

Knowledge, Attitude, and Practices (KAP) Regarding Snakebite Envenoming and its management among rural adults in Chengalpattu District, Tamil Nadu: A Community-Based Cross-Sectional Study

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ABSTRACT

Background: Snakebite envenoming is a significant, yet often neglected, public health issue in rural India. India bears the highest global burden of snakebite deaths, estimated at approximately 58,000 per year.⁴ Chengalpattu district, with its mix of agricultural lands, scrub forests, and proximity to water bodies, presents an environment where human-snake encounters are likely. This study aimed to assess the Knowledge, Attitude, and Practices (KAP) regarding snakebites among the rural population of Chengalpattu district in order to identify gaps and inform targeted public health interventions.

Methods: A community-based, cross-sectional study was conducted from February 2025 to April 2025 in the rural field practice areas attached to Shri Sathya Sai Medical College, Chengalpattu district. A total of 200 adult participants (aged ≥18 years) were selected through simple random sampling. Data were collected using a pre-tested, structured questionnaire administered in Tamil and analysed using descriptive statistics (frequencies and percentages).

Results: A significant proportion of the study population (65%) was unable to identify common venomous snakes, and only 58% were aware that Anti-Snake Venom (ASV) was available in hospitals. Harmful first-aid practices were prevalent: 70% reported they would tie a tourniquet above the bite site, and 30% would attempt to suck out the venom. However, 68% preferred hospital treatment over traditional healers, and 62% believed in the effectiveness of ASV. Correct first aid — immediate immobilisation of the limb — was practised by only 40% of respondents.

Conclusions: Despite a positive attitude towards modern medicine, there is a critical gap in knowledge about snake identification and ASV availability. Harmful and outdated first-aid practices remain common. There is an urgent need for targeted community-based health education programmes led by frontline workers such as ASHAs to correct misconceptions and promote evidence-based, life-saving practices in alignment with India's National Action Plan for Prevention and Control of Snakebite Envenoming (2024).

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INTRODUCTION

Snakebite envenoming (SBE) is a global health burden that disproportionately affects rural populations in tropical and subtropical countries. The World Health Organization (WHO) reclassified SBE as a highest-priority Neglected Tropical Disease (NTD) in 2017, setting an ambitious target of halving global deaths and disabilities by 2030.¹ A 2024 systematic review and meta-analysis estimated that approximately 1.2–5.5 million people are bitten annually worldwide, with over 125,000 fatalities — underscoring the scale of this preventable tragedy.²

India accounts for nearly half of all global snakebite deaths. A landmark nationally representative mortality study by Suraweera et al. (2020) — drawing on 611,483 verbal autopsies from the Million Death Study (2001–2014) — estimated 1.2 million snakebite deaths in India over two decades, averaging 58,000 deaths per year. Most deaths occurred at home in rural, low-altitude agricultural areas, with half occurring during the monsoon season.³ A 2025 review further highlighted that achieving the WHO 2030 target will require substantial systemic improvements in India, including community awareness, ASV availability, and trained frontline responders.⁴

Tamil Nadu is particularly vulnerable due to its agrarian economy, warm climate, and diverse ecosystems. A multifaceted community education programme conducted across rural Tamil Nadu demonstrated that prior to intervention, communities harboured numerous misconceptions about snakebite management — and that targeted education significantly improved knowledge retention and hospital-seeking behaviour.⁵

Chengalpattu district, a newly formed district in Tamil Nadu, encompasses diverse ecosystems ranging from coastal areas to inland agricultural zones and forest fringes. This topography is conducive to a variety of snake species, including the four medically most important venomous snakes in India — the Indian cobra (*Naja naja*), Russell's viper (*Daboia russelii*), saw-scaled viper (*Echis carinatus*), and common krait (*Bungarus caeruleus*).⁶ The rural population — including farmers, agricultural labourers, and herders — is at high risk of encounters, yet often wastes precious time on inappropriate first aid or consulting traditional healers, leading to preventable complications and death.

Understanding the existing KAP of a community is the essential first step towards designing effective public health interventions. This study was therefore conducted to assess the KAP regarding snakebites among the rural population of Chengalpattu district, and to identify

specific knowledge gaps and harmful practices requiring urgent redressal.

METHODS

A community-based, cross-sectional study was conducted from February 2025 to April 2025 (three months) in the rural field practice areas of Shri Sathya Sai Medical College & Research Institute, Chengalpattu district, Tamil Nadu. Ethical clearance was obtained from the Institutional Ethics Committee (IEC) of Shri Sathya Sai Medical College & Research Institute (IEC Ref. No.: [insert number]) prior to data collection. Written informed consent was obtained from all participants before enrolment. Participation was entirely voluntary, and data confidentiality and anonymity were strictly maintained throughout the study.

The sample size was calculated using the formula $n = Z^2 \times p(1-p) / d^2$, where $Z = 1.96$ (at 95% confidence level), $p = 0.50$ (assumed proportion of adequate knowledge, in the absence of a prior local estimate, to maximise sample size), and $d = 0.07$ (allowable margin of error). This yielded a minimum required sample of 196, and the study enrolled 200 participants. A total of 200 adults aged 18 years and above who had been residing in the study area for at least six months were included. Households were selected from villages using simple random sampling from an existing village registry, and one consenting adult from each selected household was interviewed. Individuals who were acutely ill, unable to communicate, or unwilling to participate were excluded from the study.

Data were collected by trained personnel using a pre-designed, structured questionnaire administered in Tamil, the local language. The questionnaire was initially developed in English, translated into Tamil by a bilingual expert, and back-translated into English to verify conceptual equivalence and linguistic accuracy. It was pre-tested on 20 participants from a neighbouring village not included in the main study and refined for clarity before finalisation. The final questionnaire comprised four sections: the first section captured socio-demographic details including age, gender, education, occupation, and distance from the nearest health centre; the second section assessed knowledge regarding snake identification, availability of anti-snake venom (ASV) in hospitals, and complications of snakebite; the third section examined attitude towards treatment preference and belief in the effectiveness of ASV; and the fourth section recorded first-aid measures followed or intended by participants after a snakebite.

The collected data were entered into Microsoft Excel 2019 and analysed using IBM SPSS Statistics Version 25.0. Descriptive statistics including frequencies and

percentages were used to summarise the data, and results are presented in tabular form

Table 1: Socio-demographic characteristics of the study population (n = 200)

Characteristic	Category	Frequency (n)	Percentage (%)
Age Group (years)	18–29	50	25.0
	30–39	90	45.0
	40–49	35	17.5
	50–59	15	7.5
	≥60	10	5.0
Gender	Male	110	55.0
	Female	90	45.0
Education	Illiterate	30	15.0
	Primary School	40	20.0
	Middle School	35	17.5
	High School	50	25.0
	Graduate & above	45	22.5

RESULTS

A total of 200 participants were enrolled. The socio-demographic profile is presented in Table 1. The majority of participants were in the 30–39 age group (45%), 55% were male, and 25% had completed high school. Illiteracy was present in 15% of the study population.

Knowledge of the respondents regarding snakebite is summarised in Table 2. Only 35% of participants (n = 70) could identify a venomous snake correctly, meaning 65% (n = 130) lacked this basic knowledge. Awareness that ASV is available in government hospitals was present in 58% of respondents (n = 116). As many as 70% (n = 140) had no knowledge of the potential complications of a snakebite.

Table 2: Knowledge of the respondents regarding snakebite (n = 200)

Knowledge Aspect	Yes (n)	Yes (%)	No (n)	No (%)
Can identify venomous snake	70	35.0	130	65.0
Aware of ASV availability in hospitals	116	58.0	84	42.0
Knowledge of snakebite complications	60	30.0	140	70.0

Attitude of the respondents is presented in Table 3. While 68% preferred hospital treatment for a snakebite, 15% still preferred traditional healers, and 17% had no clear preference. Regarding ASV, 62% believed it was effective, 14% did not, and 24% were unsure.

Table 3: Attitude of respondents towards snakebite management (n = 200)

Attitude Question	Category	Percentage (%)
Preference for treatment	Hospital	68.0
	Traditional healer	15.0
	No idea	17.0
Belief in ASV effectiveness	Effective	62.0

Attitude Question	Category	Percentage (%)
	Not effective	14.0
	No idea	24.0

Practices reported by respondents are detailed in Table 4. Alarming, 70% reported they would tie a tourniquet above the bite site — a harmful practice well-documented to cause ischaemia and increased tissue damage.⁷ Additionally, 30% would suck blood from the bite site, 28% would apply native medicines, and 25% would incise

the site. A positive finding was that 75% would immediately transport the victim to a hospital. However, only 40% reported they would immobilise the affected limb, despite this being a key WHO-recommended first-aid measure.

Table 4: Practices reported by respondents following a snakebite (n = 200)

S.No.	Practice	Yes (%)	No (%)
1	Tying a tourniquet above the bite site*	70.0	30.0
2	Sucking blood from the bite site*	30.0	70.0
3	Applying native/herbal medicines*	28.0	72.0
4	Incision at the bite site*	25.0	75.0
5	Immobilisation of the affected limb +	40.0	60.0
6	Taking the victim to hospital immediately +	75.0	25.0

* Harmful practice; +Recommended practice

DISCUSSION

The findings from this study in rural Chengalpattu district reveal a pattern consistent with other rural Indian communities: a positive attitude towards hospital care coexists with significant deficits in knowledge and the persistence of dangerous practices. Only 35% of participants could correctly identify a venomous snake. This is broadly consistent with findings from a community-level KAP study conducted in rural India by Menon et al. (2022), which documented similar gaps in snake identification among rural populations.⁸ A recent qualitative study across Maharashtra and Odisha also confirmed that inadequate identification of venomous snakes and faith in traditional healers are widespread community-level challenges in SBE prevention.⁹

The most alarming finding in this study was the high prevalence of tourniquet application (70%) as a first-aid practice. This is consistent with a recent prospective study from Coastal Karnataka which similarly found tourniquet use in 70% of civilian first responders.⁷ Tourniquet application delays venom absorption locally but causes severe ischaemia, compartment syndrome, and — upon release — a potentially fatal bolus of concentrated venom entering the circulation. Despite being universally discouraged by evidence-based guidelines, tourniquet use remains deeply entrenched in rural communities, as also demonstrated in studies from Maharashtra and Odisha.⁹

The practice of sucking venom from the wound (30%) and incision at the bite site (25%) are equally harmful. These practices are ineffective, risk secondary infection, and delay transport to a healthcare facility. Similar harmful practices were documented in a national capacity-building

protocol study by Gajbhiye et al.¹⁰ and in community awareness studies across Tamil Nadu by Samuel et al.⁵

Awareness of ASV availability (58%) was present in the majority but remains insufficient, and nearly a quarter of respondents were unsure of its effectiveness. The ICMR National Task Force survey protocol (2022) highlighted that hospital-based data on ASV use grossly underestimates true snakebite burden because most rural victims rely on alternate treatments that are never captured in national registries.¹¹ Strengthening ASV confidence through community education is therefore essential.

A noteworthy finding often under-reported in KAP studies is the low rate of correct first-aid practice. While 75% of participants would seek hospital care — a positive indicator — only 40% would correctly immobilise the affected limb before transport. Immobilisation slows lymphatic venom spread and is a critical life-saving intervention. This gap between positive health-seeking behaviour and inadequate first-aid knowledge highlights the need for simple, practical first-aid training at the community level.

The preference for hospital treatment (68%) over traditional healers is encouraging and suggests that trust in the modern healthcare system is growing. However, the persistence of 15% preferring traditional healers reflects the deep-rooted cultural beliefs identified in the barriers and enablers study by Boyers et al. (2023), which found that removing negative religious and traditional beliefs was extremely difficult even after community education programmes.¹²

LIMITATIONS

This study has several limitations. First, as a cross-sectional study, it can establish associations but not causality. Second, self-reported practices may be subject to social desirability bias, potentially overestimating positive behaviours. Third, the study was conducted in a single district with a sample of 200 participants, which limits generalisability to other regions. Fourth, clinical outcomes of snakebite cases were not captured. Future studies with larger, multi-district samples and objective assessment of practices are recommended.

CONCLUSIONS AND RECOMMENDATIONS

This study concludes that in rural Chengalpattu district, there exists a critical knowledge-practice gap concerning snakebite envenoming. While attitudes towards hospital care and ASV are generally positive, this is undermined by poor knowledge of snake identification, and the persistence of dangerous first-aid methods — particularly tourniquet application. The following recommendations are made:

1. Launch targeted, recurring community health education programmes using local leaders, village health nurses (VHNs), and local-language media to spread evidence-based information about snakebite first aid. Emphasis should be placed on the "Do's" (immobilise the limb, stay calm, rush to hospital) and "Don'ts" (no tourniquet, no incision, no sucking the wound).
2. Train ASHAs and other frontline health workers as first responders and community educators for snakebite management, in line with India's National Action Plan for Prevention and Control of Snakebite Envenoming, launched by the Ministry of Health and Family Welfare in March 2024.
3. Ensure consistent and uninterrupted availability of ASV at all Primary Health Centres and Community Health Centres in the district, with regular training of healthcare staff in ASV administration and anaphylaxis management.
4. Introduce simple, pictorial first-aid guides in local languages for distribution through schools, Panchayat offices, and agricultural extension workers to reinforce correct snakebite first-aid practices.
5. Conduct longitudinal follow-up studies and programme evaluations to assess the impact of health education interventions on KAP and snakebite outcomes in Chengalpattu district.

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