



Original Research Article

EFFECT OF COMMUNITY BASED ENGAGEMENT ON DENGUE KNOWLEDGE AND PREVENTIVE PRACTICES IN URBAN PUDUCHERRY - A PRE AND POST INTERVENTION STUDY

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ABSTRACT

Background: Sustainable dengue control requires household source reduction, early care seeking, and coordinated community action. Evidence evaluating multicomponent community programmes in urban Puducherry remains limited. We assessed changes in dengue knowledge, preventive practices, intended health-seeking responses, and perceived institutional and community participation after a locally delivered intervention.

Materials and Methods: This prospective single-group before-and-after intervention study was conducted from August to December 2024 in two urban field-practice areas of Puducherry. Adults from randomly selected households completed a pretested local-language questionnaire. A two-month intervention combined group education, pamphlets, rallies, household counselling, posters, health charts, and child-focused activities. A total of 186 participants were included in the before-and-after analysis. McNemar tests compared categorical responses, and $p < 0.05$ was considered statistically significant.

Results: Among 186 participants, correct identification of dengue as a viral disease increased from 8.7% to 36.3% ($p < 0.001$), mosquito transmission from 87.7% to 94.7% ($p = 0.020$), and fresh-water breeding sites from 23.3% to 43.3% ($p = 0.001$). Recognition of fever increased from 42.6% to 69.0% ($p < 0.001$). Intended laboratory testing rose from 58.4% to 81.9% ($p < 0.001$), container cleaning from 30.4% to 58.5% ($p = 0.001$), and repellent use from 42.6% to 70.2% ($p = 0.001$). Reported annual community breeding-site elimination increased from 20.4% to 62.6%, reporting to authorities from 11.6% to 52.0%, and waste management from 17.5% to 56.7% (all $p < 0.001$). Mosquito-net use did not change (11.6% versus 11.1%; $p = 0.700$).

Conclusion: The intervention was associated with broad improvement in dengue knowledge, stated preventive behaviour, intended care seeking, and perceived collective engagement. Reinforcement across monsoon cycles and controlled evaluations using observed household behaviour, entomological indices, and dengue incidence are needed to determine durability and public-health impact.

Keywords: Community participation; dengue; health education; Puducherry; vector control.

INTRODUCTION

Dengue is a mosquito-borne viral disease transmitted mainly by *Aedes aegypti* and, to a lesser extent, *Aedes albopictus*. Its clinical spectrum ranges from an undifferentiated febrile illness to plasma leakage, severe bleeding, organ involvement, shock, and death. Global transmission has expanded with rapid urbanisation, population movement, climate-sensitive vector ecology, inadequate water and waste management, and uneven surveillance and control capacity. The World Health Organization reported more than 7.6 million cases worldwide by 30 April 2024 and continued to classify dengue as a major public-health threat.^[1]

Routine surveillance captures only a proportion of infections. Global modelling and burden-of-disease analyses indicate that the true number of infections and disability attributable to dengue is substantially greater than notified case counts.^[2,3] India contributes importantly to the regional burden, with marked temporal and geographic variation related to rainfall, temperature, population density, water storage, urban development, vector abundance, and access to organised control programmes.^[4] Recurrent outbreaks place pressure on outpatient services, hospital beds, diagnostic facilities, blood banks, and public-health teams.

Vector control remains central because therapeutic management is supportive and prevention cannot depend on a single intervention. Integrated control requires surveillance, environmental management, responsible insecticide use, reliable water and solid-waste systems, risk communication, timely clinical recognition, and sustained cooperation among households, health services, schools, sanitation teams, and local authorities.^[5,6] Community participation is especially important because many *Aedes* breeding sites are small, dispersed containers located within or immediately around homes.

Knowledge is a necessary but incomplete foundation for preventive behaviour. Residents must recognise that *Aedes* mosquitoes may breed in clean stored water and discarded artificial containers, bite predominantly during daylight hours, and require weekly source reduction. Surveys from rural Tamil Nadu and Puducherry have shown that general awareness of dengue can coexist with misconceptions about causation, breeding habitats, warning signs, and effective household action.^[7,8] Comparable studies from Nepal, Malaysia, Delhi, and Chennai have demonstrated that education, health-worker advice, local environmental conditions, and perceived risk influence knowledge and practice.^[9-12]

Educational programmes can improve knowledge and selected preventive responses, but the size and persistence of behavioural change vary. Sensitisation workshops for schoolteachers and structured health education for municipal sanitary workers have produced measurable gains.^[13,14] Urban evidence also

favours repeated, audience-specific communication rather than isolated campaigns.^[15] Fewer evaluations have combined household counselling, printed and visual materials, rallies, and child-focused activities while simultaneously examining individual behaviour and perceived participation by primary health centres and the wider community.

The present study therefore evaluated a multicomponent community intervention among adults in urban Puducherry. The primary objective was to measure changes in dengue causation and transmission knowledge, breeding-site and symptom recognition, source-reduction practices, and mosquito-bite prevention. Secondary objectives were to assess changes in intended health-seeking responses and perceived PHC and community engagement. We hypothesised that the intervention would improve most knowledge and practice indicators, although behaviours constrained by context or feasibility might show smaller changes.

MATERIALS AND METHODS

Study design and setting: This prospective community-based single-group before-and-after intervention study was conducted in the field-practice areas of the urban health training centres at Kalapet and Tsunami Quarters, Puducherry, India, from August to December 2024. Baseline assessment preceded a two-month active intervention phase, after which participants were reassessed using the same questionnaire.

The study was designed as a pragmatic community evaluation. All assessments and educational activities were undertaken in community settings, allowing the intervention to address household water storage, waste disposal, mosquito avoidance, reporting pathways, and use of local health services in their usual context.

Participants and eligibility: Adults aged 18 years or older who resided in the selected field-practice areas and were able to provide informed consent were eligible. Individuals younger than 18 years and otherwise eligible residents who could not be contacted after two consecutive household visits were excluded. Study procedures were explained in the participant's preferred local language, and written informed consent was obtained before enrolment.

One eligible consenting adult was interviewed in each selected household. Field investigators used a standardised approach to administer the questionnaire and minimise variation in explanation. Contact details required for follow-up were stored separately from analytic responses, and participants were reapproached at the end-line assessment.

Sampling and sample size: The two field-practice areas were selected by convenience because they were accessible to the urban health training programme. Within each area, households were selected by simple random sampling, after which eligible adult residents were approached in person.

The sample-size calculation assumed a baseline knowledge proportion of 32%, an absolute post-intervention improvement of 15 percentage points, 80% power, and a two-sided 5% significance level. The minimum calculated sample was 169; allowing approximately 10% loss to follow-up produced a target of 186 participants.

Data collection instrument: A predesigned and pretested questionnaire in the local language collected sociodemographic information and responses concerning dengue causation and transmission, breeding sites, mosquito biting times, seasonality, common symptoms, severe warning signs, intended health-seeking actions, vaccine awareness, source-reduction practices, personal protection, and perceived participation by PHCs and the community. The same instrument, wording, and response structure were used at baseline and follow-up.

Knowledge and practice indicators were coded as present when participants selected the prespecified correct or recommended response. Questions allowing more than one response were analysed as separate binary items. Perceived PHC and community engagement was recorded using frequency categories, with the annual or every-year category used for the principal comparison presented in the manuscript.

Community intervention: The multicomponent intervention combined group health-education sessions, printed pamphlets, community rallies, one-to-one household counselling using health charts and posters, and drawing competitions for children. Core messages addressed viral causation, Aedes breeding in clean stagnant water and artificial containers, daytime biting, common symptoms and severe warning signs, prompt assessment at health facilities, weekly emptying and cleaning of water-holding containers, closed water storage, waste removal, personal protection, reporting, and participation in community clean-up activities.

The intervention used repeated and complementary communication channels. Group education delivered consistent core content, household counselling allowed clarification of misconceptions, visual material supported participants with different literacy levels, and neighbourhood and child-focused activities reinforced the visibility of collective prevention. No clinical treatment or experimental product was administered.

Outcomes: The primary outcomes were changes in the proportions of participants giving correct or recommended responses for dengue causation and transmission, breeding-site recognition, mosquito biting time, symptom and warning-sign recognition, intended health-seeking behaviour, source reduction, and mosquito-bite prevention. Secondary outcomes were changes in perceived annual participation by PHCs and community members in dengue prevention and control, together with the pattern of statistically significant and non-significant responses.

Statistical analysis: Data were entered in Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarised using mean, standard deviation, skewness, and kurtosis, and categorical variables using frequency and percentage. Data from 186 participants were included in the before-and-after analysis. The McNemar test was used for categorical comparisons, and absolute percentage-point change was calculated as the post-intervention percentage minus the pre-intervention percentage. Cohen's *h* was used to describe the magnitude of selected changes in proportions. All tests were two-sided, and $p < 0.05$ was considered statistically significant. Values reported as $p = 0.000$ in the source output are presented as $p < 0.001$.

Questions permitting multiple responses were analysed as separate binary indicators; their percentages were therefore not expected to sum to 100%. The Shapiro-Wilk test was used to assess the normality of age and income distributions.

Ethical considerations: The PIMS Institute Ethics Committee approved the protocol on 4 July 2024 (IEC RC/2024/35). Participation was voluntary. Written informed consent was obtained from all participants, confidentiality was maintained, and participants could withdraw without any effect on their care.

RESULTS

Participant flow and baseline characteristics

A total of 186 adults completed the baseline assessment, received the community intervention, and were included in the before-and-after analysis (Figure 1).

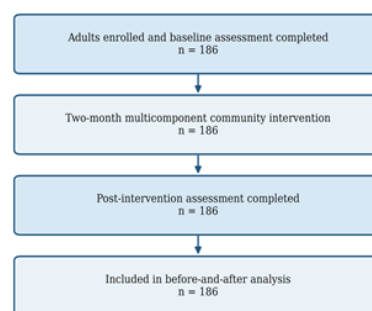


Figure 1: Participant flow through enrolment, intervention, post-intervention assessment, and analysis.

All 186 participants described in the supplied dataset contributed to the baseline profile and the reported before-and-after comparisons.

The mean age was 42.59 years (SD 14.51), and mean reported monthly income was INR 13,698.93 (SD 5,607.98). Women comprised 74.2% of participants. High-school education was the most common educational category (41.9%), followed by no formal

education (22.0%) and graduation (15.1%). More than half were unemployed (58.6%), 24.7% held

semi-skilled occupations, and 94.1% were married (Table 1).

Table 1: Baseline characteristics of enrolled participants

Characteristic	Frequency or mean	Percent or SD
Age in years	42.586	14.505
Monthly income in INR	13,698.925	5,607.977
Sex		
Male	48	25.8
Female	138	74.2
Education		
Illiterate	41	22.0
Primary school	20	10.8
Middle school	4	2.2
High school	78	41.9
Diploma	12	6.5
Graduate	28	15.1
Professional degree	3	1.6
Occupation		
Unemployed	109	58.6
Professional	9	4.8
Skilled	7	3.8
Semi-skilled	46	24.7
Semi-professional	4	2.2
Clerical	9	4.8
Student	1	0.5
Graduate	1	0.5
Marital status		
Married	175	94.1
Unmarried	7	3.8
Widowed	4	2.2
Total	186	100.0

Values are n (%) unless otherwise specified. Percentages may not total exactly 100 because of rounding. SD, standard deviation.

Dengue knowledge and symptom recognition: The intervention was followed by improvement across most knowledge indicators (Table 2). Correct identification of a virus as the cause of dengue increased from 8.7% to 36.3% (change +27.6 percentage points; $p<0.001$; Cohen's $h=0.716$). Recognition of mosquito transmission increased from 87.7% to 94.7% ($p=0.020$; $h=0.252$), while identification of fresh water as a breeding site increased from 23.3% to 43.3% ($p=0.001$; $h=0.429$). Recognition of tyres, coconut shells, and plastic bottles as breeding containers rose by 50.4, 50.9, and 51.6 percentage points, respectively (all $p<0.001$).

Symptom and warning-sign recognition also improved. Fever recognition increased from 42.6% to 69.0% ($h=0.538$), rash recognition from 23.3% to 50.3% ($h=0.569$), and severe-headache recognition from 9.9% to 46.8% ($h=0.870$; all $p<0.001$). Awareness of bleeding gums and blood in stool, urine, or vomit also increased significantly. Intended health-seeking responses shifted towards formal assessment. The proportion selecting laboratory testing increased from 58.4% to 81.9% ($p<0.001$; $h=0.523$), and intended hospital visit or health check-up increased from 40.9% to 58.5% ($p=0.005$; $h=0.354$). Dengue-vaccine awareness increased from 22.8% to 42.1% ($p=0.002$; $h=0.417$).

Table 2: Changes in dengue knowledge symptoms and intended health seeking

Indicator	Before %	After %	Change pp	p value
Cause of dengue identified as virus	8.7	36.3	+27.6	<0.001
Mosquito identified as mode of transmission	87.7	94.7	+7.0	0.020
Fresh water identified as breeding site	23.3	43.3	+20.0	0.001
Tyres identified as breeding containers	17.4	67.8	+50.4	<0.001
Coconut shells identified as breeding containers	29.2	80.1	+50.9	<0.001
Plastic bottles identified as breeding containers	23.3	74.9	+51.6	<0.001
Fever recognised as a common symptom	42.6	69.0	+26.4	<0.001
Rash recognised as a common symptom	23.3	50.3	+27.0	<0.001
Nausea or vomiting recognised as severe dengue	9.9	35.1	+25.2	<0.001
Severe headache recognised as severe dengue	9.9	46.8	+36.9	<0.001
Bleeding gums recognised as severe dengue	11.6	46.8	+35.2	<0.001
Blood in stool urine or vomit recognised as severe dengue	5.8	29.2	+23.4	<0.001
Would seek laboratory testing	58.4	81.9	+23.5	<0.001
Would visit a hospital for assessment	40.9	58.5	+17.6	0.005
Aware of a dengue vaccine	22.8	42.1	+19.3	0.002

Before-and-after analysis, n=186. Questions permitted multiple responses. Change is the absolute percentage-point difference. p values are reported comparison results. pp, percentage points.

Preventive practices and collective engagement: Reported household source-reduction and personal-protection practices generally improved (Table 3). Emptying and cleaning containers increased from 30.4% to 58.5% (p=0.001; h=0.574), preventing water stagnation from 29.2% to 46.8% (p=0.003;

h=0.372), clearing potential garbage from 40.9% to 64.3% (p=0.002; h=0.488), and mosquito-repellent use from 42.6% to 70.2% (p=0.001; h=0.564).

Not all preventive behaviours changed. Sleeping under mosquito nets remained essentially unchanged (11.6% before versus 11.1% after; p=0.700), and closing doors and windows at dusk increased from 58.4% to 70.2% with a small effect (p=0.050; h=0.246). These findings indicate selective rather than uniform behavioural change.

Table 3: Changes in household preventive practices

Indicator	Before %	After %	Change pp	p value
Emptying and cleaning containers	30.4	58.5	+28.1	0.001
Storing water in closed containers	23.3	46.8	+23.5	0.001
Preventing water stagnation	29.2	46.8	+17.6	0.003
Clearing potential garbage	40.9	64.3	+23.4	0.002
Using mosquito-repellent coils	42.6	70.2	+27.6	0.001
Closing doors and windows at dusk	58.4	70.2	+11.8	0.050
Sleeping under mosquito nets	11.6	11.1	-0.5	0.700
Driving mosquitoes away	70.1	87.7	+17.6	0.020

Before-and-after analysis, n=186. Questions permitted multiple responses. pp, percentage points. Perceived regular participation by health services and the community increased substantially (Table 4). Reported annual PHC case identification and reporting increased from 17.5% to 39.8% (p=0.002; h=0.502), and annual mosquito-control activity increased from 14.6% to 45.6% (p<0.001; h=0.658). Annual community breeding-site elimination

increased from 20.4% to 62.6% (h=0.888), reporting to authorities from 11.6% to 52.0% (h=0.916), personal protective measures from 29.2% to 63.2% (h=0.696), and waste management from 17.5% to 56.7% (h=0.842; all p<0.001). Self or family experience of dengue did not change significantly (5.8% versus 8.8%; p=0.400; h=0.109). Selected major outcomes are displayed in Figure 2.

Table 4: Changes in perceived PHC and community engagement

Indicator	Before %	After %	Change pp	p value
Self or family affected by dengue	5.8	8.8	+3.0	0.400
PHC case identification and reporting every year	17.5	39.8	+22.3	0.002
PHC mosquito controls every year	14.6	45.6	+31.0	<0.001
Community breeding-site elimination every year	20.4	62.6	+42.2	<0.001
Community reporting to authorities every year	11.6	52.0	+40.4	<0.001
Community personal protective measures every year	29.2	63.2	+34.0	<0.001
Community waste management every year	17.5	56.7	+39.2	<0.001

Before-and-after analysis, n=186. PHC, primary health centre; pp, percentage points.

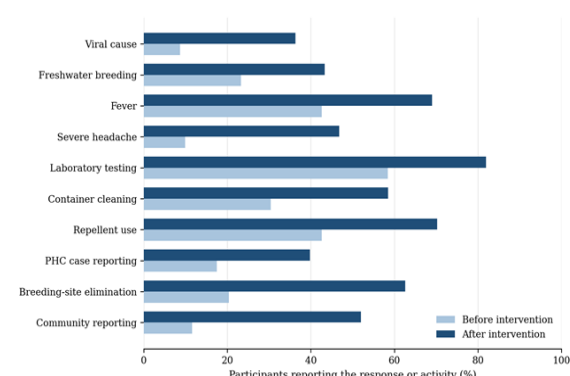


Figure 2: Selected dengue knowledge, preventive-practice, and engagement outcomes before and after intervention.

Bars show the percentages of participants (n=186) reporting the selected correct response or annual activity. PHC indicators represent perceived annual

primary-health-centre participation. The figure is descriptive; corresponding p values are reported in Tables 2 to 4.

DISCUSSION

This prospective community-based before-and-after study found broad improvement after a locally delivered multicomponent engagement programme. Knowledge of viral causation, breeding habitats, symptoms, and severe warning signs increased; intended care seeking shifted towards laboratory and hospital assessment; household source-reduction and repellent use improved; and participants reported greater PHC and community participation. The largest absolute gains involved recognition of common artificial breeding containers and collective actions such as breeding-site elimination, reporting to authorities, and waste management. These findings support the usefulness of combining disease education with visible neighbourhood activity.

Baseline gaps were consistent with earlier South Indian evidence. Krishnamoorthy et al. reported that only one-third of surveyed rural Tamil Nadu residents had adequate knowledge despite more favourable attitudes and practices.^[7] In Puducherry, Jeelani et al. found that general awareness of dengue was common, but recognition of clean water as a breeding source remained limited.^[8] Our participants similarly showed high baseline recognition of mosquito transmission but low recognition of freshwater breeding and viral causation. This pattern suggests that broad awareness campaigns may establish the name and vector of the disease without correcting the more specific misconceptions that determine household action.

The findings also align with research showing that education and health-worker advice influence dengue knowledge and practice. Dhimal et al. identified strong relationships among education, knowledge, attitudes, and practices in Nepal.^[9] Studies from Malaysia, Delhi, and Chennai likewise showed that awareness of mosquito transmission can coexist with incomplete knowledge of biting behaviour, breeding sources, and effective prevention.^[10-12] In the present study, high baseline knowledge of mosquito transmission left limited room for change, whereas initially weak knowledge of causation, breeding containers, and warning signs showed much larger gains.

The likely mechanism of benefit was repeated exposure through complementary channels. Group sessions provided standardised core messages; household counselling allowed clarification of individual misconceptions; pamphlets, charts, and posters supported recall; and rallies and children's activities made prevention visible as a shared community responsibility. Improvements after sensitisation workshops for schoolteachers.^[13] and health education for municipal sanitary workers in Puducherry.^[14] support this multilevel approach. The present intervention extended that model by addressing household decisions, perceived PHC functions, and neighbourhood participation within a single programme.

Recognition of severe warning signs and intended use of formal services improved meaningfully. Timely clinical assessment is important because progression to severe dengue may be rapid, and warning-sign recognition can reduce delays in evaluation. However, increased awareness of laboratory testing should not be interpreted as support for indiscriminate testing; diagnostic decisions must remain clinically guided. Moreover, questionnaire responses describe intentions rather than verified behaviour during an actual febrile illness. Linkage with facility records would strengthen future evaluations.

Preventive behaviour changed selectively. Container cleaning, closed storage, stagnation prevention, waste removal, and repellent use improved, but mosquito-net use did not. This is biologically plausible because *Aedes* mosquitoes bite mainly

during daylight hours, when many adults are active outside bed nets. The borderline change in closing doors and windows at dusk may similarly reflect a mismatch between the recommended timing and participants' daily routines. Intervention messages should therefore prioritise feasible behaviours aligned with *Aedes* ecology rather than treating all mosquito-control practices as interchangeable.

The strong increases in perceived PHC and community participation are programmatically important. Sustainable dengue control depends on repeated source reduction and a reliable relationship between residents and local services. Nevertheless, these outcomes measured participant perception, not independently verified institutional performance. Public-health records, clean-up logs, household observations, larval indices, and geographic mapping of reported breeding sites should be used to determine whether perceived engagement corresponds to measurable environmental improvement.

The unchanged proportion reporting dengue in themselves or family members should not be interpreted as intervention failure. The study was not powered to detect a change in disease incidence, the follow-up interval was short for that purpose, and infection risk is influenced by transmission intensity beyond individual behaviour. Future controlled studies should measure incident laboratory-confirmed dengue and entomological outcomes, while accounting for seasonality, rainfall, temperature, and concurrent municipal control activity.

These findings support an implementation model based on repeated seasonal reinforcement. PHCs could deliver pre-monsoon household reminders, simple weekly container checklists, school-linked micro-campaigns, and accessible reporting routes for breeding sites. Messages should be adapted for groups with lower baseline knowledge and refreshed throughout the year, consistent with urban evidence that risk and information needs vary across neighbourhoods and demographic groups.^[15]

Strengths and limitations: The study had several strengths. It evaluated a pragmatic multicomponent intervention in routine community settings, used the same pretested instrument at both assessments, and examined both household and collective domains. Important limitations remain. The single-group design cannot separate intervention effects from seasonal influences, concurrent media or public-health campaigns, repeated testing, or secular change. Convenience selection of the field-practice areas limits generalisability, and women, unemployed individuals, and married participants were overrepresented. Outcomes were self-reported and may be affected by recall and social-desirability bias. Questionnaire reliability, intervention fidelity, direct household observations, larval indices, and dengue incidence were not reported. The supplied summary data did not support adjusted analyses by age,

education, income, water-storage pattern, or other potential effect modifiers.

CONCLUSION

A community-based programme combining structured education, household counselling, printed and visual materials, rallies, and child-focused activities was associated with substantial improvements in dengue knowledge, warning-sign recognition, intended health seeking, household source reduction, and perceived PHC and community participation in urban Puducherry. The strongest gains involved breeding-container recognition and collective preventive action, while mosquito-net use and reported dengue experience did not change. The findings support continued locally tailored engagement with repeated pre-monsoon and monsoon reinforcement. Controlled studies incorporating observed household behaviour, intervention-fidelity measures, entomological indices, service-use records, and laboratory-confirmed dengue are needed before attributing the observed changes solely to the programme.

Declarations

Ethics approval and consent to participate

The PIMS Institute Ethics Committee approved the study on 4 July 2024 (IEC RC/2024/35). All participants provided written informed consent.

Consent for publication

Not applicable. No identifiable participant information is presented.

Data availability

De-identified data may be made available by the corresponding author on reasonable request, subject to institutional and ethics requirements.

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Competing interests

The authors declare that they have no competing interests.

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