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Original Research Article

Effectiveness of school-based health education through student Arogyadoots for vector-borne disease prevention in rural Maharashtra: a pre-post interventional study

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ABSTRACT

Background: Vector-borne diseases (VBDs) continue to place a heavy burden on rural India, and conventional control efforts have produced only limited gains. School-based peer education through student 'Arogyadoots' (messengers of good health) may offer a practical way to reach rural households. Objective was to assess changes in knowledge, attitudes and practices (KAP) regarding VBD prevention among trained student Arogyadoots and the rural families they educated.

Methods: A pre-post interventional study was carried out in Ghorad village, Seloo Block, Wardha district, Maharashtra, between January 2023 and March 2025. Ninety-seven students from classes VIII-X received a two-month (60-hour) training module on VBDs and then delivered household health education to 970 families over six months. KAP was measured at baseline, immediately after the intervention, and three months later.

Results: Mean knowledge scores rose from 46.12% to 77.62% among students (d=2.84, p<0.001) and from 32.20% to 68.34% among families (d=2.67, p<0.001). Attitude and practice scores improved similarly in both groups. At three-month follow-up, more than 94.9% of the gains were retained. All 970 households were reached, 97% of students completed the programme, and protocol fidelity was 94.6%.

Conclusions: Trained school students can function as effective, low-cost health communicators for VBD prevention in resource-limited rural settings. Larger controlled trials with longer follow-up and objective outcome measures are needed before wider adoption.

Keywords: Community intervention, Health education, Implementation science, Knowledge translation, Peer education, Rural health, Vector-borne diseases

INTRODUCTION

Vector-borne diseases (VBDs) cause more than 17% of all infectious diseases worldwide and are responsible for over 700,000 deaths each year. In India, illnesses such as malaria, dengue, chikungunya and Japanese encephalitis affect millions every year, and rural populations with poor sanitation, limited health-care access and low awareness bear most of the burden.[1-3]

Maharashtra, particularly the Wardha district in the Vidarbha region, continues to report endemic VBD transmission. Traditional control measures that rely mainly on chemical vector control and reactive case management have proved unsustainable because of growing insecticide resistance, environmental concerns and limited community involvement.[4,5]

Using schools as a base for community health education is a promising alternative, since children naturally carry information into their homes and neighbourhoods.[6-8] Because student educators come from within the same community, they can bridge gaps that often exist between health professionals and local residents, and they help build a sustainable local workforce.[8] Evidence from rural India on school-based interventions against VBDs, however, is still limited; most published studies come from urban settings and lack long-term follow-up.[9-12] Little is also known about the effectiveness of young people educating adults on VBD prevention in resource-poor areas.

Objective of the study

The present study was planned to estimate the change in knowledge, attitudes and practices regarding VBD prevention among rural families educated by trained student Arogyadoots, and to assess the change in the students' own KAP scores after they completed the training module. We hypothesized that both the Arogyadoots and the families they taught would show measurable improvements in KAP after the intervention.

METHODS

Study design and setting

A pre-post interventional study was carried out in Ghorad village, Seloo Block, Wardha district, Maharashtra, from January 2023 to March 2025. The site was selected because it had a functional secondary school, sufficient student enrolment, a documented history of VBD cases, limited health-care access, supportive community leadership and good accessibility for the research team. As per the 2011 census, Ghorad has about 6,621 residents, 78% of whom depend on agriculture, with a literacy rate of 87.8% and confirmed endemic VBD transmission.[4]

Selection criteria

Students (Arogyadoots) of classes VIII-X at Yashvant Vidyalaya, Ghorad; age 13-16 years; academic average of 60% or more in the preceding examination; school attendance of at least 80%; fluency in Marathi; residence within a 5-km radius of the school; and written parental consent together with student assent were included.

Long-term medical illness likely to interfere with training attendance; planned relocation during the study period; inability to attend the full six-week training schedule; and refusal of consent by parents or student were excluded.

Community families- Inclusion criteria: households residing in Ghorad village for at least two years; presence of at least one adult (≥18 years) responsible for household decisions; willingness to receive repeated home visits over six months; and written informed consent from the head of the household. Exclusion criteria: families planning to move out of the village within six months; households where no adult was available during the planned visits; severe illness or bereavement in the family at the time of enrolment; and refusal to consent. Out of 100 students screened, 97 completed the training and qualified as Arogyadoots. Using systematic random sampling, 970 eligible families were enrolled, with each Arogyadoot assigned to a cluster of 10 geographically close households.

Sample size calculation

Sample size was calculated using the paired comparison formula $n = (Z_{\alpha/2} + Z_{\beta})^2 \times 2\sigma^2(1-\rho)/\Delta^2$, with α=0.05 (two-tailed), β=0.20, σ=12%, ρ=0.5 and Δ=15%, giving a minimum of 52 participants per group. The final enrolment of 97 students and 970 families provided more than 95% power for the planned analyses.

Intervention: student Arogyadoot training programme

The training ran over six weeks (60 contact hours) on weekends in a dedicated school classroom, with batches of 15-20 students.[17] The curriculum comprised seven modules: public health fundamentals and VBD overview; disease-specific knowledge of malaria, dengue, chikungunya, Japanese encephalitis and filariasis; vector biology and control; prevention and personal protection; health communication skills; community engagement; and basic data collection and monitoring.[13,19,20] Teaching methods combined interactive lectures (40%) with practical workshops, group activities, role-plays and demonstrations (60%).[17] Certification as an Arogyadoot required a score of at least 60% on the comprehensive written examination.

Community education implementation

Between January and June 2024, each household received 4-6 education sessions of 45-60 minutes delivered by the assigned Arogyadoot.[18] Sessions followed a structured plan covering identification of vectors, transmission pathways, symptoms, prevention, environmental management and health-seeking behaviour, supported by locally adapted visual aids.[20,21] Regular review meetings with Arogyadoots and monthly supervisory visits were used to maintain quality and protocol adherence.[6,22]

Data collection instruments

Knowledge was assessed with a 50-item multiple-choice test on vector identification, transmission, symptoms, prevention and treatment (score 0-50, converted to percentage). Attitude was measured with a 30-item

Health Belief Model-based scale using a 5-point Likert format covering perceived susceptibility, severity, benefits, barriers, self-efficacy and cues to action (raw scores 30-150, converted to percentage).[6] Practice was assessed with a 25-item self-reported checklist on personal protection, environmental management, water storage, waste management and health-seeking behaviour (converted to percentage). All instruments were developed in English, translated into Marathi and back-translated, and reviewed by public health experts. Cronbach's alpha exceeded 0.75 for all scales.

Data collection timeline

T_0 (Baseline): December 2023- all students and family representatives completed KAP assessments. T_1 (post-intervention): July 2024- immediate assessment after completion of all education sessions. T_2 (follow-up): October 2024- three-month follow-up to evaluate retention.

Statistical analysis

Data were analysed with SPSS v28.0 and R v4.3.0. Descriptive statistics summarized participant characteristics and outcomes. Paired t-tests compared pre-post scores within groups, independent t-tests compared improvements between groups, and ANCOVA was used to adjust for baseline differences. Cohen's d measured effect size (0.2 small, 0.5 medium, 0.8 large, >2.0 very large). Statistical significance was set at $p<0.05$ (two-tailed).

Subgroup analyses were performed by age, gender and parental education. The study was approved by the Institutional Ethics Committee of Datta Meghe Institute of Higher Education and Research, and written informed consent/assent was obtained from all participants in accordance with the Declaration of Helsinki and ICMR guidelines.

RESULTS

Participant characteristics

Of 97 participating students, the mean age was 14.2 years and 53.6% were male; 30.9% were in class VIII, 33.0% in class IX and 36.1% in class X. Most came from agricultural families (80.4%) with limited formal education. The 970 participating families had an average of 5.4 members, with heads of household mostly aged 31-50 years; 42.3% had no formal education. Families lived mainly in the primary village (69.9%) and surrounding hamlets (30.1%).

KAP improvements from baseline to post-intervention

All six comparisons showed very large effect sizes (Cohen's d > 2.4) at $p<0.001$. These effect sizes are larger than those typically reported in the health-education literature and should be interpreted cautiously in the light of the paired design, measurement properties and possible floor/ceiling effects of the scales used.

Table 1: KAP improvements for both groups.

Domain	Group	Baseline Mean±SD (%)	Post-intervention Mean±SD (%)	Absolute change (pp)	Relative change (%)	Cohen's d / p
Knowledge	Students (n=97)	46.12±12.8	77.62±9.4	31.50	68.3	2.84 / <0.001
Knowledge	Community (n=970)	32.20±15.4	68.34±11.8	36.14	112.2	2.67 / <0.001
Attitude	Students	39.42±11.6	68.78±8.7	29.36	74.5	2.91 / <0.001
Attitude	Community	28.40±16.8	64.86±12.4	36.46	128.4	2.48 / <0.001
Practice	Students	44.17±13.4	72.46±10.2	28.29	64.0	2.52 / <0.001
Practice	Community	34.88±17.2	72.94±13.6	38.06	109.1	2.54 / <0.001

pp = percentage points. All p-values <0.001.

Table 2: Disease-specific knowledge gains for both students and community members.[13,19]

Disease	Students baseline (%)	Students post (%)	Improvement (pp)	Community baseline (%)	Community post (%)	Improvement (pp)
Malaria	49.6±14.7	83.4±9.2	33.8	38.6±17.2	79.8±11.4	41.2
Dengue	38.2±16.9	79.6±11.8	41.4	26.8±19.4	75.4±13.2	48.6
Chikungunya	35.8±18.2	76.8±12.4	41.0	24.3±18.9	72.1±14.6	47.8
Japanese encephalitis	28.4±21.3	68.9±15.6	40.5	18.7±22.1	63.9±16.8	45.2

Disease-specific knowledge improvements

The largest absolute gains were seen for the less well-known diseases- dengue, chikungunya and Japanese encephalitis- suggesting that the programme successfully filled important knowledge gaps. Specific outcomes for filariasis, although covered in training, were not measured (Table 2).

Comparative analysis: students versus community

Across all three domains, community families showed greater improvement than students by 4.64, 7.10 and 9.77 percentage points respectively (all $p<0.001$; d=0.42, 0.58 and 0.71). These differences may be partly explained by the lower baseline scores among families and possible ceiling effects among students.

Retention at three-month follow-up

Retention at three months was ≥94% across all domains and in both groups, indicating minimal decay of the gains achieved. Longer-term follow-up of 12-24 months is still needed to judge sustained impact.[24]

Table 3: Knowledge, attitude and practice retention data.

Group	Domain	Immediate post (%)	3-Month follow-up (%)	Retention rate (%)
Students	Knowledge	77.62±9.4	74.8±10.6	96.4
Students	Attitude	68.78±8.7	66.2±9.8	96.3
Students	Practice	72.46±10.2	69.4±11.4	95.8
Community	Knowledge	68.34±11.8	64.8±13.2	94.8
Community	Attitude	64.86±12.4	61.4±14.1	94.7
Community	Practice	72.94±13.6	68.9±15.4	94.4

Implementation process metrics

All 100 enrolled students completed training, and 97 qualified as certified Arogyadoots with a mean post-training examination score of 78.4% (±8.6). For community delivery, all 970 assigned households were reached, 98.4% of planned sessions were held, and 100% of educational materials were distributed. The mean number of sessions per household was 4.2, with protocol adherence of 94.6%. Community satisfaction was high, with 92.8% rating the programme as 'excellent' or 'good', and the mean supervisor observation score was 86.4±7.8%.

Subgroup analyses

No significant differences in KAP gains were seen between male and female students. Among community members, female participants showed a small but statistically significant advantage of about 1.9 percentage points in knowledge. Younger students (12-14 years) gained marginally more than older students (15-17 years), and younger community members (18-30 years) improved more than older age groups. Parental education showed a weak positive correlation with student gains ($r=0.28–0.34$, $p<0.05$). As no formal correction for multiple testing was applied, subgroup findings should be interpreted cautiously.

DISCUSSION

This study shows that a school-based peer education model using trained student Arogyadoots is feasible in a rural Maharashtra setting and is associated with substantial improvements in KAP related to VBD prevention among both the students themselves and the families they educate. The programme achieved full household coverage, high student completion and strong retention of learning at three months, suggesting that it could complement existing community-based prevention strategies in similar rural areas.

Community families tended to improve slightly more than students, possibly because they started from a lower baseline and were directly motivated by personal risk, and because practical household-level advice delivered by familiar local peers was easy to apply.[17,18] The high protocol adherence (94.6%) and community satisfaction (92.8%) indicate that this approach is not only efficient but also well accepted.[22]

These findings align broadly with school- and community-based VBD education studies from Thailand, Kenya and other parts of India, while adding evidence on a multi-disease model delivered by young peer educators in a rural Indian setting. A single multi-disease curriculum is likely to be more efficient than separate single-disease campaigns, because many preventive behaviours are shared across VBDs. The model could fit naturally into existing school health programmes and national VBD control strategies.[2,10]

Several limitations should be kept in mind while interpreting these findings. First, the study followed a pre-post design without a parallel control group, so secular trends, media coverage, co-existing health programmes and seasonal variation in VBDs cannot be completely ruled out as alternative explanations for the observed improvements; cluster-randomized or stepped-wedge designs would provide stronger causal evidence. Second, outcomes were based on self-reported KAP and the assessments were carried out by Arogyadoots within their own assigned households, which may have introduced social desirability and Hawthorne effects; independent blinded assessors and objective indicators such as entomological indices or routine surveillance data were not used. Third, the analysis did not account for clustering of households within student educators and hamlets, which may have led to underestimated standard errors and inflated statistical significance; mixed-effects or cluster-robust models would be more appropriate in future work, and intraclass correlation coefficients should be reported. Fourth, the reported effect sizes (d ≈ 2.5-2.9) are larger than those usually seen in health education research and may partly reflect scale properties, floor/ceiling effects or the paired-design calculation, and should therefore be interpreted with caution. Fifth, purposive site selection and the requirement of ≥60% academic average and ≥80% attendance for Arogyadoots limit generalizability and raise equity concerns, because students who do not meet these criteria are excluded from participation. Sixth, the three-month follow-up is too short to judge long-term sustainability; a 12-24-month follow-up is needed. Finally, multiple subgroup comparisons were made without formal correction, and no detailed economic evaluation or disease-incidence modelling was undertaken, so cost-effectiveness claims should be treated as exploratory. Well-designed multi-site cluster-randomized trials with independent assessors, objective outcomes, transparent costing and longer follow-up are needed before wider adoption.[16]

CONCLUSION

Trained student Arogyadoots were able to deliver VBD prevention education to almost every household in a rural Maharashtra village and were associated with large improvements in knowledge, attitudes and practices among both students and families, with good three-month retention. Despite the methodological limitations noted above, the findings suggest that school-based peer education is a promising, low-cost approach that deserves rigorous evaluation through controlled trials with objective outcomes, robust statistical handling of clustering and longer follow-up before being considered for wider implementation within India's VBD control strategy. With these refinements, the Arogyadoot model could become a useful template for community-based VBD prevention in rural India and similar settings elsewhere.

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