different ecological and economic settings like Cross River State. Research that addresses local issues is vital for understanding community perspectives, risk factors, access to healthcare, and specific disruptions to livelihoods. This knowledge can guide the development of policies and initiatives that meet the needs of farming communities in Nigeria. This study examines the public health and socioeconomic significance of snakebite and snakebite envenoming in farming communities in Odukpani local government area of Cross River State, Nigeria. The study aims to gather specific evidence on knowledge, attitudes, practices and behaviours, health patterns, access to care, and economic impacts. This information will help inform public health policies and targeted interventions in rural Nigeria.

2.0 Methodology

Study Design

The study adopted a descriptive cross-sectional survey design, deemed appropriate because it allowed for the systematic collection of quantitative and qualitative data from participants within the farming communities, providing insight into their level of awareness, preventive practices, health-seeking behavior, and experiences of snakebite. (Setia, 2016; Habib *et al*., 2020).

Study Area

The study was conducted in Adiabo Community in Odukpani Local Government Area (LGA) of Cross River State, comprising two villages; Adiabo Ikot Mbo Otu and Adiabo Esine Ufot. Odukpani LGA is located in the southern part of Cross River State and is predominantly inhabited by farming communities. The area is characterized by dense vegetation, farmlands, rivers, and bushy environments, which create a suitable habitat for snakes and increase the risk of human-snake contact. The major occupation of the residents is subsistence farming, hunting, and fishing; activities which often expose persons to snake-infested environments. Odukpani LGA has a tropical climate with high humidity and rainfall, further increasing the prevalence of snakes in

farmlands and bushes. Healthcare facilities in the LGA include primary health centers, a few private clinics, and access to secondary healthcare services in Calabar, but the availability of antivenom is limited.

Study Population

The study population consisted of adult residents of the community, particularly those actively engaged in farming, hunting, fishing, or related agricultural activities. This population is most at risk of snakebite due to frequent exposure to farmlands, bushes, and water sources where snakes are commonly found. The population included both males and females aged 18 years and above.

Sampling Technique and Sample Size

The study employed a purposive and simple random sampling technique to select respondents. Purposive sampling was used to target farmers, hunters, and community members who are most at risk of snakebite, while simple random sampling ensured that every eligible respondent had an equal chance of selection, thereby minimizing bias. A total of 100 respondents were sampled for the study. This sample size was deemed adequate to generate meaningful insights into the knowledge, attitudes, practices, and behaviors (KAPB) of community members regarding snakebite and envenoming. The use of 100 participants aligns with recommended practices in community health surveys where moderate populations are involved and available resources determine feasibility (Setia, 2016). This sample size also balances the need for statistical reliability with the practical limitations of time, cost, and logistics associated with data collection in rural communities (Creswell & Creswell, 2018).

Instrument for Data Collection

The major instrument used for data collection in this study was a structured questionnaire, developed based on the study objectives and variables. The instrument was divided into two major sections: Socio-Demographic Variables, and Knowledge, **Attitudes, Practices, and Behaviour (KAPB) on Snakes and Snakebite, which** addressed the four variables of the study, and also offered the interface to generate data contributing to the assessment of incidence, public health and economic impact of snakebite and snakebite envenoming in the community. The questionnaire contained both **closed-ended and open-ended questions.** The instrument was prepared in **English language.** The choice of a questionnaire as the data collection instrument was informed by its **suitability for collecting standardized data from large samples**, cost-effectiveness, and ability to provide insights into community knowledge and practices within a relatively short timeframe. A Health Record Sheet was also prepared for gathering of secondary data from health records in the community health center.

Validity and Reliability of Instrument

The questionnaire was subjected to expert review, corrected to improve clarity, relevance, and alignment with study objectives; and pretested to refine ambiguous or leading questions. The pilot data were analyzed using Cronbach's Alpha coefficient, a widely accepted statistical test for internal consistency of survey instruments. A reliability coefficient of 0.78 was obtained, which falls within the acceptable threshold ($\geq$0.70), indicating that the instrument was reliable (Taber, 2018).

Data Collection

A total of 100 questionnaires were administered to respondents in Adiabo community by the researchers, assisted by two trained field assistants familiar with the local dialect. Before administration, the purpose of the study was explained to the respondents, and informed consent was obtained. For literate respondents, the questionnaires were self-administered, while for those with little or no formal education, the questions were read out and interpreted in the Efik language and other local dialects where necessary, to enhance comprehension and accuracy of responses. Using both self-administered and interviewer-administered methods helped capture responses across different literacy levels. The data collection process lasted three weeks, during which repeated visits were made to farmlands, homes, and local gathering spots to maximize participation. For secondary data, the Health Record Sheet was used to record reported cases of snakebite and snakebite envenoming at the Health Center, Adiabo, within the 12-year period 2014 to 2025. The study interval was chosen to ensure that data for a decade were fully captured.

Data Analysis

Completed questionnaires were checked for completeness and consistency. Data were coded and entered into the Statistical Package for the Social Sciences (SPSS) version 25.0 for analysis. The analysis was conducted using descriptive statistics of frequency counts, percentages, means, and standard deviations. These were computed to summarize the socio-demographic characteristics of respondents (age, sex, marital status, educational background, and occupation). Responses to KAPB questions were summarized to show the distribution of knowledge levels, attitudes, practices, and behaviors related to snakebite and envenoming, from which data on incidence and public health impact of snakebite and snakebite envenoming were derived.

3.0 Results

Characteristics of Respondents

Out of a total of 100 questionnaires administered, **99 % response rate was achieved**. The analysis of respondents' characteristics focused on age, sex, marital status, educational level, and occupation, which are crucial variables in understanding exposure levels and responses to snakebites in the community. These are presented in tables and chart.

Age and Sex of Respondents

The majority of the respondents (52.6%) were within the 25–44 age group, which represents the most active farming population (Table 1). Males were more represented (70.7%) compared to females (29.3%). This reflects the higher involvement of men in farming and outdoor activities, which predisposes them to snakebite.

Table 1: Age Distribution of Respondents

Age Group (Years)	Frequency	Percentage (%)
15–24	12	12.1
25–34	26	26.3
35–44	26	26.3
45–54	16	16.2
55–65	14	14.1
66–76	5	5.0
Total	**99**	**100**

Marital Status of Respondents

Married respondents accounted for the largest group (43.4%), reflecting the family-oriented structure of rural communities (Figure 1).

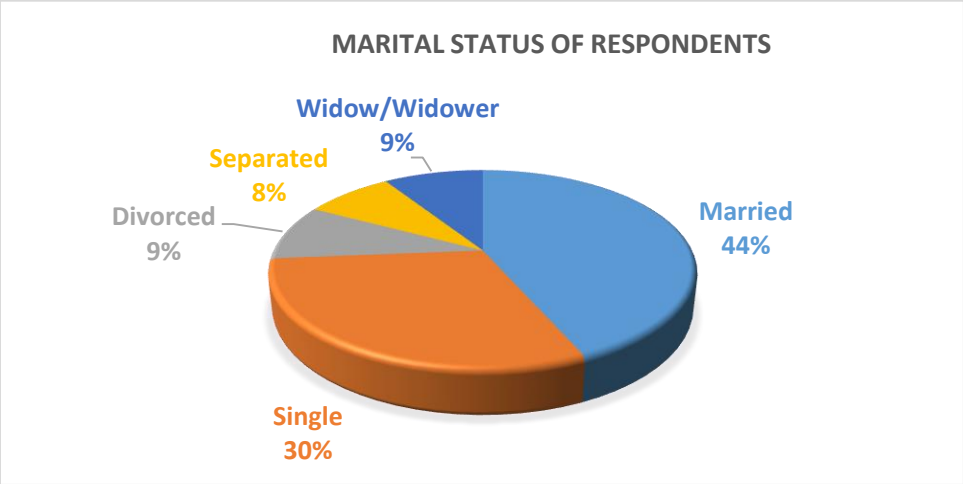

Figure 1: Marital Status of Respondents

Literacy Level and Occupation of Respondents

Table 2: Literacy Level and Occupation of Respondents

LITERACY LEVEL OF RESPONDENTS			OCCUPATION OF RESPONDENTS		
Educational Level	**Frequency**	**Percentage (%)**	**Occupation**	**Frequency**	**Percentage (%)**
No formal education	9	9.1	Farming	40	40.4
Primary education	14	14.1	Fishing	11	11.1

Secondary education	49	49.5	Trading	16	16.2
Tertiary education	21	21.2	Civil service	28	28.3
Higher degree	6	6.1	Others	4	4.0
Total	**99**	**100**	**Total**	**99**	**100**

The majority of respondents (49.5%) attained secondary education, suggesting moderate literacy levels in the study area. However, 9.1% had no formal education, which could affect awareness and preventive practices regarding snakebites. Farming was the predominant occupation (40.4%), followed by civil service (28.3%) and trading (16.2%) (Table 2). This confirms that the study area is largely agrarian, thereby justifying the focus on snakebite risk in the community.

Incidence of Snakebite and Snakebite Envenoming

Table 3: Incidence of Snakebite among Respondents

Variable	Response	Frequency	Percentage (%)
Ever bitten by a snake (self/family)	Yes	32	32.3
	No	67	67.7
Total		**99**	**100**
Frequency of snakebite among victims	Once	86	86.9
	Twice	13	13.1
Total		**99**	**100**
Perceived snakebite cases in community (per week)	1–5	4	4.0
	None reported	95	96.0

Findings showed 32.3% of respondents or their family members had experienced snakebites, with most reporting one incident. However, the majority (96%) reported that snakebite was not rampant in their community, suggesting sporadic but significant occurrences (Table 3).

Within the period under study, 2014 – 2025, one case of snakebite/envenoming was recorded (in the month of July 2025) at the Adiabo primary healthcare center.

Patterns and Outcomes of Snakebite

Table 4: Patterns of Snakebite

Variable	Category	Frequency	Percentage (%)
Season of occurrence	Rainy season	34	25.6
	Dry season	99	74.4
Place of occurrence	Farm	87	70.2
	River	16	12.9
	Home	9	7.3

Occupational group at higher risk	Farmers	92	92.9
	Fishermen	7	7.1
	Traders	0	0.0
Age/Gender group at higher risk	Adults	94	94.9
	Children	5	5.1
	Men	65	65.7
	Women	34	34.3

Snakebites were more frequently reported during the **dry season (74.4%),** with the **farm (70.2%)** as the most common site. **Farmers (92.9%)** and **adult males (65.7%)** were identified as the most at-risk groups, underscoring the occupational hazard of farming (Table 4).

In terms of outcomes, 8 respondents reported snakebite-related deaths in the community within the past six months, though the majority (91.9%) indicated no deaths. This suggests that while mortality is relatively low, the threat of fatal envenoming persists.

Access to Treatment and Health-Seeking Behaviour

Table 5: Treatment methods and Health-Seeking Behaviour after Snakebite

Variable	Category	Frequency	Percentage (%)
Treatment method used after bite	Hospital	38	38.4
	Herbalist	30	30.3
	Self-treatment (herbs/drugs)	5	5.1
	No treatment	2	2.0
	Not indicated	24	24.2
Availability of herbalists in community	Yes	47	47.5
	No	52	52.5
Common local treatment methods	Herbs, roots, concoctions, vaccines, hospital care	–	–

The findings show that **hospitals were the most common treatment choice (38.4%)**, followed closely by **traditional herbalists (30.3%).** Self-treatment was less common, while a few cases went untreated. Almost half (47.5%) acknowledged the presence of herbalists within their communities (Table 5).

Knowledge of Common Snakes in the Community

Respondents were able to identify snake species common in farms and bushes in their community. The python (68.7%) and green snake (48.5%) were the most commonly identified snake species, followed by black

snakes (34.3%), and Boa (27.3%). A smaller proportion identified venomous species such as cobras (18.2%), vipers (13.1%), and mambas (4.0%). Other species identified include Water snakes (7.1%), and Rattle snake (2.0%). This suggests moderate awareness of snake biodiversity, although many may not distinguish venomous from non-venomous species.

Community Perception of Snakebite as a Problem

A small proportion of the respondents (17.3%) agreed that snakebite was a major problem in the community, while the majority (82.8%) did not. This indicates that although snakebites occur, the community may underestimate the public health impact.

Preventive Measures Reported by Respondents

The most widely cited preventive measures were bush clearing (35.4%) and fumigation (20.2%), both of which reflect environmental control approaches. A smaller proportion mentioned anti-snake vaccines (18.2%) and the use of herbicides (15.2%). A few respondents (11.1%) also suggested traditional practices such as charms or herbal repellents.

Impact of Snakebite on Livelihoods

The impact of snakebite on livelihoods was analysed using SPSS. The Pearson correlation coefficient ($N = 99$, $r = 0.462$, $p < 0.01$) indicates a moderate positive and statistically significant relationship between snakebite incidence and negative livelihood impact among farmers.

4.0 Discussions

This study explored the incidence and perceptions of snakebite and snakebite envenoming, and their impact on public health and livelihoods in a predominantly farming community where occupational demands create inevitable conditions for human exposure to snakes in their natural environment. With nine different types/species of snakes identifiable in the farmland and bushes in the area, the risk of human-snake contact and subsequent bite is undoubtedly heightened.

Knowledge, Attitudes, and Perceptions of Snakes and Snakebite

The respondents demonstrated moderate knowledge of common snakes, identifying species such as pythons, green snakes, and cobras. However, the ability to distinguish venomous from non-venomous snakes appeared limited. This knowledge gap is crucial because misidentification can lead to underestimation of risks or inappropriate responses during an encounter. These findings resonate with Olawale *et al*., (2022), who found that communities in Nigeria often possess local knowledge of snake species but lack scientific awareness of venom toxicity and management. This gap contributes to poor preventive behaviours and reliance on unverified treatment methods.

Attitudes toward snakes were ambivalent; while snakes were feared for their danger, 30% of respondents admitted to eating snakes like pythons. A significant number (47

respondents) also believed in the role of herbalists in snakebite treatment, while 82% did not see snakebite as a major farming problem despite the risk of bites and death. Interestingly, only 17.2% of respondents perceived snakebite as a major problem, despite the significant incidence and reported fatalities. This indicates a cultural underestimation of snakebite as a public health concern. Such perceptions may hinder proactive prevention and advocacy for healthcare interventions. Previous studies had emphasized that low community risk perception is a major barrier to effective snakebite prevention, as it reduces demand for protective equipment and timely medical care (Williams *et al*., 2019). Preventive measures reported by respondents included bush clearing (35.4%), fumigation, use of herbicides, and vaccination. These strategies were largely environmental, with little emphasis on personal protective practices such as wearing boots or gloves during farm work. There is a need for strong advocacy for prevention, improved community health education, empowerment, and effective first response strategies (Babangida *et al*., 2020).

Practices and Health-Seeking Behaviour

Hospital care was the most common treatment choice (38.4%), yet this did not reflect in their practice, as only one case was reported at the health center in more than 10 years; rather, reliance on herbalists (30.3%) remained strong. Knowledge of first aid was inadequate, as reliance on traditional remedies prevailed. Almost half of the respondents confirmed the presence of herbalists in their communities. The preference for traditional treatment reflects cultural beliefs, accessibility issues, and possibly the cost of hospital care. Dual reliance on orthodox and traditional medicine aligns with Habib (2013) and Afolabi *et al*., (2020), who found that while rural dwellers recognize the efficacy of hospital treatment, they often resort to herbalists due to cultural trust, affordability, or distance from health facilities.

Incidence and patterns of snakebite and snakebite envenoming

The study identified moderate incidence of snakebite in the community, with 32% of respondents reporting personal or family experience of snakebite. Snakebite incidents occurred mainly on farmlands, during the dry season; and affected mostly adult men, underscoring the occupational and gendered nature of snakebite exposure. These findings are consistent with previous reports, which noted that snakebite incidence is highest among rural agricultural workers who are regularly exposed to bush and farm environments (Chippaux 2017). The predominance of farms as sites of bites corroborates previous studies (Okeke *et al*., 2019), which showed that snakebites occur mainly in farmlands, bushes, and riversides where snakes naturally reside and where protective measures are often inadequate. Similarly, it had been observed that farming-related activities, particularly during planting and harvesting seasons, increase the risk of snake-human encounters in Nigeria (Habib *et al*., 2020). The predominance of males among victims is also supported by studies in West Africa, where men engage more in outdoor farm labour (Musah *et al*., 2019). Despite the recorded incidence amongst the

people, secondary data from the Adiabo health Center showed one (1) reported case of snakebite/snakebite envenoming from the community in a decade. This indicates preferences for other sources of treatment in the health-seeking behavior of the community people. Notably, most (97%) of respondents did not perceive snakebite as rampant, suggesting that the threat is underestimated within the community.

Impact of Snakebite on Public Health in the Community

The study found that snakebite incidents were perceived as sporadic but significant. Although most cases were survived, 8 cases of death were reported within the last six months before the study, highlighting the fatal potential of envenoming if not properly treated. This aligns with the World Health Organization's (2019) report that snakebite envenoming is a leading cause of morbidity and mortality in tropical rural areas, often due to delays in treatment.

The ecological factors, which favour snake abundance and diversity, availability and identification of venomous snake species, the largely farming population, low-risk perception of snakes, as well as inappropriate practices and behaviours regarding prevention and treatment, would constitute potent risk factors and indicators of potential significant health impact of snakebite/envenoming in the community. The line between snakebite and envenoming is a thin one and depends on the type of snakes involved. Venomous snakebites would definitely result in envenoming. This study has identified 32% incidence of snakebites not reported at the health center and hence could not be ascertained medically if there were envenoming. However, few mortality cases were recorded from snakebites within six months before the study. These are indicators that snakebite and snakebite envenoming have negative impact on public health in the community; and should be categorized as a major public health issue.

Generally, in the scheme of things in the health sector, snakebite envenoming is a neglected tropical disease, with very little or no attention towards control and treatment. The impact of this common categorization is worsened by negative attitudes and perceptions of the community people, which underestimate the risks and health impact of snakebite and envenoming.

Impact of snakebite on farming

This study has indicated adverse socioeconomic impacts of snakebite in the community. Snakebite caused loss of productive farm time and financial strain from treatment costs, underscoring its burden on livelihoods. The Pearson correlation coefficient ($r = 0.462$, $p < 0.01$) indicates a moderate positive and statistically significant relationship between snakebite incidence and negative livelihood impact among farmers. This means that as snakebite occurrence increases, the disruption to farming activities and livelihood losses also increase. Snakebite has been identified as a common occupational hazard to rural farmers (Zacharia *et al*., 2025). Like most tropical diseases, especially those that are debilitating, this could result in excessive productivity loss with concomitant effect on

the general well-being of the community, which is largely agrarian.

Snakebite in Adiabo community is both a neglected tropical health problem and a socio-cultural issue shaped by local perceptions, limited knowledge, and inadequate preventive practices. Addressing these gaps requires targeted health education, improved access to antivenom, and integration of community cultural practices into formal healthcare strategies. This exploratory study has identified the need for further studies on species distribution and ecological patterns of snakes and incidence of snakebites and envenoming in other faming / fishing communities, and exploration on how various cultural perceptions influence treatment-seeking behaviours and management of Snakebite envenoming across different cultures.

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