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Original Research Article

Public awareness regarding antimicrobial resistance in a hilly area of Garhwal Uttarakhand: a cross-sectional community-based study

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ABSTRACT

Background: Rising resistance for antimicrobials is a significant health concern globally. India is one of the countries with high prevalence of infectious diseases and misuse of antibiotics associated with it, contributing to emergence of drug-resistant organisms. Awareness among people is therefore important to prevent antimicrobial resistance.
Methods: This cross sectional, community-based study assessed public awareness about antimicrobial resistance with 24 close ended questions scaled on three-point Likert scale as agree, disagree and not sure, divided in five parts including basic knowledge regarding antimicrobials, purchase of antimicrobials, duration of antimicrobial course, spread of antimicrobial resistance, and misuse of antimicrobials. Overall, 17 questions were positively scored as 0,1 and 2 for disagree, not sure and agree respectively, and reverse scoring was done for 7 questions. Data was analysed using SPSS v.27.
Results: Sixty three percent study participants have good awareness about antimicrobial resistance and awareness level is significantly associated with age group, education level of the participants, occupation and not with gender.
Conclusions: Findings reveal that even basic knowledge was poor among one fifth participants in study. Poor awareness about purchase, duration of course and spread of antimicrobial resistance, found in nearly half of study participants.

Keywords: Antimicrobial, Resistance, Antibiotic, Knowledge

INTRODUCTION

When micro-organisms develop resistance to antimicrobial medicines, possible treatment decisions for various diseases are minimized. Such resistance is occurring throughout the world for diverse range of microorganisms with rising prevalence, threatening human as well as animal health.[1] According to World Health Organization (WHO), antimicrobial resistance (AMR) is among top 10 threats for public health with serious health and economic implications globally, and public awareness is critical in global fight against AMR.[2,3]

In the year 2023, worldwide approximately one in six laboratory-confirmed bacterial infections were caused by bacteria resistant to antibiotics.[2] Also, antimicrobial resistant infections are predicted to cause 39·1 million deaths attributable to AMR and 169 million deaths associated with AMR, cumulatively from the year 2025 to 2050.[4]

AMR globally has increased in 40% of the pathogen-antibiotic combinations monitored between 2018 and 2023.[2] Also, urinary tract infections and bloodstream infections have been more resistant compared to gastrointestinal and urogenital gonorrhoeal infections,

increasing the severity and mortality risk. Correspondingly, important concern is rising resistance to "Watch" antibiotics in the "AWaRe" (Access, Watch, Reserve antibiotics) classification, chiefly carbapenems and fluoroquinolones, in Gram-negative pathogens.[2-5]

India with high burden of bacterial infections has strategic objectives of National Action Plan (NAP) AMR aligned with the Global Action Plan, with chief priority strategy as enhancing awareness of antimicrobial resistance through education and communication, as resistance development immensely depends on knowledge regarding appropriate use of antibiotics by general people in community.[6] Recent report from ICMR AMR surveillance network revealed emerging resistance trends that E. coli and K. pneumoniae are most resistant organisms, with severely compromised activity of cephalosporins, carbapenems, and fluoroquinolones.[7]

AMR is increasing not only due to inappropriate use of antimicrobials in humans but also in animal health, agriculture, and food production, hence association of AMR with the concept of "One Health" approach is gaining more importance.[1-6] Consequently, such use raises treatment costs and reduces production due to illness in both humans and animals, leading to worldwide economic losses. Hence for combating AMR, besides preventing infective diseases, available effective and safe medicines should be used in a responsible way. People centered approach therefore requires people to have the education and support they need to make decisions and participate in their own care.[3] In the hilly areas, there is lack of data on awareness and use of antimicrobials among general people, hence, present study was conducted to assess awareness regarding antimicrobial resistance among residents in a hilly area of Garhwal, Uttarakhand.

METHODS

This community-based study with cross-sectional design was done among individuals of hilly area from October 2023 to January 2024. Approval was obtained from Institutional Ethics Committee, VCSGGIMS and R Srinagar Pauri Garhwal (MC/IEC/2024/58). Individuals above 18 years of age, residents of field practice areas associated with department of Community Medicine, who gave consent and knew about the term 'antibiotics/antimicrobials' were included to assess awareness about antimicrobial resistance. Sample size calculated using formula Z2pq/L2, considering the prevalence of knowledge p=50%, L=5%, Z=1.96, was 384. Participants were purposively selected and were talked to using a predesigned pretested questionnaire covering socio-demographic information and 24 questions based on WHO multi-country and ICMR supported recent surveys, divided into five parts including basic knowledge regarding antimicrobials, purchase of antimicrobials, duration of antimicrobial course, spread of antimicrobial resistance, and misuse of antimicrobials, scaled on three-point Likert scale as agree, disagree and not sure.[8,9]

Overall, 17 questions were positively scored as 0,1 and 2 for disagree, not sure and agree respectively, and reverse scoring was done for 7 questions. Responses were recorded with the help of interview, explaining questions clearly to participants in English/Hindi. Total score range was 0 to 48 for each participant and transformed scores (correct response percentage) ≥ 60% measured as good, in all domains. Data was analysed using SPSS version 27. Reliability analysis showed Cronbach's alpha equal to 0.807 for all 24 questions. Chi square test was used to assess association of good knowledge with sociodemographic factors.

RESULTS

Of 384 study participants, 208 (54.2%) were females and 176 (45.8%) were males. Majority of participants 210 (54.7%) were 18-30 years of age, followed by 104 (27.1%) in 31-45 years, 49 (12.8%) in 46-60 years age categories, and 21 (5.5%) above 60 years of age. As stated by them, majority have studied till graduate level 188 (49.0%), followed by intermediate 85(22.1%), high school 48 (12.5%), primary/middle 29 (7.6%), postgraduates 24 (6.3%) and rest 10 (2.6%) were illiterates. Talking about occupation, majority 152 (39.6%) were students, followed by 101 (26.3%) homemakers, 44 (11.5%) semi-professionals, 27 (7%) were involved in business, 24 (6.3%) were semiskilled workers, and 12 (3.1%) were skilled, professionals and retired each (Table 1).

As per the responses given by them, people were best aware of basic questions, and only one fifth participants (19.8%) had poor knowledge about questions asked in basic knowledge domain. Antimicrobials are correctly agreed as vital means for fighting diseases in humans by 79.4% study participants and, 77.1% correctly agreed that resistance to antimicrobials develops when microorganisms including bacteria, virus, parasite, and fungi fight the effect of antibiotic medicine. Also, 64.1% study participants correctly agreed that antimicrobials include antibiotic, antiviral, antifungal, and antiprotozoal medicines, and 70.3% study participants agreed that resistance to antimicrobials makes common infections harder to treat. "Antimicrobial/antibiotic resistant infections are more expensive to treat" and "antimicrobials/antibiotics are used in humans as well as in animals" are respectively correctly agreed by 67.7% and 60.4% study participants (Table 2).

When asked about awareness related to purchase of antibiotics 72.7% correctly knew that antimicrobial/antibiotic medicines should not be bought without prescription from a registered medical practitioner, 13.3% disagreed and rest were not sure about it. But when asked that "to save time, sometimes antimicrobial/antibiotic medicines can be purchased from

pharmacist without asking a doctor," 42.7% study participants incorrectly agreed to this showing influence of lack of time on AMR.

Table 1: Sociodemographic characteristics of study participants (n=384).

Sociodemographic variable	No. of respondents (%)
Gender	
Females	208 (54.2)
Males	176 (45.8)
Age groups (years)	
18-30	210 (54.7)
31-45	104 (27.1)
46-60	49 (12.8)
>60	21 (5.5)
Education	
Illiterate	10 (2.6)
Primary/middle	29 (7.6)
High-school	48 (12.5)
Intermediate	85 (22.1)
Graduate	188 (49.0)
Postgraduate	24 (6.3)
Occupation	
Homemakers	101 (26.3)
Students	152 (39.6)
Business	27 (7.0)
Semiskilled	24 (6.3)
Skilled	12 (3.1)
Semi-professional	44 (11.5)
Professional	12 (3.1)
Retired	12 (3.1)

Nearly half (48.7%) participants disagreed that "antimicrobial/antibiotic medicines can be purchased with help of internet." Majority of participants (56.3%) knew the importance of duration of antimicrobial course and resulting resistance. 35.7% said that it is better to stop antibiotic before prescribed duration if symptoms improve to reduce cost of treatment as antibiotic medications are costly. 40.1% believed that they can share antibiotics with their friends and relatives if they suffer from similar symptoms (Table 2).

Regarding spread of antimicrobial resistance, 42.2% incorrectly agreed that it is not the microorganism but the human body which develops resistance to antibiotic medicine. Antibiotic resistant bacteria can be transmitted from one person to other person, and by contaminated water or food to human beings, are respectively correctly agreed by 53.6% and 63.3%.

Lack of sanitation and clean water, increases risk of antimicrobial resistance, is correctly agreed by 57.6%. Also, 68% study participants correctly agreed that antimicrobial resistance enhances disease spread, illness severity and death. Antibiotics can be shared with friends or relatives, if symptoms are similar is incorrectly agreed by 40.1%.

However, 72.9%, 58.3% and 57% study participants respectively correctly agreed that danger of antimicrobial resistance has increased worldwide due to overuse of antimicrobial medicines in humans, in animals and in agriculture (Table 2).

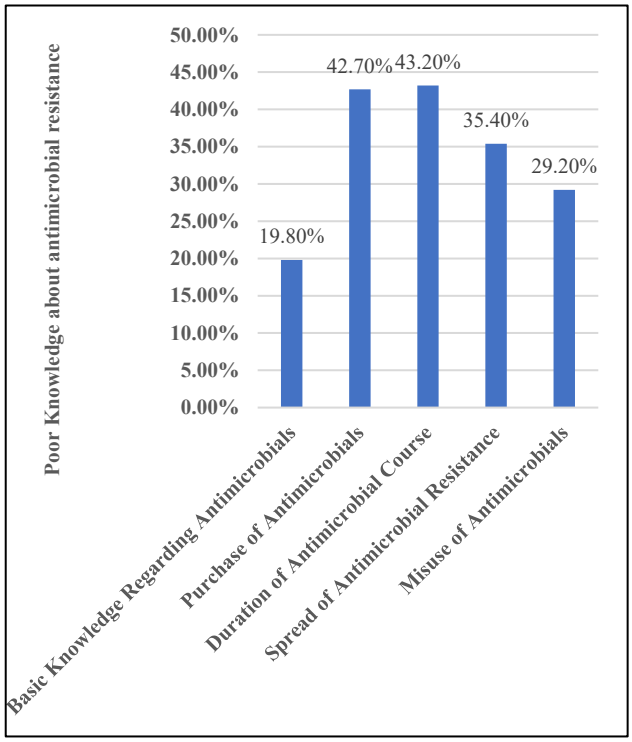

Figure 1: Poor knowledge among study participants in different domains (n=384).

Overall, 242 (63.0%) of study participants had good knowledge. No statistically significant association was found between good knowledge and gender of participants across all domains.

Good knowledge scores were highest among 18-30 years age participants in 166 (79.0%) as compared to other age categories with statistically significant difference (p=0.001). Education level of study participants is also significantly associated with good knowledge and, 142 (75.5%) graduate and 18 (75%) postgraduate participants had good knowledge across all domains (p=0.001).

According to occupation, knowledge is best among students 125 (82.2%) and least among homemakers 42 (41.6%) with statistically significant difference (p=0.001) (Table 3). Also, 42.7%, 43.2%, 35.4%, 29.2%, respectively had poor knowledge in purchase, duration, spread and misuse domains. On application of Chi square test difference is not statistically significant (Figure 1).

Table 2: Awareness regarding antimicrobial resistance among study participants (n=384).

Questions	Agree (%)	Disagree (%)
Basic knowledge regarding antimicrobials		
Antimicrobial medicines are vital means for fighting diseases in humans.	79.4	10.2
Antimicrobial medicines include antibiotic, antiviral, antifungal, and antiprotozoal medicines.	64.1	8.3
Resistance to antimicrobials/antibiotics arises when bacteria/viruses/parasites/fungi fight medicine effects.	77.1	6.0
Resistance to antimicrobials/antibiotics makes common infections harder to treat.	70.3	10.4
Antimicrobial/antibiotic resistant infections are more expensive to treat.	67.7	9.1
Antimicrobials/antibiotics are used in humans as well as in animals.	60.4	15.1
Purchase of antimicrobials		
Antimicrobial/antibiotic medicines should not be bought without prescription from a registered medical practitioner.	72.7	13.3
To save time, sometimes antimicrobial/antibiotic medicines can be purchased from pharmacist without asking a doctor.*	42.7	48.7
Antimicrobial/antibiotic medicines can be purchased with help of internet.	31.5	48.7
Duration of antimicrobial course		
Duration of antibiotic course determines development of resistance.	56.3	10.4
Improving symptoms/ feeling better means antibiotic medicine can be stopped before prescribed duration.*	34.9	49.5
Short duration of antibiotic course means less side effects.*	33.9	47.4
To reduce cost of treatment antibiotic medicines can be stopped before prescribed duration.*	35.7	48.4
Duration of antibiotic course determines the speed by which bacteria/ pathogen develops resistance.	47.7	18.2
Spread of antimicrobial resistance		
It is human body that is resistant to antimicrobial/antibiotic medicine.*	42.2	27.9
Antibiotic resistant bacteria can be transmitted from person to person.	53.6	24.5
Antibiotic resistant bacteria can be found in community in addition to hospital.	73.7	9.6
Antibiotic resistant bacteria can spread by contaminated water or food to humans.	63.3	16.7
Antimicrobial resistance enhances risk of spread of disease, severity of illness and death.	68.0	9.6
Lack of sanitation and clean water, can increase risk of antimicrobial resistance.	57.6	15.6
Misuse of antimicrobials		
For similar symptoms antibiotics can be shared with friends or relatives.*	40.1	47.9
Danger of antimicrobial resistance has increased worldwide due to overuse of antimicrobial medicines in humans.	72.9	9.6
Danger of antimicrobial resistance has increased worldwide due to overuse of antimicrobial medicines in animals.	58.3	10.7
Danger of antimicrobial resistance has increased worldwide due to overuse of medicines in agriculture.	57.0	13.3

*7 reverse scored questions

Table 3: Sociodemographic factors associated with good knowledge (n=384).

Variables	Good knowledge score (n=242) row% (63.0%)	Poor knowledge score (n=142) row% (37.0%)	Chi square test	P value
Age groups (years)				
18-30	166 (79.0)	44 (21.0)	51.11	0.001
31-45	46 (44.2)	58 (55.8)		
46-60	21 (42.9)	28 (57.1)		
>60	9 (42.9)	12 (57.1)		
Gender				
Females	126 (60.6)	82 (39.4)	1.16	0.281
Males	116 (65.9)	60 (34.1)		

Continued.

Variables	Good knowledge score (n=242) row% (63.0%)	Poor knowledge score (n=142) row% (37.0%)	Chi square test	P value
Education				
Illiterate	2 (20.0)	8 (80.0)	36.71	0.001
Primary/middle	13 (44.8)	16 (55.2)		
High-school	21 (43.8)	27 (56.3)		
Intermediate	46 (54.1)	39 (45.9)		
Graduate	142 (75.5)	46 (24.5)		
Postgraduate	18 (75.0)	6 (25.0)		
Occupation				
Homemakers	42 (41.6	59 (58.4)	50.21	0.001
Students	125 (82.2)	27 (17.8)		
Business	14 (51.9)	13 (48.1)		
Semiskilled	11 (45.8)	13 (54.2)		
Skilled	9 (75.0)	3 (25.0)		
Semi-professional	27 (61.4)	17 (38.6)		
Professional	8 (66.7)	4 (33.3)		
Retired	6 (50.0)	6 (50.0)		

DISCUSSION

Our study reveals that 63% of study participants have overall good awareness about antimicrobial resistance across all domains. Azithromycin was commonly known antibiotic among study participants. But more than one fifth of participants (22.9%) responded incorrectly as disagree/not sure, to the fact that AMR occurs when bacteria, viruses, fungi, and parasites change progressively to withstand the drugs used to treat them. Similarly, in an ICMR supported survey in Kolkata, incorrect knowledge about AMR was found in 28% of urban, educated people, reflecting substantial lack of awareness.[9]

Worldwide resistance is most frequent in the South-East Asia and Eastern Mediterranean regions, followed by the African Region, and less frequent in the European Region and Western Pacific Region.[2] Even in the WHO African region, low knowledge of AMR and wide misuse of antimicrobials has been reported in recent review study.[10] In a multi-country survey by WHO it was found that China and India were the only countries where antibiotics are bought online and from India 2% of respondents in survey agreed antibiotics purchase online compared to 5% from China.[8] However in our study 31.5% of participants agreed that antibiotics can be purchased with help of internet, and 13.3% participants disagreed and 14% were not sure when asked about, not taking antibiotics without prescription from registered doctor, reflecting overall lack of awareness among one fourth. Similar results were revealed in a study done in Mangaluru India by Khelgi A et al.[11] This is however higher than found in Kolkata survey where only 17% respondents incorrectly disagreed that without prescription from registered doctor, antibiotics should not be purchased or used. Differences in findings may be due to increasing awareness with time and development of newer and more expensive antibiotics resulting in more and more people using antibiotics without doctor consultation. Also, environmental factors may play a role in hilly areas like limited access to healthcare facilities and difficult terrain. This emphases on importance of awareness among people and an important initiative “Red Line awareness campaign” has already been started in India, urging people not to use medicines marked with a red vertical line, including antibiotics, without a doctor’s prescription.[12]

In study done in Karnataka by Bhardwaj et al it was found that graduates and post-graduates more likely agreed that prescription from a doctor is required before purchasing antibiotics and this is similar to our study where graduates and post-graduates have significantly higher knowledge.[13] Suboptimal treatment leads to complications or longer recovery, and higher risk of morbidity or mortality due to infections that are difficult to treat or untreatable.[3] In our study, 34.9% participants incorrectly agreed that feeling better with improving symptoms means that stop antibiotic before prescribed duration, compared to 51% and 62.5% participants respectively in studies by Bhat MJ et al and Miyano et al, stating that they stopped using antimicrobials when felt better.[14,15] These figures from different countries, emphases on making people aware of the fact that weak bacteria die first relieving the symptoms but stronger stubborn bacteria may still be alive and can multiply causing more severe infection if treatment is stopped earlier, and consequently resulting in development of resistance, and therefore completing the full prescribed course is essential. Also, they should know that more expensive antibiotics will then be needed to treat resistant infections, and in our study, only 67.7% participants correctly agreed that antimicrobial resistant infections are more difficult and expensive to treat.

Although AMR develops naturally with time due to genetic changes in microorganisms but its occurrence and spread increases due to misuse. In our study, 53.6% participants correctly agreed that resistant organisms can spread from person to person, however 32% incorrectly disagreed/not sure about fact that the risk of spread, severity of illness and death, increases due to AMR. Inappropriate self-medication including use of "over-the-counter medicines" (OTC) or leftover antimicrobials, and incomplete treatment is an important people's challenge to be addressed, for combatting AMR.[3] Consequently therapeutic choices become limited by rising AMR and making a shift from oral to intravenous treatments, including greater dependence on last choice antibiotics. In a household survey done at national level in Thailand, 57.8% agreed it was not good to use left-over antibiotics, and this resembles our study findings. Sharing of antibiotics with friends or relatives for familiar symptoms is incorrectly agreed/not sure by more than half of participants in our study.[16] India does not have any specific regulations for permitting OTC medicines, and self-medication prevalence in India is 52%, due to lack of time, to save money by avoiding fees for consulting doctors, and internet dependence.[17] In our study 42.7% participants incorrectly agreed that "to save time" purchase of antibiotics can be from pharmacy.

Among outpatient clinic attendees in tertiary hospital in Kolkata, age was not significantly associated with awareness and this markedly differs due to community-based setting in our study where awareness is highest among 18-30 years age.[18] Males had better antibiotic and antimicrobial resistance awareness than females in studies from and Kolkata and Northeast Ethiopia, contrary to our study where gender was not associated significantly with awareness on AMR.[18,19] Though in study from Northwest Ethiopia, occupation was significantly associated with AMR and, farmers and housewives have poorer knowledge.[20]

Similarly, our study also reveals that poor awareness is significantly higher among homemakers, and also among retired elderly people. This is particularly concerning given that AMR-related deaths are projected to reach 1.9 million annually by 2050, with the highest mortality expected among children and those over 70, particularly in low- and middle-income countries.[4] Most of our study participants (60%) correctly agreed that threat of antimicrobial resistance has increased worldwide due to overuse of antimicrobial medicines in farm animals and agriculture. And nearly three fourth farmers lack knowledge that antibiotics used in farming can lead to drug-resistant microbes.[21] To achieve a successful 'One Health' approach, farmers should be made aware of fact that antibiotics are derived from soil, which is the reservoir of microorganisms with antibiotic resistance genes and, contaminated water with faecal microorganisms and organic fertilisers used on food crops may disseminate drug-resistant bacteria in the soil.

Evidence suggests that both large-scale and grassroots public health campaigns effectively improve AMR knowledge.[22] Key strategies for future interventions should include point of care education, diverse stakeholder active engagement including AMR survivors in policy-making and research, and media utilization especially television- the most frequent source of health information.[23-25]

Leveraging social influencers and champions can add credibility to the brief and important campaign messages, if strategies remain independent of commercial conflicting interests.[26] Interventions aimed at schoolchildren and parents have shown significant success.[27] Video-based interventions, particularly those utilized in Africa, and global initiatives like world AMR awareness week (November 18-24), provide important platforms for sustained public education.[28]

Strength and limitations

Community-based setting and appropriate sample size are strength of our study. But limitation is that assessment is based on awareness only and actual practices were not assessed, and therefore a large gap which usually exists between knowledge and practices, was not assessed. Also, assessment could be biased if respondents give agree responses to correct questions if asked in leading manner, as general public lacks exact distinction between antibiotics and other medicines.

CONCLUSION

Findings highlight the need for raising awareness among people that antibiotics should be used only when prescribed by a registered medical practitioner, always adhering to entire course prescribed, never using and sharing antibiotics which are unused with others. Preventing initial infection and spread of resistant organisms by good hand-washing practices, taking precautions when closely contacting sick people, good food hygiene, and vaccination. Focusing homemakers and elderly is strategic and sale of nonprescribed antimicrobials should be regulated to prevent self-medication.

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REFERENCES

1. WHO. Global action plan on AMR, 2015. 2015. Available at: https://iris.who.int/handle/10665/193736. Accessed on 07 January 2026.
2. WHO. Global antibiotic resistance surveillance report 2025: WHO Global Antimicrobial Resistance and Use Surveillance System (GLASS). Geneva.

2025. Available at: https://www.who.int/publications/i/item/9789240116337. Accessed on 07 January 2026.
3. WHO. People-centred approach to addressing antimicrobial resistance in human health: WHO core package of interventions to support national action plans. Geneva. 2023. Available at: https://www.who.int/publications/i/item/9789240073180. Accessed on 07 January 2026.
4. Murray CJL, Ikuta KS, Sharara F, Swetschinski L, Aguilar GR, Gray A, et al. Global burden of bacterial antimicrobial resistance 1990-2021: a systematic analysis with forecasts to 2050. Lancet. 2024;404:1199-226.
5. WHO. WHO AWaRe (Access, Watch, Reserve) antibiotic book. Geneva. 2022. Available at: https://www.who.int/publications/i/item/9789240062382. Accessed on 07 January 2026.
6. MOHFW Government of India. National action plan on AMR. 2017. Available at: https://ncdc.mohfw.gov.in/national-action-plan-on-amr-nap-amr. Accessed on 07 January 2026.
7. Indian Council of Medical Research. Antimicrobial Resistance Research and Surveillance Network Annual Report January 2024-December 2024. Division of Descriptive Research Indian Council of Medical Research, New Delhi. 2025. Available at: https://main.icmr.nic.in/. Accessed on 07 January 2026.
8. WHO. Antibiotic resistance: multi-country public awareness survey. 2015. Available at: http://www.who.int/drugresistance/en. Accessed on 07 January 2026.
9. Walia K, Chaudhuri S, Sinha R, Ghosh S, Chowdhury A, Manna S, et al. Public Awareness on Antimicrobial Resistance: Results of a Community-Based Survey and Implications for Policy. New Delhi, Observer Research Foundation. 2022.
10. Fuller W, Kapona O, Aboderin AO, Adeyemo AT, Olatunbosun OI, Gahimbare L, et al. Education and Awareness on Antimicrobial Resistance in the WHO African Region: A Systematic Review. Antibiotics. 2023.
11. Khelgi A, Huchchannavar R, Mathew MM, Anandam S. Knowledge, attitude and practice regarding antibiotic use and antimicrobial resistance among the rural public in Mangaluru, India. J Prev Epidemiol. 2022;7(2):e26162.
12. Press Information Bureau, HFW India. Steps taken by the govt to increase surveillance and awareness of AMR. 2025. Available at: https://www.pib.gov.in/PressReleasePage.aspx?PRID=2116222. Accessed on 07 January 2026.
13. Bhardwaj K, Shenoy S, Baliga S, Unnikrishnan B, Baliga SK. Knowledge, attitude, and practices related to antibiotic use and resistance among the general public of coastal south Karnataka, India-A cross-sectional survey. Clin Epidemiol Glob Health. 2021;11:100717.
14. Bhat MJ, Al-Qahtani M, Badawi AS, Asiri GB, Alhmare AM, Rashid A, et al. Awareness and Knowledge of Antibiotic Resistance and Risks of Self-Medication with Antibiotics Among the Aseer Region Population, Saudi Arabia. Cureus. 2023;15(6):e40762.
15. Miyano S, Htoon TT, Nozaki I, Pe EH, Tin HH. Public knowledge, practices, and awareness of antibiotics and antibiotic resistance in Myanmar: The first national mobile phone panel survey. PLoS ONE. 2022;17(8):e0273380.
16. Tangcharoensathien V, Chanvatik S, Kosiyaporn H, Kirivan S, Kaewkhankhaeng W, Thunyahan A, et al. Population knowledge and awareness of antibiotic use and antimicrobial resistance: results from national household survey 2019 and changes from 2017. BMC Public Health. 2021;21(1):2188.
17. Saxena D, Gwalani R, Yadav A, Shah R. Growing concerns on antimicrobial resistance- Past, present, and future trends. Indian J Community Med. 2025;50:4-8.
18. Datta M, Mukherjee P, Ghosh S. Awareness and Knowledge of Antibiotics and Antimicrobial Resistance among Beneficiaries Attending the General Outpatient Clinic of a Tertiary-level Hospital in India. J Compr Health. 2024;12:44-9.
19. Simegn W, Moges G. Awareness and knowledge of antimicrobial resistance and factors associated with knowledge among adults in Dessie City, Northeast Ethiopia: Community-based cross-sectional study. PLoS ONE. 2022;17(12):e0279342.
20. Geta K, Kibret M. Knowledge, Attitudes and Practices of Patients on Antibiotic Resistance and Use in Public Hospitals of Amhara Regional State, Northwestern Ethiopia: A Cross-Sectional Study. Infect Drug Resist. 2022;15:193-209.
21. Aniyozova D, Akilov H, Kasimova M, Favaretti C, Sadyrova M, Egamberdieva Z, et al. Antimicrobial resistance related knowledge, attitude and practice of general practitioners, patients and farmers: A cross-sectional study in Uzbekistan. Heliyon. 2024;10:e37566.
22. Gilham EL, Pearce-Smith N, Carter V, Ashiru-Oredope D. Assessment of global antimicrobial resistance campaigns conducted to improve public awareness and antimicrobial use behaviours: a rapid systematic review. BMC Public Health. 2024;24:396.
23. Otieku E, Fenny AP, Labi A-K, Owusu-Ofori AK, Kurtzhals J, Enemark U. Knowledge, attitudes and practices regarding antimicrobial use and resistance among healthcare seekers in two tertiary hospitals in Ghana: a quasi-experimental study. BMJ Open. 2023;13:e065233.
24. Scott-Dearing E, Carter V, Corley M, Mathew P, Darzi A. Patient and public involvement and engagement to improve impact on antimicrobial resistance. Nat Commun. 2025;16:1022.
25. Ulaya G, Nguyen TCT, Vu BNT, Dang DA, Nguyen HAT, Tran HH, et al. Awareness of Antibiotics and

Antibiotic Resistance in a Rural District of HaNam Province, Vietnam: A Cross-Sectional Survey. Antibiotics. 2022;11(12):1751.
26. Mathew P, Sivaraman S, Chandy S. Communication strategies for improving public awareness on appropriate antibiotic use: Bridging a vital gap for action on antibiotic resistance. J Family Med Prim Care. 2019;8(6):1867-71.
27. Price L, Gozdzielewska L, Young M, Smith F, McNulty CA. Effectiveness of interventions to improve the public's antimicrobial resistance awareness and behaviours associated with prudent use of antimicrobials: a systematic review. J Antimicrob Chemother. 2018;7396:1464-78.
28. Nkaiwuatei J, Hamza H, Akbi S, Muzondo N. Enhancing the general public knowledge of antimicrobial resistance (AMR) in Africa: a video-based brief educational resource review. JAC Antimicrob Resist. 2025;7(1):dlaf005.

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