RESEARCH PAPER

A Community-Based Study on Environmental and Behavioural Determinants of Malaria Among people residing at Ambap Village.

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Abstract
Background: Although malaria incidence has declined in Maharashtra, focal transmission persists in rural areas due to environmental and behavioural determinants.
Objective: To assess environmental and behavioural determinants related to malaria among households in Ambap village, Kolhapur district.
Methods: A community-based descriptive cross-sectional study was conducted among 450 households covering a population of approximately 1,909 individuals. Data were collected through a structured household survey and direct environmental observation.
Results: A majority of households lived in kaccha or semi-pucca houses (70.5%). Stagnant water was observed around 38.4% of households, primarily due to open drainage (42.4%) and pits (38.9%). Mosquito net usage was low (11.3%), while reliance on liquid repellents and coils was high. A history of malaria was reported by 37.2% of households.
Conclusion: Malaria transmission in Ambap village is driven by modifiable environmental and behavioural factors. Strengthening environmental management, housing improvement, and sustained behaviour change communication is essential for malaria elimination in low-endemic rural settings.
Keywords: Malaria, Environmental determinants, Behavioural determinants, Rural Maharashtra, Community-based study
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Introduction

During the last five years (approximately 2020–2024), Maharashtra has reported a sustained decline in overall malaria incidence in line with national trends; however, focal transmission persists in specific rural, tribal, irrigated, and forest-fringe areas. State surveillance data indicate that malaria cases show clear seasonal clustering during and immediately after the monsoon months (June–October), coinciding with increased vector breeding due to rainfall, agricultural irrigation, and water stagnation. While districts in Vidarbha and parts of Marathwada continue to contribute a higher burden, Western Maharashtra—including Kolhapur district—reports sporadic cases and localized outbreaks, particularly in rural villages with poor drainage and mixed housing patterns.

Kolhapur district has experienced intermittent malaria cases over the past five years, often associated with monsoon-related waterlogging, sugarcane cultivation, canal irrigation, and construction-related pits. District health reports highlight that although annual parasite incidence (API) remains low, repeated detection of cases in the same villages suggests persistent environmental and behavioural determinants rather than random importation alone. These trends underscore the importance of micro-level, community-based studies to identify local risk factors and support the malaria elimination agenda in low-endemic but receptive areas such as Ambap village.

Background of the Study

Malaria remains a major vector-borne disease of public health importance globally, particularly in tropical and subtropical regions where environmental and behavioural factors strongly influence transmission. The disease is transmitted by female *Anopheles* mosquitoes, whose breeding and survival depend on environmental conditions such as stagnant water, rainfall, temperature, humidity, housing quality, and sanitation practices. Although significant global and national progress has been made in malaria control, residual and focal transmission continues to pose challenges to elimination efforts.[1-4]

India has achieved a substantial decline in malaria incidence over the past decade, contributing to a marked reduction in cases within the WHO South-East Asia Region. However, recent reports indicate that malaria persists in localized pockets due to ecological diversity, rural–tribal vulnerability, migration, and inconsistent community-level preventive practices.[5-7]

In Maharashtra, malaria transmission demonstrates seasonal and geographic variation. The state is categorized as a low-to-moderate endemic region, yet rural, tribal, irrigated, and peri-urban areas continue to report sporadic cases, particularly during the monsoon and post-monsoon period.[8-10] Western Maharashtra, including Kolhapur district, receives heavy rainfall and has extensive agricultural activity, irrigation channels, sugarcane cultivation, and semi-permanent water bodies, all of which create favourable conditions for mosquito breeding.

District surveillance data over the last five years (2019–2024) indicate that Kolhapur experiences low but persistent malaria transmission, with clustering of cases during monsoon months. Disruptions in routine surveillance and vector control during the COVID-19 pandemic further highlighted the need for strengthened community-based monitoring. In this context, village-level studies are crucial to generate locally relevant evidence to support malaria elimination strategies under the National Framework for Malaria Elimination (NFME) 2016–2030.

Need for the Study

Although malaria control programmes emphasize early diagnosis, treatment, and vector control, persistent environmental and behavioural risk factors at the community level continue to undermine elimination efforts. Studies from Maharashtra have shown that improper water storage, poor drainage, kaccha housing, and low utilization of long-lasting insecticidal nets (LLINs) contribute to ongoing malaria risk. Ambap village, like many rural areas of Kolhapur district, has mixed housing patterns, variable sanitation coverage, and seasonal water stagnation.

A community-based assessment of environmental and behavioural determinants is essential to identify modifiable risk factors, guide targeted interventions, and strengthen the role of community health nurses and grassroots health workers in malaria prevention and surveillance.

Despite ongoing malaria control initiatives, environmental and behavioural determinants at the household and community levels continue to undermine elimination efforts. Studies from Maharashtra report that improper water storage, open drainage, construction pits, kaccha housing, and low utilization of long-lasting insecticidal nets (LLINs) remain significant contributors to malaria risk.[12-14]

Ambap village in Kolhapur district exhibits mixed housing patterns, seasonal water stagnation, variable sanitation coverage, and dependence on agriculture-related water sources. A community-based assessment is therefore essential to identify modifiable environmental and behavioural risk factors, guide targeted interventions, and strengthen the role of community health nurses and frontline workers in malaria prevention, surveillance, and health education.

Statement of the Problem

A descriptive study to assess environmental and behavioural determinants related to malaria among households in selected areas covering a population of approximately 2000 at Ambap village district Kolhapur.

Objectives of the Study

1. To assess the demographic characteristics of the surveyed households.
2. To evaluate housing and environmental conditions related to malaria risk.
3. To identify mosquito breeding indicators and sources of stagnant water.
4. To assess preventive practices adopted by households against malaria.
5. To determine the history of malaria among surveyed households.

Operational Definitions

- **Stagnant Water:** Accumulated water around households that remains unmoving for more than seven days and is capable of supporting mosquito breeding.
- **Preventive Practices:** Measures adopted by households to prevent mosquito bites and breeding, including use of mosquito nets, coils, liquid repellents, environmental sanitation, and cooperation with anti-larval activities.

Assumptions

- Respondents provided truthful and accurate information.
- Environmental observations during the survey period reflect routine household conditions.

Delimitations

- The study was limited to selected survey areas of Ambap village.
- Laboratory confirmation of malaria cases was not performed.

Research Methodology

Research Design

A descriptive cross-sectional survey design was adopted

Study Setting

The study was conducted in 30 selected community areas covering a population of approximately 2000.

Population and Sample

- **Population:** All households in the selected areas.
- **Sample Size:** 450 households.
- **Sampling Technique:** Non-probability convenient sampling.

Tool for Data Collection

A structured household survey checklist covering demographic details, environmental conditions, mosquito breeding indicators, preventive practices, and malaria history.

Data Collection Procedure

Data were collected through house-to-house visits and direct observation of environmental conditions.

Ethical Considerations

Permission was obtained from local authorities. Verbal consent was taken from respondents.

Analysis and Interpretation of Data

This chapter presents a detailed analysis and interpretation of the data collected from 450 households covering a population of approximately 1,909 (≈2000) individuals across 30 selected areas. The findings are organized according to the study objectives and presented with appropriate interpretation to understand environmental and behavioural determinants related to malaria.

Demographic Profile of the Study Population

The study covered 30 clusters with a total population of 1,909 individuals.

Variable	Observation
Total population	1,909
Number of clusters	30

Interpretation: The population structure reflects moderately large family sizes, common in rural settings. Overcrowding may enhance human–mosquito contact, thereby increasing the risk of malaria transmission.

Housing and Environmental Conditions

Type of Housing

Type of House	Number	Percentage (%)
Kaccha	165	36.7
Semi-pucca	152	33.8
Pucca	133	29.5
Total	450	100

Interpretation: Out of 450 households, 165 (36.7%) lived in kaccha houses, 152 (33.8%) in semi-pucca houses, and 133 (29.6%) in pucca houses. Thus, 70.5% of households resided in kaccha or semi-pucca structures, which are structurally more vulnerable to mosquito entry due to cracks, mud walls, and inadequate sealing. A higher proportion of households lived in kaccha and semi-pucca houses (70.5%). Such structures often have cracks, mud walls, and poor sealing, facilitating mosquito entry and indoor resting, thereby increasing malaria risk. A higher proportion of households lived in kaccha and semi-pucca houses (70.5%). Such structures often have cracks, mud walls, and poor sealing, facilitating mosquito entry and indoor resting, thereby increasing malaria risk.

Ventilation in Houses

Ventilation	Number	Percentage (%)
Adequate	**241**	**53.6**
Poor	**209**	**46.4**
Total	**450**	**100**

Interpretation:
Adequate ventilation was observed in 241 (53.6%) households, while 209 (46.4%) had poor ventilation. Poor ventilation contributes to increased indoor humidity and reduced air circulation, creating a favorable environment for mosquito survival and resting. Nearly half of the houses had poor ventilation, creating humid indoor environments favorable for mosquito survival. Nearly half of the houses had poor ventilation, creating humid indoor environments favorable for mosquito survival.

Water Supply and Sanitation Facilities
Source of Water Supply

Water Source	Number	Percentage (%)
Tap	**362**	**80.4**
Well	**63**	**14.0**
Hand pump	**9**	**2.0**
Other	**16**	**3.6**
Total	**450**	**100**

Interpretation: The majority of households (362; 80.4%) relied on tap water. However, 63 (14.0%) used wells, 9 (2.0%) used hand pumps, and 16 (3.6%) depended on other sources. Households using non-tap water sources frequently practiced water storage, which may inadvertently promote mosquito breeding if containers are not properly covered. Although tap water was the major source, households depending on wells and other sources often stored water, increasing the likelihood of mosquito breeding in uncovered containers. Although tap water was the major source, households depending on wells and other sources often stored water, increasing the likelihood of mosquito breeding in uncovered containers.

Sanitary Facilities

Facility Type	Number	Percentage (%)
Household toilet	**379**	**84.2**
Shared toilet	**14**	**3.1**
Open defecation	**57**	**12.7**
Total	**450**	**100**

Interpretation:
Most households (379; 84.2%) had household toilets, while 14 (3.1%) shared toilet facilities. Open defecation was still practiced by 57 households (12.7%), indicating persistent sanitation gaps that indirectly contribute to environmental contamination and stagnant water formation. Despite good toilet coverage, open defecation persists in over one-tenth of households, contributing indirectly to environmental contamination and stagnant water accumulation. Despite good toilet coverage, open defecation persists in over one-tenth of households, contributing indirectly to environmental contamination and stagnant water accumulation.

Waste Disposal Practices

Method	Number	Percentage (%)
Municipality	**284**	**63.1**
Open dumping	**88**	**19.6**
Covered bin	**63**	**14.0**
Total	**435***	**100**

(*_Some households reported multiple practices_)

Interpretation:
Municipal waste collection services were utilized by 284 households (63.1%). Open dumping was reported by 103 households (22.9%), while 63 households (14.0%) used covered bins. Open dumping remains a significant concern, as it creates organic waste accumulation and water stagnation, both conducive to mosquito breeding. Open dumping was practiced by nearly one-fifth of households, creating potential mosquito breeding sites.Open dumping was practiced by nearly one-fifth of households, creating potential mosquito breeding sites.

Stagnant Water and Mosquito Breeding Indicators
Presence of Stagnant Water

Response	Number	Percentage (%)
Yes	**173**	**38.4**
No	**277**	**61.6**
Total	**450**	**100**

Interpretation: Stagnant water was observed in 173 households (38.4%), whereas 277 households (61.6%) reported no stagnant water in or around their premises.

The presence of stagnant water represents a critical environmental determinant for malaria transmission. More than one-third of households reported stagnant water, a major risk factor for malaria transmission. More than one-third of households reported stagnant water, a major risk factor for malaria transmission.

Sources of Stagnant Water

Source	Number	Percentage (%)
Drainage	**191**	**42.4**
Pits	**175**	**38.9**
Water containers	**84**	**18.7**
Total	**450**	**100**

Interpretation: Among households reporting stagnant water, open drainage (191; 42.4%) and pits (175; 38.9%) were the most common sources, followed by water containers (84; 18.7%). This highlights deficiencies in drainage infrastructure and environmental maintenance. Open drainage and pits were the predominant breeding sites, indicating inadequate environmental management. Open drainage and pits were the predominant breeding sites, indicating inadequate environmental management.

Behavioural Determinants: Preventive Practices

Use of Mosquito Control Measures

Measure	Number	Percentage (%)
Liquid repellents	**166**	**36.9**
Coils	**134**	**29.8**
Mosquito nets	**51**	**11.3**
None	**76**	**16.9**

Interpretation: Liquid repellents were used by 166 households (36.9%), mosquito coils by 134 (29.8%), and mosquito nets by only 51 households (11.3%). Notably, 76 households (16.9%) reported using no mosquito control measures at all. Use of mosquito nets was notably low compared to other methods, despite their proven effectiveness. **Use of mosquito nets was notably low compared to other methods, despite their proven effectiveness.**

Use of Mosquito Nets at Night

Response	Number	Percentage (%)
Yes	**51**	**11.3**
No	**384**	**85.3**

Interpretation: Only 51 households (11.3%) reported regular use of mosquito nets at night, while 399 households (88.7%) did not use nets, indicating poor adoption of one of the most effective malaria prevention strategies. Low usage of mosquito nets increases night-time exposure to malaria vectors. Low usage of mosquito nets increases night-time exposure to malaria vectors.

Environmental Hygiene Practices

Variable	Yes (%)	No (%)
Covered water containers	**72.0**	**28.0**
Clean surroundings	**74.2**	**25.8**
Anti-larval spraying allowed	**96.2**	**3.8**

Interpretation: Covered water containers were observed in 324 households (72.0%), while 126 (28.0%) left containers uncovered. Clean surroundings were maintained by 334 households (74.2%), whereas 101 (25.8%) had poorly maintained surroundings. Acceptance of anti-larval spraying was high, with 430 households (95.6%) permitting spraying and only 20 (4.4%) refusing.High acceptance of anti-larval spraying reflects positive community participation in malaria control initiatives. High acceptance of anti-larval spraying reflects positive community participation in malaria control initiatives.

Health Status Related to Malaria

Malaria History	Number	Percentage (%)
Yes	**172**	**37.2**
No	**293**	**62.8**

Interpretation: A previous history of malaria was reported by 172 households (37.2%), while 293 households (62.8%) reported no such history. This indicates sustained malaria transmission within the study area. More than one-third of households reported a previous history of malaria, indicating persistent transmission in the area. More than one-third of households reported a previous history of malaria, indicating persistent transmission in the area.

Discussion of Findings with Literature Comparison

The findings of the present study are consistent with previous research conducted in rural India. Studies by Singh et al. (2019) and WHO (2021) reported higher malaria prevalence in communities with kaccha housing, poor drainage, and stagnant water, similar to observations in Ambap village.

Low utilization of mosquito nets observed in this study aligns with findings by Sharma et al. (2020), who highlighted lack of awareness and perceived discomfort as barriers to net usage. The high acceptance of anti-larval spraying is comparable to results reported by NVBDCP (2022), indicating improved trust in government-led vector control programs.

The association between poor sanitation, stagnant water, and malaria history corroborates studies by Das & Mishra (2018), emphasizing environmental sanitation as a cornerstone of malaria prevention.

Discussion

The findings of the present study gain further significance when viewed in the context of recent malaria trends in Maharashtra and Kolhapur district. Over the last five years, district surveillance reports have consistently shown that malaria transmission in Kolhapur is sporadic but recurrent, particularly during post-monsoon months. Similar to observations in the present study, recent regional studies have identified stagnant water in drainage channels, agricultural pits, and domestic surroundings as key determinants of persistent transmission in rural Western Maharashtra.

The high proportion of kaccha and semi-pucca houses observed in Ambap village mirrors findings from recent Maharashtra-based studies, which report significantly higher indoor mosquito density in poorly constructed houses. Low mosquito net usage documented in this study is consistent with recent behavioural research from rural Maharashtra, which attributes poor adoption to discomfort, low perceived risk in low-endemic areas, and preference for short-term chemical repellents. Importantly, the high acceptance of anti-larval spraying observed in Ambap village aligns with state-level findings indicating improved community trust in government vector control services. This presents a strategic opportunity for strengthening integrated vector management through enhanced community participation, environmental sanitation drives, and nurse-led behaviour change communication. The findings of the present study reinforce evidence from rural Maharashtra indicating that environmental factors such as stagnant water, open drainage, and housing type play a dominant role in malaria transmission[16,18] The predominance of kaccha and semi-pucca houses is consistent with regional housing patterns and has been associated with increased indoor vector density.[21,24]Low utilization of mosquito nets observed in Ambap village mirrors findings from recent behavioural studies conducted in Maharashtra between 2019 and 2023.^12,13^ In contrast, high acceptance of anti-larval spraying aligns with improved community trust in public health interventions, as reported in recent NVBDCP evaluations.[14]

Conclusion

Although basic infrastructure exists, persistent environmental risks and inadequate preventive practices continue to pose a threat for malaria transmission.

The study concludes that malaria transmission in Ambap village is primarily driven by modifiable environmental and behavioural determinants rather than lack of awareness or absence of control programs. In line with recent trends observed in Maharashtra and Kolhapur district, low-endemic settings remain vulnerable due to ecological receptivity and inconsistent preventive practices. Addressing these determinants is essential for sustaining malaria elimination gains.

Recommendations

- Strengthen health education on mosquito net usage.
- Conduct regular anti-larval spraying.
- Promote community participation in environmental sanitation.
- Intensify behaviour change communication focusing on regular mosquito net use, especially during monsoon and post-monsoon periods.
- Strengthen village-level drainage maintenance and source reduction activities in coordination with local self-government bodies.
- Ensure regular and timely anti-larval measures in identified high-risk pockets.
- Conduct periodic community-based surveillance and environmental audits with the involvement of community health nurses and ASHAs.

Implications for Community Health Nursing

Community health nurses play a pivotal role in sustaining malaria elimination efforts in low-endemic districts like Kolhapur. Their involvement in household surveillance, health education, environmental sanitation monitoring, and community mobilization is critical for early identification of risk factors and prevention of re-emergence of malaria transmission.

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