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Effectiveness of a structured educational training program on antimicrobial resistance among community health workers in Karnataka, India

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Abstract

Globally, antimicrobial resistance (AMR) is escalating due to the frequent and inappropriate consumption of antibiotics. In India, Accredited Social Health Activists (ASHAs) play a vital role in community healthcare and have the potential to promote antimicrobial stewardship practices in their local communities effectively. This study aimed to evaluate the impact of a structured training program for ASHAs on AMR and antibiotic use and its integration into community-level health promotion. A pre-post educational intervention study was conducted among 103 ASHAs from selected Primary Health Centres (PHCs). A three-day structured training was conducted, and pre- and post-training KAP were assessed using a validated questionnaire. Training impact was evaluated through observation checklists, supervisor feedback, and community surveys. Quantitative Data were analyzed using IBM SPSS Statistics version 25, and qualitative data were thematically analyzed. Statistically significant improvements were observed across all KAP domains. Misconceptions, such as using antibiotics for viral infections, declined (from 67.9% to 14.6%; $p=0.002$), while confidence in providing AMR-related guidance increased to 61.1% ($p<0.001$). Practice scores improved significantly ($p<0.001$), with post-training responses changing towards “always” and “sometimes.” Spearman’s correlation indicated a positive association between post-training knowledge, including both attitude ($\rho=0.14$, $p=0.001$) and practice ($\rho=0.221$, $p<0.001$). Community feedback showed high engagement and understanding, with 92% willing to follow ASHAs’ advice. Observational data confirmed strong adherence to training content. The training improved ASHAs’ skills to promote AMR awareness and rational antibiotic usage, highlighting their importance in community-level antimicrobial stewardship.

Keywords Antimicrobial resistance, ASHA workers, Antibiotic use, Prevention



1 Introduction

Common infections are becoming more difficult to treat due to antimicrobial resistance (AMR), which is an escalating issue in global public health. Infection control and treatment outcomes are seriously threatened by the emergence and spread of drug-resistant bacteria, viruses, parasites, and fungi, which frequently result in longer illness duration, higher mortality rates, and higher healthcare expenses [1, 2]. The improper use of antibiotics, which frequently results from irrational and inappropriate use, is one of the primary causes of AMR. In low- and middle-income countries (LMICs) like India, antibiotics are readily available without a prescription, there is a lack of public awareness, and regulatory enforcement is lax. The latter is particularly pertinent [3].

To combat this issue, India introduced the National Action Plan on Antimicrobial Resistance (NAP-AMR) in 2017. In order to enhance antimicrobial stewardship (AMS) at all levels of healthcare, the plan highlights public involvement, education, and training [4]. Accredited Social Health Activists (ASHAs), who are part of India's National Health Mission (NHM), provide primary healthcare services in an effort to effect change at community level. They are crucial for promoting connection between people in rural and urban areas, preventing disease, and promoting health [5, 6]. ASHAs are in a good position to change people's behaviour and promote responsible antibiotic use because they are so closely connected to their communities. However, a lack of training and widespread misconceptions, like using antibiotics for viral infections or stopping treatment when symptoms resolve, may limit their ability to effectively promote behaviour change linked to AMR [7].

Previous studies have mostly focused on improving the health of mothers and children, but there is little data on AMR-related capacity-building programs for frontline community health workers [8, 9]. This study evaluates the impact of a structured AMR training program on improving ASHAs' knowledge, attitude, and practice (KAP) concerning antibiotic use, while additionally exploring the integration of these concepts into their regular outreach activities. We hypothesized that the training would lead to measurable improvements in AMR-related knowledge and community engagement practices. By assessing both individual learning and field-level application, this study contributes to the growing evidence on community-based interventions for AMR control. It furthermore highlights the significant role of ASHAs in addressing global health challenges through grassroots-level initiatives.

2 Materials and methods

2.1 Study design and setting

A pre-post educational intervention study was conducted among ASHAs from selected primary health centres (PHCs) in Karnataka, India.

2.2 Study participants

A total of 103 ASHAs participated in the study. Participants were selected using a convenience sampling method from PHCs where community engagement activities were ongoing.

Inclusion criteria:

- ASHAs working under NHM in the selected PHCs, with at least one year of continuous work experience.
- ASHAs who have completed the standard ASHA induction and refresher training under NHM have the ability to read registers and record information, and the ability to communicate health messages effectively.

Exclusion criteria:

- ASHAs with less than one year of experience.
- ASHAs not willing to participate in the study.

2.3 Overview of training program

2.3.1 Development and validation of KAP questionnaire

A structured KAP questionnaire was developed to assess ASHAs' understanding and behaviour related to antibiotic use and AMR, both before and after the educational intervention. The development process began with a comprehensive literature review to identify validated tools that had previously assessed similar domains among community health workers and frontline health providers [10–13]. This review guided the content selection and contextual adaptation of questions appropriate for ASHAs working in both rural and urban PHCs. Responses on the Knowledge and Attitude parts were assessed using a 5-point Likert scale, from 1 (Strongly Disagree) to 5 (Strongly Agree). To reduce response bias, certain negatively worded statements were reverse-coded during analysis. For the Practice section, a 3-point frequency scale was used: 1 (Never), 2 (Sometimes), and 3 (Always), enabling a nuanced evaluation of how often specific community-facing behaviours were performed.

The developed questionnaire underwent a rigorous validation process to ensure its relevance, clarity, and applicability. A panel of 15 experts, including ASHAs, faculty members, and research scholars from the Department of Pharmacy Practice, assessed each topic for relevance, clarity, simplicity, and ambiguity applying a four-point Likert scale, as advised by Yaghmaie [14]. Item-level content validity index (I-CVI) and scale-level content validity indices (S-CVI) were calculated using responses compiled in Microsoft Excel. Reliability was assessed through Cronbach's alpha, with values ≥ 0.8 considered acceptable, indicating strong internal consistency across domains. The pre-final Kannada version was pretested with 10 ASHAs to evaluate comprehension, feasibility, and clarity. Feedback-informed minor revisions ensured the tool's suitability for field-level use among the ASHA workforce.

2.3.2 Training structure and content

A structured educational program was developed to strengthen ASHAs' knowledge on infection prevention and control (IPC), AMR, prudent use of antibiotics and AMS. The program was designed with input from infectious disease specialists, public health experts and pharmacy practice experts and aligned with national and international guidelines, including the Indian Council of Medical Research's Antimicrobial Stewardship Guidelines (ICMR-AMS) and WHO's AMR Toolkit, forming the foundation for the training [15, 16]. It comprised three interactive sessions covering IPC practices, community awareness of AMR, and the role of ASHAs in promoting rational antibiotic use. Sessions were delivered in Kannada using infographics, role-plays, and group discussions

adapted to local literacy levels. Each session lasted 60–90 min and included pre- and post-tests using the validated KAP questionnaire along with structured feedback to assess knowledge improvement.

The training program was conducted over three days in the form of workshops at certain PHCs located in Mysuru city, such as Bannimantap, N.R Mohalla, Rajendra Nagar, Kyathmarnahalli, and Agrahara. Srimangala and Thithimathi PHCs in Coorg District and Gumballi, YK Mole and B.R Hills PHCs in Chamarajanagar District. The most important topics covered were.

1. Introduction to microbes and antimicrobials.
2. Understanding AMR.
3. Principles of IPC.
4. Rational use of antibiotics.
5. Role of ASHAs in AMS and health promotion.

On each day, there were interactive lectures, group discussions, demonstrations, and role-playing activities. The hands-on activities were conducted as simulated role-plays, where ASHAs practised delivering AMR awareness messages in mock community meeting settings [e.g., Mahila Arogya Samiti (MAS), Village Health Sanitation and Nutrition Committee (VHSNC) and Urban Health and Nutrition Day (UHND)]. Trainers provided immediate feedback to strengthen communication skills. ASHAs were also provided with printed training manuals, role-play scripts, and infographic-based materials, all of which were translated into Kannada and adapted for use in communities with limited resources and low levels of literacy.

2.3.3 Method of training evaluation

A validated KAP questionnaire was administered to participants before the training and again 4 weeks post-training to assess knowledge retention and behaviour change. Observations were conducted by trained research officer's familiar with local health activities. ASHA-led community sessions were observed by supervisors like Primary Health Care Officers and Community Health officers during UHND, VHSNC & MAS meetings to assess how well they applied the training content. A checklist-based monitoring and evaluation tool was used to document the delivery of AMR messages, use of educational materials, and interaction with community members (Supplementary file 1: Annexures 1 and 2).

2.4 Data analysis

Quantitative data from the KAP responses were analysed using SPSS (Version 25.0). Descriptive statistics were calculated, and pre-post comparisons were performed using paired t-tests. Spearman's correlation analysis was done to assess relationships between knowledge, attitudes, and practices. Qualitative data from interviews and observation notes were analyzed thematically to identify key implementation patterns and barriers.

3 Results

A total of 103 ASHAs participated in the study, with a mean age of 37.03 ± 7.00 years. Most were aged 31–40 years (42.7%), married (89.3%), and had completed pre-university education (57.3%). Nearly 38.8% reported 1–5 years of work experience. All participants were female, as per NHM recruitment policy (Table 1).

3.1 ASHAs' KAP towards antibiotic use and AMR before and after training

The post-training assessment demonstrated a significant improvement in ASHAs' knowledge towards antibiotic use and AMR. Misconceptions such as using antibiotics for all germs and treating the common cold among participants decreased from 54.3% (56) to 1.9% (2) ($p=0.012$) and from 67.9% (70) to 14.6% (15) ($p=0.002$), respectively. Additionally, the majority of participants correctly identified that improper antibiotic use and non-adherence can contribute to the development of AMR ($p=0.001$ and $p=0.035$) (Supplementary Table 1).

Significant improvements were observed in ASHAs' attitudes toward antibiotic use and AMR. Post-training, 62.1 (64) % of participants expressed confidence in naming commonly used antibiotics at their primary health centre, from 5.8% (6) before training ($p<0.001$). Similarly, agreement on the importance of guiding patients to complete antibiotic courses increased from 0% to 61.1% (62) ($p<0.001$) (Supplementary Table 2). The practice scores of ASHAs demonstrated a significant improvement following the training, with all four practice-related questions showing statistically significant changes ($p<0.001$). Before the intervention, the majority of participants responded with "Never" for all practices related to antibiotic use. Post-intervention, there was a marked shift towards "Sometimes" and "Always" responses (Supplementary Table 3).

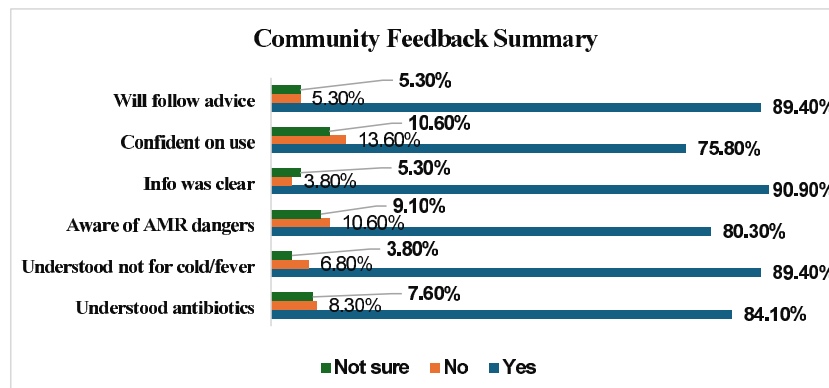
A weak but significant positive association was identified in post-training between knowledge and attitude ($\rho=0.14$, $p=0.001$) and between knowledge and practice ($\rho=0.221$, $p=0.001$) based on Spearman's correlation analysis. In pre-training, knowledge

Table 1 Demographic details of ASHAs

Characteristics	Frequency (N=103)	Percentage (%)
<i>Age group</i>		
21–30	25	24.3
31–40	44	42.7
41–50	31	30.1
51–60	3	2.9
<i>Marital status</i>		
Married	92	89.3
Widowed	11	10.7
Divorced	0	0
<i>Qualification</i>		
Secondary School	3	2.9
High School	30	29.1
Equivalent to Grades 11–12	59	57.3
Undergraduate	11	10.7
<i>Years of experience as an ASHA</i>		
1–5	40	38.8
6–10	33	32
11–15	29	28.2
16–20	1	1

Table 2 Correlation of pre- and post-training knowledge, attitude and practice

	Pre-training		Post-training	
	Spearman's rho	p-value	Spearman's rho	p-value
Knowledge-attitude	-0.093	0.034	0.14	0.001
Attitude-practice	0.07	0.153	-0.082	0.098
Practice-knowledge	0.038	0.438	0.221	0

**Fig. 1** Community feedback on ASHA-led sessions

and attitude were weakly negatively correlated ($\rho = -0.093$, $p = 0.034$), while other correlations were not statistically significant (Table 2).

3.2 Implementation and evaluation of training provided to ASHAs

The evaluation of ASHA-led sessions on antibiotic use and AMR using three tools—community feedback, supervisor assessments, and observation checklist yielded highly encouraging results. Among 132 community members surveyed, over 84% (111) understood the correct use of antibiotics, nearly 90% (118) recognized that antibiotics are not effective for viral infections such as the common cold or fever, and more than 90% (118) found the sessions clear and helpful. Additionally, 92% (120) expressed willingness to follow the ASHA's advice (Fig. 1).

Supervisor feedback from 30 (100%) respondents confirmed that 80% (24) of ASHAs used appropriate materials, 70% (21) demonstrated excellent communication, and 100% (30) successfully engaged the community, with very few instances of misinformation (Supplementary Tables 4 and 5).

Observation of 30 ASHA-led sessions showed high adherence to training protocols—nearly 97% (29) explained antibiotics correctly, and over 83% (25) addressed AMR, 87% (26) used training materials (Infographics) effectively. Collectively, the results highlight the successful implementation and impact of the ASHA-led AMR awareness initiative, while suggesting a need for periodic reinforcement training (Table 3).

4 Discussion

The demographic distribution of ASHAs participating in this study highlights the characteristics of India's frontline health workforce in Karnataka. A significant proportion of participants were in the 31–40 age group (44, 42.7%), aligning with previous studies that ASHAs are often mid-career women with sufficient life experience to earn trust within their communities [17, 18]. The majority of ASHAs (92, 89.3%) were married, which

Table 3 Direct monitoring and observation checklist summary

Questions	Category	Frequency n (%)
ASHA used any training materials	Yes	24 (80)
	No	6 (20)
Explained what antibiotics are and when they should be used	Yes	30 (100)
	No	0
Clearly stated that antibiotics don't treat viral infections (cold, flu, etc.)	Yes	29 (96.7)
	No	1 (3.3)
Talked about AMR and dangers of misuse of antibiotics	Yes	25 (83.3)
	No	5 (16.7)
Encouraged community interaction or answered questions	Yes	26 (86.7)
	No	4 (13.3)
Delivered session confidently and in local language	Yes	26 (86.7)
	No	4 (13.3)
Community members appeared attentive/engaged	Yes	21 (70)
	No	9 (30)
Session completed within expected time (10–15 min)	Yes	20 (66.7)
	No	10 (33.3)
Any misinformation or incorrect messages observed	Yes	2 (6.7)
	No	28 (93.3)

reflects the NHM eligibility preferences, which prioritise married, resident women to ensure long-term commitment and community acceptance [19]. The educational background of the participants was significant, with (59, 57.3%) having completed equivalent to grade 11 to 12 education and an additional (11, 10.7%) holding undergraduate degrees. These figures are significantly higher than the minimum qualification of Grade 8 for ASHA recruitment, indicating that the majority of the selected ASHAs have the necessary educational background to effectively convey and understand public health information [19].

The baseline data showed major gaps in antibiotic knowledge and practices among ASHAs. Although 83.5% (86) reported being aware of antibiotics, only 34% (35) correctly understood how to use them. This discrepancy between awareness and practical knowledge aligns with data from community-based studies from Nepal and Ethiopia, where essential familiarity with medications failed to result in appropriate antibiotic usage [20, 21]. One of the most critical misconceptions corrected through the intervention was related to the duration of antibiotic use. Initially, a majority (78, 75.7%) believed that antibiotics should be used for ≤ 3 days, which could potentially contribute to inappropriate treatment and development of resistance. Post-intervention, 64% (66) correctly identified ≤ 7 days as appropriate, aligning with evidence-based treatment duration.

Counselling practices also improved remarkably, from only 6.8% (7) of ASHAs reporting that they counsel patients about antibiotic use pre-intervention to 94.2% (97) post-intervention. This supports findings from AY Binsaleh et al., where family caregivers who underwent training showed increased confidence in engaging patients and promoting responsible antibiotic use [22]. Such behavioural changes are crucial for the sustainability of AMS programs at the community level.

Misconceptions based on knowledge were also greatly impacted by the intervention. For example, there was a significant decline in the percentage of ASHAs who incorrectly thought that antibiotics were beneficial against viral infections like the common cold.

Other global studies have revealed that such beliefs are significant factors contributing to the irrational use of antibiotics by individuals [7].

The attitude part showed that ASHAs were more responsible as they were more aware of their role in fighting AMR. Even though the question about attitudes toward using antibiotics without a doctor's advice didn't reveal a statistically significant change, more ASHAs believed they disagreed after the intervention. This is comparable to the results that were observed in Kenya's national AMR curriculum implementation, which indicated that changes in strongly held attitudes may take longer but are helped by frequent training and supportive supervision [23].

The practice-based outcomes in this study were arguably the most impressive. All four practice indicators showed statistically significant enhancements ($p < 0.001$), with ASHAs transitioning from "Never" to "Sometimes" and "Always" in teaching, counseling, and following up with patients. These findings support earlier AMS initiatives in Ghana and the UK, wherein behavioural interventions integrated with educational tactics effectively enhanced healthcare personnel's antibiotic-related practices [24, 25].

The evaluation of the ASHA-led community sessions on antibiotic use and AMR demonstrated strong evidence of successful implementation, with high community uptake and appropriate delivery of key messages. Over 90% of community members reported clarity in the sessions, recognised the inappropriateness of antibiotics for viral infections, and expressed willingness to adopt the ASHAs' recommendations, affirming their trust in local health workers and the relevance of the content delivered. Findings from supervisor observations and direct monitoring reinforced the fidelity of training implementation. Most ASHAs used training materials (Infographics) effectively, maintained message accuracy (97%), and promoted interaction during sessions. These outcomes resonate with the results of Abdel-All et al., where a similar model of training ASHAs for hypertension education led to improved knowledge, behaviour change, and confidence in leading community meetings [26].

The ASHAs in this study demonstrated the ability to transfer learned concepts into practice, aligning with Kirkpatrick's model of training evaluation, particularly the behaviour and result domains. As in prior health worker capacity-building interventions across India and LMICs, including hypertension management [23, 27]. Our findings affirm that brief, structured, and interactive training can result in significant improvements in knowledge translation and community-level impact.

This study had few limitations. The study adopted a convenience sampling strategy, thus limiting the generalisability of the findings beyond the selected ASHAs and PHCs. The follow-up examination was completed only four weeks post-training. Hence, the long-term retention of knowledge and the sustainability of behaviour change were not assessed. Future research should explore the long-term impact of AMR training among ASHAs by conducting follow-ups at 6- and 12-month post-intervention. Scaling the intervention across different states and socio-cultural contexts will help validate its adaptability and effectiveness.

5 Conclusion

The training program significantly improved the awareness and practice of ASHAs towards AMR and the proper use of antibiotics. ASHAs demonstrated strong potential to act as community-level antimicrobial stewards by effectively integrating AMR

awareness into their routine outreach activities. Community feedback, supervisor evaluations, and field observations confirmed high implementation fidelity and strong community engagement. This study strengthens the importance of frontline health workers in AMR prevention and offers a scalable model for community-based antimicrobial stewardship efforts in LMICs.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12982-025-01001-x>.

Supplementary Material 1.

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Author contributions

RR: Conceptualisation/design, Methodology, Investigation, Data curation, Writing—original draft. SMS: Conceptualization/design, Methodology. GEV: Methodology, data analysis. PKT: review & editing, Supervision.

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Data availability

Data used in this study are available from the corresponding author (SMS) upon reasonable request.

Declarations

Ethics approval and consent to participate

Ethical clearance for the project was obtained from Institutional Ethics Committee of JSS Medical College, JSS Academy of Higher Education & Research, Mysuru (Ref No: JSSMC/IEC/110523/16 NCT/2023-24). The authors confirm that the study was conducted in compliance with the principles outlined in the Declaration of Helsinki. Before data collection and the training program, written informed consent was obtained from all participating ASHAs.

Consent for publication

Participants also provided consent for the anonymized data, photographs, and feedback collected during the study to be used for research dissemination and publication purposes. No identifying information has been disclosed in the manuscript.

Competing interests

The authors declare no competing interests.

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