

Community Empowerment Through Health Education on Rational Antibiotic Use in Sempu, Banyuwangi

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ABSTRACT

Unsupervised antibiotic use remains a public health concern and may contribute to antimicrobial resistance, inappropriate medication use, and antibiotic-related renal impairment. Limited knowledge regarding antibiotic indications, acquisition, dosage, and resistance highlights the need for targeted community education. This community service activity aimed to improve residents' knowledge, perceptions, and behavioral intentions regarding rational antibiotic use in RT 02, RW 04, Sempu, Banyuwangi Regency. The activity was conducted in May 2026 using a participatory educational approach with a one-group pretest-posttest design. A total of 35 respondents were selected through purposive sampling. Knowledge was assessed using a 21-item questionnaire covering antibiotic indications, acquisition, dosage, storage, resistance, and renal impairment risks. The mean knowledge score increased from 44.6 ± 12.8 to 92.9 ± 6.4 , with a mean difference of 48.3 ± 13.1 points ($p < 0.001$). The proportion of respondents categorized as having good knowledge increased from 5.7% to 91.4%. The greatest improvements were observed in knowledge of appropriate antibiotic indications (57.1%) and antibiotic resistance (51.4%). Positive changes in perceptions and behavioral intentions were also observed, with 88.6% of respondents reporting that they would no longer purchase antibiotics without a prescription and 91.4% expressing interest in continued mentoring. Participatory health education improved knowledge and supported positive behavioral intentions toward rational antibiotic use. Collaboration with pharmacists, primary healthcare professionals, health cadres, and local pharmaceutical service facilities is recommended to strengthen continuous education, monitoring, and adherence to prescription requirements.

Keywords : Antibiotics, Health Education, Community Service, Antibiotic Resistance, Self-Medication.

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INTRODUCTION

Antibiotics are classified as prescription-only medicines that should be used solely based on clear medical indications under the supervision of qualified healthcare professionals.

However, in practice, antibiotics remain widely accessible and are frequently self-administered by the general public without a physician's prescription (Bellino et al., 2018). They are commonly used to manage everyday complaints such as fever, cough, rhinorrhea, sore throat, and pain conditions that are predominantly caused by self-limiting viral infections and do not require antibiotic therapy (Zanichelli et al., 2023).

Limited public understanding of the distinction between bacterial and viral infections, combined with inadequate literacy regarding the principles of rational antibiotic use, constitutes the primary driver of inappropriate antibiotic practices (Shehadeh et al., 2016). The most frequently observed patterns of misuse include antibiotic consumption without prior medical examination, incorrect dosing, truncated or incomplete treatment courses, and reuse of leftover antibiotics from previous prescriptions (Dewi, 2020). In Indonesia, the 2023 Indonesian Health Survey (SKI) reported that 22.1% of respondents had used oral antibiotics within the previous year, of whom 41.0% obtained antibiotics without a doctor's prescription. Furthermore, 61.3% of antibiotics obtained without a prescription were sourced from licensed pharmacies or drugstores (Ministry of Health of the Republic of Indonesia, 2023). At the regional level, a study conducted among 677 women visiting health centers in Malang, East Java, reported that 38.4% of respondents had practiced antibiotic self-medication, while 51.7% reported completing their antibiotic treatment regimen (Yunita et al., 2022). These self-medication practices are further reinforced by the ease of purchasing antibiotics from retail outlets that do not enforce prescription regulations, as well as the widespread practice of sharing medications among family members and neighbors (da Costa et al., 2026; Kumar et al., 2024)

Irrational antibiotic use contributes substantially to the emergence of antibiotic resistance a condition in which bacteria no longer respond to antibiotic treatment, thereby rendering standard therapies ineffective (Unsleber et al., 2019). The World Health Organization has identified antimicrobial resistance as one of the most critical threats to global public health, given its direct association with increased morbidity, mortality, prolonged hospitalization, and escalating healthcare costs (Zanicelli, 2024). The consequences of antibiotic resistance extend beyond the individual user, spreading to the community level through the transmission of resistant bacterial strains.

Beyond resistance, uncontrolled antibiotic use particularly with regard to dosing and duration also poses a significant risk of renal impairment (Tanha et al., 2024). The kidneys play a central role in drug excretion and the elimination of metabolic waste products; consequently, prolonged exposure to pharmacological agents can impose an excessive burden on renal tissue and precipitate structural and functional damage (Katzung et al., 2021). Such damage typically progresses insidiously in its early stages, often remaining asymptomatic until it reaches an advanced phase. By that point, long-term renal replacement therapies such as dialysis become necessary, imposing a substantial economic burden on both patients and the healthcare system (Hamao et al., 2025; Liao et al., 2025)

Previous community-based interventions have shown that health education can improve knowledge regarding rational antibiotic use. Christanti et al. (2024) reported a significant improvement in antibiotic-related knowledge among health cadres in Malang through education using audio media and a pocketbook. A community education program in Jakarta also addressed inappropriate antibiotic practices, including purchasing antibiotics without prescriptions and inappropriate dose modification. Meanwhile, Yulia et al. (2026) implemented participatory education among high school students to improve knowledge and awareness of rational antibiotic use and antimicrobial resistance.

These studies share a similar focus on improving knowledge and awareness of rational

antibiotic use through community-based education. However, they differed in their target populations, settings, and evaluation outcomes. The present activity involved adult residents of RT 02 RW 04, Sempu District, Banyuwangi Regency, and evaluated changes in knowledge, perception, and behavioral intention using a one-group pretest-posttest design. This approach provides additional evidence regarding community education on rational antibiotic use at the neighborhood level.

Based on this situational analysis, irrational antibiotic use among the community of Kecamatan Sempu represents an urgent public health concern that necessitates preventive and promotive interventions. A community engagement program in the form of health socialization and education is considered a highly relevant approach, as it directly addresses the root cause of the problem: insufficient public knowledge and awareness regarding appropriate antibiotic use.

This program aims to enhance public knowledge and awareness regarding the principles of rational antibiotic use, the dangers of antibiotic resistance, and the risk of renal dysfunction associated with uncontrolled medication use. Through targeted and accessible health education, community members are expected to make more informed decisions regarding medicine use, thereby preventing more serious health consequences and contributing to the sustainable improvement of community health outcomes.

METHOD

This community service program employed a participatory educational approach focused on three core themes: rational antibiotic use, antibiotic resistance, and the risk of renal impairment resulting from uncontrolled medication consumption. Program effectiveness was evaluated using a one-group pretest-posttest design (Yusef et al., 2018). The program was conducted in Mei 2026 among residents of RT 02 RW 04, Kecamatan Sempu, Banyuwangi Regency. Participants were recruited through purposive sampling, with the following inclusion criteria: aged ≥ 18 years, residing within the target area, completing all program activities, and providing informed consent to participate. Participants who did not complete either the pretest or the posttest were excluded from the analysis.

The program comprised five sequential stages: preparation, pretest administration, interactive health education, posttest administration, and evaluation. Health education was delivered through structured presentations supplemented by informational leaflets, followed by an open discussion and question-and-answer session. Participant knowledge was assessed using a 21-item questionnaire covering antibiotic use, appropriate medication practices, antibiotic resistance, medication storage, and the potential renal risks of uncontrolled drug use. Each correct answer was scored as 1 and each incorrect answer as 0. The instrument was supplemented by six additional items (P1–P6) assessing perceptions and behavioral intentions. Content validity was established through expert judgment by subject matter specialists. Knowledge scores were expressed as percentages and categorized into three levels: poor ($<56\%$), moderate ($56\text{--}75\%$), and good ($76\text{--}100\%$) (Bhardwaj et al., 2021).

Data were analyzed descriptively by comparing pretest and posttest knowledge scores. The difference in scores was examined using a paired-samples t-test for normally distributed data, or the Wilcoxon signed-rank test for non-normally distributed data. Statistical significance was set at $p < 0.05$.

RESULTS

Respondent demographics

The activity was attended by 35 respondents who met the inclusion criteria. Respondent characteristics collected through Section A of the questionnaire included age, sex, level of education, and occupation, as presented in Table 1.

Tabel 1. General Characteristic of respondents (n = 35)

Category	Response option	Number (n)	Percentage (%)
Age	18–25 years	7	20,0
	26–35 years	13	37,1
	36–50 years	11	31,4
	>50 years	4	11,4
Gender	Male	13	37,1
	Female	22	62,9
Education	Elementary School	11	31,4
	Junior High School	10	28,6
	Senior High School	9	25,7
	University	5	14,3
Occupation	Housewife	15	42,9
	Student	9	25,7
	Employee/Trader/Others	11	31,4

The majority of respondents were in the productive age group of 18–50 years (31 individuals; 88.6%) and were female (22 individuals; 62.9%). In terms of educational background, the largest proportion of respondents had completed only elementary school (31.4%), followed by junior high school (28.6%), senior high/vocational school (25.7%), and higher education (14.3%). With regard to occupation, the largest proportion were housewives (42.9%), followed by employees/traders/others (31.4%) and students (25.7%). The predominance of the productive age group with diverse educational backgrounds reflects the heterogeneous characteristics of the respondents. Community-based health education activities involving demographically and educationally diverse participants of this kind have been reported to remain beneficial when the material is delivered in simple language accompanied by easily accessible educational media. (Dwi Putri Rejeki et al., 2025; Risnawati, 2021)

Comparison of Knowledge Scores Before and After the Educational Intervention

Respondents' knowledge scores were derived from 21 questionnaire items and converted to a 0–100 scale. The comparison of pre-test and post-test scores, together with the distribution of knowledge-level categories, is presented in Table 2.

Table 2. Comparison of Respondents' Knowledge Scores Before and After Education

Parameter	Pre-test	Post-test	Difference	p-value
Rerata $\pm$ SD (skala 0–100)	44,6 $\pm$ 12,8	92,9 $\pm$ 6,4	48,3 $\pm$ 13,1	< 0,001
Median(minimum–maximum)	47,6 (28,6–71,4)	95,2 (76,2–100)	–	–
Poor category (< 56), n (%)	24 (68,6)	0 (0,0)	–	–
Fair category (56–75), n (%)	9 (25,7)	3 (8,6)	–	–
Good category (76–100), n (%)	2 (5,7)	32 (91,4)	–	–

Note. The Wilcoxon signed-rank test showed a statistically significant difference in knowledge scores between the pre-test and post-test ($p < 0.001$).

The mean knowledge score increased from 44.6 ± 12.8 at pre-test to 92.9 ± 6.4 at post-test, yielding a mean difference of 48.3 ± 13.1 points. The Wilcoxon signed-rank test showed a statistically significant difference between pre-test and post-test scores ($p < 0.001$). The smaller standard deviation observed at post-test compared with pre-test indicates that the distribution of respondents' scores became more homogeneous following the intervention. The distribution across categories also shifted: the proportion of respondents classified as having good knowledge increased from 5.7% to 91.4%, whereas the poor-knowledge category, which had initially comprised 68.6% of respondents, was no longer observed at post-test.

Achievement per Knowledge Domain

The proportion of correct responses for each knowledge domain is presented in Table 3.

Table 3. Proportion of Correct Responses per Knowledge Domain

Knowledge Domain (item number)	Pre-test (%)	Post-test (%)	Difference (%)
Definition and use of antibiotics (1, 3, 4)	18 (51,4)	33 (94,3)	42,9
Appropriate indications for use (2, 6)	12 (34,3)	32 (91,4)	57,1
How to obtain antibiotics (5)	16 (45,7)	33 (94,3)	48,6
Dosage instructions, dose, and duration of therapy (7–9)	20 (57,1)	34 (97,1)	40,0
Storage, sharing, and disposal of medicines (10, 17, 21)	15 (42,9)	32 (91,4)	48,6
Antibiotic resistance (11–13)	13 (37,1)	31 (88,6)	51,4
Impact on kidney function (14–16)	14 (40,0)	31 (88,6)	48,6
Reading medication labels and information sources (18–20)	19 (54,3)	34 (97,1)	42,9

Improvements were observed across all knowledge domains. The largest gain was recorded in the domain of appropriate indications for use (57.1%), followed by the antibiotic resistance domain (51.4%); these two domains also had the lowest pre-test achievement, with 12 respondents (34.3%) and 13 respondents (37.1%) answering correctly, respectively. The highest post-test achievement was observed in the domains of dosage instructions and of reading medication labels and information sources, with 34 respondents (97.1%) each, whereas the lowest post-test achievement was found in the domains of antibiotic resistance and impact on kidney function, with 31 respondents (88.6%) each.

Perception and Behavioral Intention

The proportions of responses on perception and behavioral-intention items, including respondents' interest in continued mentoring, are presented in Table 4.

Table.5 Proportion of Responses on Perception and Behavioral Intention Items

Perception / Behavioral Intention Item	Pre-test, n (%)	Post-test, n (%)
Perception: antibiotics should only be used with a prescription (P1)	20 (57,1)	34 (97,1)
Perception: ordinary colds and flu do not require antibiotics (P2)	13 (37,1)	32 (91,4)
Intention: not discontinuing antibiotics before completing the recommended course (P3)	18 (51,4)	33 (94,3)
Intention: not purchasing antibiotics without a prescription (P4)	–	31 (88,6)
Intention: not sharing antibiotics with others (P5)	–	30 (85,7)
Interest in continued mentoring (P6)	–	32 (91,4)

Note: Items P4–P6 were assessed at post-test only; n = number of respondents who agreed/answered yes.

Regarding perception, the proportion of respondents agreeing that antibiotics should only be used with a prescription increased from 20 respondents (57.1%) to 34 respondents (97.1%), while the perception that ordinary colds and flu do not require antibiotics increased from 13 respondents (37.1%) to 32 respondents (91.4%). Regarding behavioral intention, the proportion of respondents intending not to discontinue antibiotics before completing the recommended course increased from 18 respondents (51.4%) to 33 respondents (94.3%). At post-test, 31 respondents (88.6%) stated they would not purchase antibiotics without a prescription, 30 respondents (85.7%) would not share antibiotics with others, and 32 respondents (91.4%) expressed interest in continued mentoring on DAGUSIBU (proper medication procurement, use, storage, and disposal).

DISCUSSION

The respondent characteristics in this study, dominated by the productive age group, individuals with secondary to higher education, and predominantly female participants, indicate an adequate health-literacy foundation for receiving material on the rational use of antibiotics. The productive age group and working individuals in general tend to engage most frequently in self-medication owing to limited time available for visiting health facilities. Meanwhile, women and housewives constituted the majority of respondents in this study, consistent with their role as household health managers and the primary decision-makers regarding medication provision within the household. The presence of respondents with only elementary-level education (31.4%) necessitated simplified language when delivering the material as well as assistance in completing the questionnaire to ensure the validity of the measurement results. A respondent profile of this kind provides a favorable foundation for the success of educational interventions, given that health literacy has been shown to be closely associated with knowledge, attitudes, and behaviors related to the rational use of antibiotics (Elkhadry & Tagoon, 2024; Tarhan & Guc, 2026). A high prevalence of self-medication among the working-age population has also been reported across various countries, including in

metropolitan areas of Thailand, where rates reached 88.2%, including the use of antibiotics without a prescription (Chautrakarn et al., 2021). Mothers, as primary caregivers of children, have been shown to possess greater awareness of the consequences of antibiotic use compared with other family members (Kumar et al., 2024), and within the Indonesian context, family knowledge and practices in selecting, obtaining, storing, and disposing of medicines strongly influence household self-medication behavior (Rauf *et al.*, 2021). Standard health-literacy measurement instruments remain applicable among low-literacy groups provided that the wording is simplified and direct assistance is offered during completion (Storms et al., 2017).

This study demonstrated a mean increase in knowledge score of 48.3 points, with a p -value < 0.001 , indicating that the educational intervention produced a meaningful change rather than mere random variation. In addition, the standard deviation decreased from 12.8 to 6.4, indicating that the improvement in knowledge occurred relatively evenly across all respondents rather than being confined to participants with higher educational attainment. This pattern of even improvement suggests that the combination of interactive lectures, demonstrations of reading medication labels, and case-based discussions was able to accommodate differences in participants' educational backgrounds. The magnitude of this improvement is consistent with various other antibiotic education intervention studies that have similarly reported statistically significant increases in knowledge scores following education, although the magnitude varies depending on the method and duration of the intervention employed (Bhardwaj et al., 2021; Shehadeh et al., 2016). Participatory and interactive educational methods can enhance participant engagement and comprehension in receiving health information, particularly among communities with diverse characteristics and literacy levels. Approaches that actively involve participants, employ easily understandable materials, and incorporate collaborative learning can support improvements in health literacy and the application of information in daily life (Romanova et al., 2024; Shehadeh et al., 2016; Singh et al., 2024)

The domains of appropriate indications for use and antibiotic resistance showed the greatest improvement in this study, while also having the lowest baseline achievement. This finding indicates that, prior to the intervention, respondents had a better understanding of procedural aspects, such as how and when to take medication, than of conceptual aspects concerning the distinction between bacterial and viral infections and the mechanisms underlying antibiotic resistance. This limited conceptual understanding constitutes the underlying basis of antibiotic self-medication practices for upper respiratory tract complaints, and strengthening material in these two domains should therefore be prioritized in similar future activities. This pattern is consistent with a study among the general population in Karnataka, India, which found that nearly half of respondents still believed antibiotics could kill viruses and that most did not correctly understand the mechanism of resistance (Karuniawati et al., 2021; Nguyen et al., 2022) (Bhardwaj et al., 2021). The domain concerning the impact on kidney function also showed a relatively lower post-test achievement compared with the other domains. This may be explained by the gradual and asymptomatic nature of drug-induced kidney damage, which is consequently less readily perceived as a tangible threat by the public. Drug-induced nephrotoxicity is indeed often described as a hidden form of kidney damage, as many cases of early kidney injury do not produce symptoms that patients can recognize before they are detected through laboratory testing (Dobrek, 2023).

The changes observed in perception and behavioral intention in this study indicate that the intervention extended beyond the cognitive domain, beginning to influence the affective and conative domains as well. The high level of respondent interest in continued mentoring

(91.4%) indicates that considerable potential exists for the sustainability of the program. Nevertheless, intention does not always translate into actual behavior, particularly when access to purchasing antibiotics without a prescription remains readily available; a dual approach is therefore required, comprising ongoing education delivered through health cadres and community health posts (posyandu), together with strengthened oversight of the dispensing of prescription-only medicines at local pharmacies and drug outlets. This finding is consistent with the theory of planned behavior, which posits that knowledge forms the foundation for the formation of attitudes, subjective norms, and perceived behavioral control, which in turn shape behavioral intention; educational interventions based on this theoretical framework have been shown to significantly enhance both knowledge and behavioral intention (Byrne et al., 2019; Ghasemian et al., 2024; Widayati et al., 2015)

CONCLUSION

Participatory health education improved community knowledge and supported positive perceptions and behavioral intentions regarding the rational use of antibiotics among residents of RT 02 RW 04, Sempu, Banyuwangi Regency. The most notable improvements were observed in the domains of appropriate indications for antibiotic use and antibiotic resistance. To support sustained behavioral change, a community-based monitoring system is recommended, involving periodic follow-up education by health cadres, monitoring of antibiotic purchasing practices through community surveys, and referral of suspected inappropriate antibiotic use to healthcare professionals. Collaboration with local pharmaceutical service facilities is also needed to strengthen compliance with prescription requirements, provide counseling on appropriate antibiotic use, and encourage the documentation of antibiotic dispensing. The high level of respondent interest in continued mentoring provides an opportunity to establish regular education and monitoring activities to reinforce rational antibiotic use in the community.

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