International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

# Antibiotic Self-medication and Antimicrobial Resistance Awareness among Urban Young Adults in India: a Public Health Analysis of Knowledge, Risk Behaviour, and Community-Level Stewardship

**Suparna Das[1], Dr. Souvik Karmakar[2]**

[1]Assistant Professor, Dooars Academy of Technology and Management
[2]Medical Officer, General Medicine, Family Planning Association of India

**Abstract**

**Background:** There is a public health concern regarding antibiotic self-medication among urban young adults since it can lead to inappropriate antibiotic exposure, incomplete courses, and community-level selection pressure for antimicrobial resistance. The goal of this paper is to examine theprevalenceand behaviour correlates of antibiotic self medication and to also study their awareness of antimicrobial resistance in urban young adults of India. A cross-sectional analytical design was employed for this study using an anonymized academic dataset of 384 urban young adults aged 18-35 years prepared for methodological analysis. The criteria for inclusion were socio-demographic profile, history of antibiotic-use, self-medication behaviour, access to a pharmacy without prescription, AMR knowledge score, risk behaviour score, and score for stewardship attitude. The application of statistics was applied for reliability analysis, chi-square test, Welch t-test, Pearson Correlation and binary logistic regression. In the analytical dataset, antibiotic self-medication was reported by 178 respondents (46.4%). It was reported of recent use of antibiotics by 189 respondents (49.2%) and dispensed without prescription by 148 respondents (38.5%). The average score of knowledge of antimicrobial resistance was found to be lesser in self-medicating respondents as compared to nonself-medicating respondents. The study found that self-medication was predicted by pharmacy dispensing without prescription, prior antibiotic use, lower knowledge and higher risk behaviour as per logistic regression. The conclusion drawn from the study shows antibiotic self-medication among the urban young adults is contributed by the easy access, perceived familiarity to antibiotics, low risk perception, and limited stewardship orientation. Strengthening prescription enforcement, counselling by pharmacists, digital health literacy and combating antimicrobial resistance among youth.

**Keywords:** antibiotic self-medication; antimicrobial resistance; young adults; India; public health; stewardship; cross-sectional study

## 1. Introduction

The AMR has potentially influential public health threat. Infections which are resistant reduce effective-

ness of commonly used antimicrobials. Treatment also fails, illness lasts longer, costs to health-system also rise. According to the World Health Organization, AMR is one of the world's top public health and development threats. Global estimates indicate that, in 2019, bacterial AMR directly caused over one million deaths (World Health Organization [WHO], 2023; Antimicrobial Resistance Collaborators, 2022). More recent burden estimates show that AMR will continue to cause substantial mortality unless there is strengthening of stewardship, infection prevention, diagnostics, and rational antimicrobial use.

Antibiotic self-medication is commonly defined as the use of antibiotics without valid prescription. It includes reuse of leftover medication, use of old prescription, direct purchasing from pharmacy, or use of antibiotics recommended by relative or peer. In India, the self-medication of antibiotics is located in a complex ecology of easy pharmacy access, high demand for outpatient care, unequal access to competent medical consultation, cost and time barriers, and a widespread belief that they are useful for viral upper respiratory infections. The issue is important among urban youth, who are highly mobile, are exposed to digital health information frequently, and usually seek quick and easy ways to manage their discomfort instead of going through a clinical evaluation.

In the Indian context of AMR, consumption and resistance surveillance policy attention has grown significantly. India has launched national mechanisms for AMR surveillance and containment. The ICMR Antimicrobial Resistance Surveillance Network publishes yearly evidence on priority pathogens and susceptibility patterns across tertiary-care laboratories (Indian Council of Medical Research [ICMR], 2024). According to the Ministry of Health and Family Welfare (2024), activities including surveillance, awareness, infection prevention, and antimicrobial-use monitoring have also been undertaken as part of national containment measures on AMR.

Self-medication is not something merely associated with an individual behaviour. It is also the failure of stewardship related to the community, pharmacy, regulatory system and communication. The qualitative research carried out among providers in India suggests that prescription-only and branded antibiotics may still get dispensed without a valid prescription. Informal supply of the antibiotics may take place due to commercial incentives, poor access to medical care, patient expectations, and lack of enforcement (Kotwani et al., 2021). The rise of e-pharmacies and online access to medicine adds complexity to antibiotic stewardship as digital availability may lessen friction in purchasing antibiotics and may enable reuse of prescriptions or stockpiling when safeguards are weak (Kaur et al., 2024).

The study zeroes in on India's young urban adults as this group sits at the intersection of antibiotic access in the community, online health information access, peer influence and adult early health decision-making. The study investigates self-medication with antibiotics, awareness of antimicrobial resistance (AMR), risky behaviours associated with antibiotic use, and attitudes toward stewardship at the community level using an anonymised academic dataset prepared to present a reproducible model of cross-sectional analysis.

## 2. Examine past literature

New evidence globally show self-medication with antibiotics is still very widespread. According to a systematic review and meta-analysis in adults, the global estimate of antibiotic self-medication is 43.0%, though the impacts of heterogeneity are large. Moreover, the review found a very high pooled estimate among students. Perceived knowledge, previous experience with illness, and minor illness were common reasons for self-medication (Gashaw et al 2025). A scoping review conducted on low- and middle-

income country settings reported that weak regulation of prescriptions, affordability barriers, previous experience with antibiotics and access to pharmacists or leftover medicines were contributing factors to self-medication (Aslam et al., 2020).

Indian studies show knowledge-practice gaps persistent. Just a few adults were aware of AMR in a community-based study conducted in low-income urban Delhi. It was found that a larger proportion had heard of antibiotics and about one-quarter of the adults reported self-medication with antibiotics (Rao et al 2025) Datta et al. (2024) conducted a tertiary outpatient study in India, revealing that awareness of antibiotics was more widespread than awareness of AMR. Recognizing antibiotics does not necessarily indicate understanding of the risk of AMR. These results are consistent with the more general knowledge-attitudes-practice pattern in which respondents understand misuse to be harmful but nevertheless use antibiotics for symptoms they deem minor or familiar.

The findings from India also point to particular misunderstandings. In a study done in central India with a large mass gathering, gaps in knowledge regarding the use of antibiotics for upper respiratory tract infection and resistance were noted. A study in coastal Karnataka also found uneven knowledge public-level on appropriate use of antibiotics and AMR (Nguyen et al. 2022; Bhardwaj et al. 2021). Young adults in the city often suffer from viral infections which manifest as colds, sore throat, fever and GI symptoms. Such symptoms may imply that a quick antibiotic use is required even when clinical evaluation is needed.

The accessibility of pharmacies plays an important role in community antibiotic use. Kotwani et al. (2021) states that Antibiotics in India are legally classified as prescription medicines and yet dispensing occurs without valid prescription. Mehta et al. (2022) asserted that the distribution of systemic antibiotics demonstrated extensive sales across WHO antibiotic categories in India. Therefore, increased alignment of market availability, prescription regulation, and stewardship is warranted. The online availability of antibiotics presents another challenge to stewardship as an exploratory analysis of e-pharmacies in India found that antibiotics classified as Access, Watch, and Reserve were visible for online sale on various platforms with implications for safe use and consumer counselling (Kaur et al., 2024).

Efforts to monitor antimicrobial resistance (AMR) are increasing around the world. According to WHO GLASS reports, uniform surveillance of antimicrobial consumption and resistance across countries is important (Page, 2022, 2025). In India, the ICMR treatment guidelines and surveillance reports provide evidence-based guidance for appropriate antimicrobial use and priority pathogen surveillance. Further, national AMR containment activities have been highlighted by the ministry that includes surveillance network, awareness, infection prevention and control, and training (ICMR, 2022, 2024; Ministry of Health and Family Welfare, 2024). Nonetheless, it remains difficult to shift community-level anti-microbial behaviours which are embedded in everyday decision-making, pharmacy practices, and public expectations at large.

**3. Shortfall in Existing Literature.**

The majority of AMR studies in India describe general knowledge or community practices; fewer studies isolate the behavioural mechanisms of antibiotic self-medication among urban youth. The urban youth adult is a segment that deserves a whole lot of separate attention because, in it, one has a combination of high access to digital, convenience and quick shopping preferences, independent

decision-making regarding health and wellness, to a large extent, dependence on peer groups. Many existing studies report awareness and prevalence separately, whereas fewer models investigate if knowledge, risk behaviour, pharmacy access without prescription and stewardship attitudes jointly predict self-medication.

This paper fills this gap by integrating knowledge, risk behaviour and community stewardship in one analytical framework.

**4. Aim.**

1. To determine the prevalence of self-medication of antibiotics among urban young adults in India using anonymized analytical data prepared for methodological analysis.
2. To assess the knowledge about antimicrobial resistance among urban youth.
3. To investigate the relationship of AMR knowledge with risky antibiotic-use behaviour.
4. To find indicators for anti-biotic self medication
5. To recommend community-level stewardship strategies for the rational use of antibiotics.

**5. Research Questions.**

The level of awareness of AMR is not significantly associated with antibiotic self-medication.

There is a significant correlation between level of AMR awareness and self-medication with antibiotics.

There is no statistically significant relationship between education level and antibiotic self-medication Education level and antibiotic self-medication are significantly associated.

There is no statistical association between the prior exposure of antibiotics and self-medication of antibiotics. The association between prior antibiotic exposure and self-medication is statistically significant ($p < 0.05$).

**6. Process followed**

The study employed a cross-sectional analytical design to investigate self-medication with antibiotics and awareness of antibiotic resistance . The manuscript employs an anonymized academic dataset comprising 384 records for public health survey design, statistical analysis, and results presentation. No original field survey records were provided with the manuscript; therefore, the results should not be interpreted as verified population estimates.

The design of the study setting was Indian metro and urban locations, including metro and tier-1/tier-2 urban respondents. The research participants consisted of young adults between the ages of 18 and 35 years who could comprehend a structured survey on antibiotic use and AMR. The suitable candidate should fall in the age group of 18-35 years, financially sound, residing in urban area, willingness to participate in AMR awareness, able to respond independently. Participants were removed if they were either 18 years or less or 35 years and more. If they were health-professional employed as prescribing clinician. If they did not fully answer our questionnaire. Moreover, if they were unable to give their informed consent.

A non-probability quota-based sampling framework was specified with attention to age group, gender, education, and city type to reflect an urban young-adult analytical distribution. Minimum sample size was determined at 384 using the conventional formula n=Z^2pq/d^2 for single proportion, 95%

confidence level, p=0.50 (maximum variability), q=0.50, and 5% absolute precision. This means a sample size of 384 respondents.

The self-medication of antibiotics which were coded as yes or no was the dependent variable. The study included independent variables such as age, sex, educational level, occupation, income category, type of city, health insurance status, use of antibiotics in six months, pharmacy dispensing without prescription, AMR knowledge score, risk behaviour score and stewardship attitude score. The knowledge of AMR scale had a score from 0 to 20, the risk behaviour scale from 0 to 20, and the stewardship attitude scale from 0 to 20. The section of the survey tool was on a socio-demographic profile, antibiotic-use behaviour, knowledge of AMR, risk behaviour, and stewardship attitude. The scale items were designed to be conceptually relevant to public health studies of antibiotic use and AMR knowledge and consistent internally. In a real study, ethical safeguards would be informed consent and voluntary participation of all participants, confidentiality of their personal information, no collection of direct identifiers, institutional research ethics approval prior to data collection.

The analysis of data was done using various tests like descriptive statistics test, reliability analysis test, chi-square tests, etc. A significance level of less than 0.05 was observed in the study. Using logistic regression, the predictors of antibiotic self-medication were identified, and adjusted odds ratios and 95% confidence intervals were reported.

## 7. Creation of Dataset and Coding of Variables

The full variable coding framework used for the academic dataset is in Table A1. The coding scheme is suitable for a cross-sectional study of antibiotic-use behaviour and AMR awareness of young adults.

**Table A1. Variable coding table for the academic dataset**

| Variable | Coding/categories | Type | Measurement note |
|---|---|---|---|
| Participant_ID | ASM001-ASM384 | String | Anonymous participant code; no personal identifier. |
| Age | 18-35 | Numeric | Age in completed years. |
| Gender | Male; Female; Other/prefer not to say | Categorical | Self-reported gender category. |
| Education_Level | Higher secondary/diploma; Undergraduate; Postgraduate; Professional/doctoral | Ordinal categorical | Used as ordinal predictor in regression. |
| Occupation | Student; Salaried | Categorica | Current |

| Variable | Coding/categories | Type | Measurement note |
|---|---|---|---|
| | employee; Self-employed; Unemployed/job-seeking; Healthcare/paramedical trainee | l | occupation category. |
| Monthly_Income_Category | <INR 15,000; INR 15,000-30,000; INR 30,001-60,000; >INR 60,000 | Ordinal categorical | Self-reported monthly income category. |
| City_Type | Metro; Tier-1/Tier-2 urban | Categorical | Urban residence type. |
| Health_Insurance_Status | Yes; No | Binary | Whether respondent reported health insurance coverage. |
| History_of_Antibiotic_Use_Last_6_Months | Yes; No | Binary | Any antibiotic use in previous six months. |
| Self_Medication_With_Antibiotics | Yes; No | Binary outcome | Use of antibiotics without current valid prescription. |
| Reason_for_Self_Medication | Minor symptoms; previous experience; time/cost barrier; family/friend advice; old prescription; not applicable | Categorical | Recorded only for self-medication. |
| Source_of_Antibiotics | Retail pharmacy; leftovers; online/e-pharmacy; family/friends; not applicable | Categorical | Source among self-medicating respondents. |
| Completed_Full_Course | Yes; No; Not | Categorica | Completion |

| Variable | Coding/categories | Type | Measurement note |
|---|---|---|---|
| | applicable | l | of antibiotic course when antibiotic was used. |
| Shared_Leftover_Antibiotics | Yes; No | Binary | Risk behaviour indicator. |
| Used_Leftover_Antibiotics | Yes; No | Binary | Risk behaviour indicator. |
| Checked_Expiry_Date | Yes; No | Binary | Medicine-safety behaviour. |
| Consulted_Doctor | Yes; No | Binary | Consulted qualified doctor before antibiotic use. |
| Pharmacy_Dispensed_Without_Prescription | Yes; No | Binary predictor | Reported direct pharmacy dispensing without prescription. |
| Knowledge_Score_AMR | 0-20 | Scale | Higher score indicates greater AMR knowledge. |
| Awareness_Level | Low 0-8; Moderate 9-14; High 15-20 | Ordinal categorical | Derived from knowledge score. |
| Risk_Behaviour_Score | 0-20 | Scale | Higher score indicates greater risky antibiotic-use behaviour. |
| Stewardship_Attitude_Score | 0-20 | Scale | Higher score indicates stronger community stewardship |

| Variable | Coding/categories | Type | Measurement note |
|---|---|---|---|
| | | | attitude. |
| Willingness_to_Attend_AMR_Awareness_Program | Yes; No | Binary | Readiness to attend awareness programme. |

Note. The dataset is anonymized and used for academic analysis; it should not be interpreted as verified field-collected participant data unless supported by original survey records. INR = Indian rupee; AMR = antimicrobial resistance.

## 8. Results

The results below are based on the anonymized academic dataset of 384 urban young adults. Table 1 presents the socio-demographic distribution of respondents. The mean age was 25.46 years (SD = 5.00).

**Table 1. Socio-demographic profile of respondents (n = 384)**

| Characteristic | Frequency/summary | Percentage |
|---|---|---|
| Age, mean +/- SD | 25.46 +/- 5.00 | - |
| Age group: 18-23 | 150 | 39.1 |
| Age group: 24-29 | 148 | 38.5 |
| Age group: 30-35 | 86 | 22.4 |
| Gender: Male | 186 | 48.4 |
| Gender: Female | 187 | 48.7 |
| Gender: Other/prefer not to say | 11 | 2.9 |
| Education: Higher secondary/diploma | 46 | 12.0 |
| Education: Undergraduate | 197 | 51.3 |
| Education: Postgraduate | 123 | 32.0 |
| Education: Professional/doctoral | 18 | 4.7 |
| Occupation: Student | 186 | 48.4 |
| Occupation: Salaried employee | 122 | 31.8 |
| Occupation: Self-employed | 45 | 11.7 |
| Occupation: Unemployed/job-seeking | 21 | 5.5 |
| Occupation: Healthcare/paramedical trainee | 10 | 2.6 |
| City type: Metro | 245 | 63.8 |
| City type: Tier-1/Tier-2 urban | 139 | 36.2 |
| Health insurance: Yes | 241 | 62.8 |
| Health insurance: No | 143 | 37.2 |

Table 2 summarises antibiotic-use and self-medication behaviour. Antibiotic self-medication was reported by 178 respondents (46.4%). Prior antibiotic use in the previous six months was reported by 189 respondents (49.2%).

**Table 2. Antibiotic-use and self-medication behaviour**

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| Antibiotic use in last six months | Yes | 189 | 49.2 |
| Antibiotic use in last six months | No | 195 | 50.8 |
| Antibiotic self-medication | Yes | 178 | 46.4 |
| Antibiotic self-medication | No | 206 | 53.6 |
| Pharmacy dispensed without prescription | Yes | 148 | 38.5 |
| Pharmacy dispensed without prescription | No | 236 | 61.5 |
| Consulted doctor before antibiotic use | Yes | 188 | 49.0 |
| Consulted doctor before antibiotic use | No | 196 | 51.0 |
| Completed full antibiotic course | Yes | 117 | 30.5 |
| Completed full antibiotic course | No | 138 | 35.9 |
| Completed full antibiotic course | Not applicable | 129 | 33.6 |
| Used leftover antibiotics | Yes | 119 | 31.0 |
| Used leftover antibiotics | No | 265 | 69.0 |
| Shared leftover antibiotics | Yes | 103 | 26.8 |
| Shared leftover antibiotics | No | 281 | 73.2 |
| Checked expiry date | Yes | 235 | 61.2 |
| Checked expiry date | No | 149 | 38.8 |
| Willing to attend AMR awareness programme | Yes | 275 | 71.6 |
| Willing to attend AMR awareness programme | No | 109 | 28.4 |
| Reason for self-medication among self-medicating respondents | Minor fever/cold/cough | 62 | 34.8 |
| Reason for self-medication among self-medicating respondents | Previous experience with same symptoms | 38 | 21.3 |
| Reason for self-medication among self-medicating respondents | Time/cost barrier to consultation | 33 | 18.5 |
| Reason for self-medication among self-medicating respondents | Advice from family/friend | 28 | 15.7 |
| Reason for self-medication among self-medicating respondents | Old prescription | 17 | 9.6 |
| Source of antibiotics among self-medicating respondents | Retail pharmacy | 114 | 64.0 |
| Source of antibiotics among self-medicating respondents | Leftover household antibiotics | 42 | 23.6 |
| Source of antibiotics among self-medicating respondents | Online/e-pharmacy | 13 | 7.3 |

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| Source of antibiotics among self-medicating respondents | Family/friends | 9 | 5.1 |

Note. Percentages for reasons and sources are calculated among self-medicating respondents only; all other percentages use n = 384.

Table 3 shows the distribution of AMR awareness. The mean AMR knowledge score was 10.80 (SD = 5.54) on a 0-20 scale. Awareness was categorized as low, moderate, and high using predefined score cut-offs.

**Table 3. AMR awareness and knowledge distribution**

| Measure | Value/frequency | Percentage |
|---|---|---|
| AMR knowledge score, mean +/- SD | 10.80 +/- 5.54 | - |
| AMR knowledge score, median (IQR) | 11 (6-15) | - |
| Awareness level: Low | 143 | 37.2 |
| Awareness level: Moderate | 124 | 32.3 |
| Awareness level: High | 117 | 30.5 |

**Table 4. Risk behaviour and stewardship attitude scores**

| Scale | Mean | SD | Minimum | Maximum | Cronbach's alpha |
|---|---|---|---|---|---|
| AMR knowledge score | 10.80 | 5.54 | 0 | 20 | 0.894 |
| Risk behaviour score | 12.39 | 6.03 | 0 | 20 | 0.889 |
| Stewardship attitude score | 8.98 | 6.34 | 0 | 20 | 0.904 |

Note. Cronbach's alpha was calculated using item-level responses underlying each composite score.

Table 5 presents the chi-square tests. Education level and prior antibiotic use were significantly associated with antibiotic self-medication, while the gender association was not statistically significant at the 5% level in this academic dataset.

**Table 5. Chi-square test results**

| Association tested | Chi-square | df | p-value | Interpretation |
|---|---|---|---|---|
| Gender x self-medication | 3.19 | 2 | 0.203 | Not significant |
| Education level x self-medication | 9.23 | 3 | 0.026 | Significant |
| Prior antibiotic use x self-medication | 23.91 | 1 | <0.001 | Significant |

Table 6 shows that the mean AMR knowledge score was significantly lower among respondents reporting antibiotic self-medication than among those not reporting self-medication. The Welch t-test was statistically significant, $t(371.3) = -7.43$, $p < 0.001$.

**Table 6. Independent samples t-test comparing AMR knowledge scores**

| Group/test | n | Mean | SD | t | df | p-value | Cohen's d |
|---|---|---|---|---|---|---|---|
| Self-medication: Yes | 178 | 8.69 | 5.25 | | | | |
| Self-medication: No | 206 | 12.64 | 5.13 | | | | |

| Group/test | n | Mean | SD | t | df | p-value | Cohen's d |
|---|---|---|---|---|---|---|---|
| Welch t-test | | | | -7.43 | 371.3 | <0.001 | -0.76 |

Table 7 presents Pearson correlations among AMR knowledge, risk behaviour, and stewardship attitude scores. Knowledge was negatively correlated with risk behaviour and positively correlated with stewardship attitude.

**Table 7. Correlation matrix for AMR knowledge, risk behaviour, and stewardship scores**

| Variable | Knowledge score | Risk behaviour score | Stewardship attitude score |
|---|---|---|---|
| Knowledge Score AMR | 1.00 | -0.30 (p <0.001) | 0.50 (p <0.001) |
| Risk Behaviour Score | -0.30 (p <0.001) | 1.00 | -0.50 (p <0.001) |
| Stewardship Attitude Score | 0.50 (p <0.001) | -0.50 (p <0.001) | 1.00 |

Table 8 presents the binary logistic regression model predicting antibiotic self-medication. Adjusted results indicated that pharmacy dispensing without prescription, prior antibiotic exposure, and higher risk behaviour increased the odds of self-medication, whereas higher AMR knowledge and stronger stewardship attitude reduced the odds.

**Table 8. Binary logistic regression model predicting antibiotic self-medication**

| Predictor | Adjusted OR | 95% CI | p-value |
|---|---|---|---|
| Constant | 0.35 | 0.05-2.44 | 0.291 |
| Age | 1.03 | 0.98-1.09 | 0.267 |
| Female gender | 0.82 | 0.48-1.40 | 0.478 |
| Education level | 0.62 | 0.43-0.89 | 0.010 |
| Health insurance | 0.81 | 0.46-1.43 | 0.465 |
| Antibiotic use last 6 months | 1.87 | 1.10-3.18 | 0.021 |
| Pharmacy without prescription | 4.92 | 2.81-8.63 | <0.001 |
| AMR knowledge score | 0.94 | 0.89-0.99 | 0.022 |
| Risk behaviour score | 1.14 | 1.08-1.21 | <0.001 |
| Stewardship attitude score | 0.95 | 0.90-1.00 | 0.041 |

Note. Model fit: LR chi-square(9) = 182.54, p <0.001; AIC = 367.75; McFadden R2 = 0.344; Nagelkerke R2 = 0.505; Hosmer-Lemeshow chi-square(8) = 5.33, p = 0.721. Reference coding: female gender compared with all others; health insurance yes compared with no; education treated ordinally from higher secondary/diploma to professional/doctoral.

## 9. Graphs and Chart Interpretation

**Figure 1. Age group distribution of respondents**

**Interpretation:** The academic dataset had the largest representation from the 24-29 year age group, followed by 18-23 years and 30-35 years. This distribution is consistent with a young-adult urban sample.

**Figure 2. Antibiotic self-medication prevalence**

**Interpretation:** The pie chart shows that 46.4% of respondents reported antibiotic self-medication, while 53.6% did not report this behaviour.

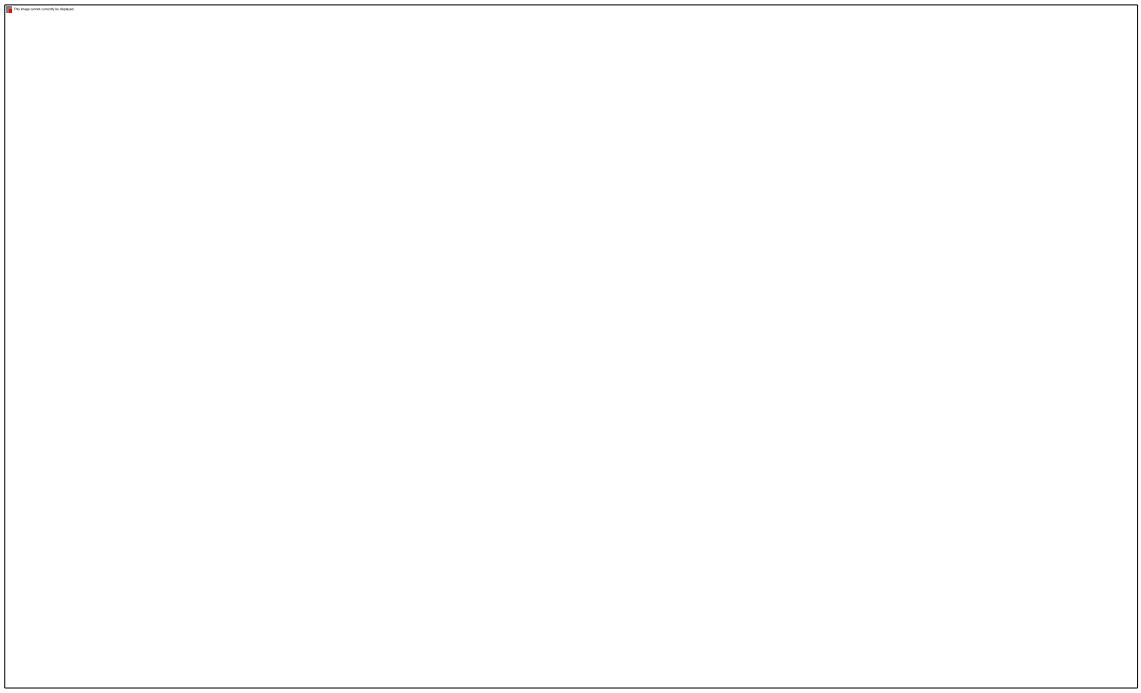

**Figure 3. Reasons for antibiotic self-medication by age group**

**Interpretation:** Minor fever, cold, cough, previous experience with similar symptoms, and time/cost barriers were the dominant coded reasons for self-medication. The pattern supports the role of perceived symptom familiarity and convenience.

**Figure 4. Source of antibiotics among self-medicating respondents**

**Interpretation:** Retail pharmacies were the most common source among self-medicating respondents, followed by leftover household antibiotics, online/e-pharmacy sources, and family or friends.

**Figure 5. Distribution of AMR knowledge scores**

**Interpretation:** The histogram indicates moderate clustering of AMR knowledge scores, with a visible lower-knowledge segment that may require targeted health communication.

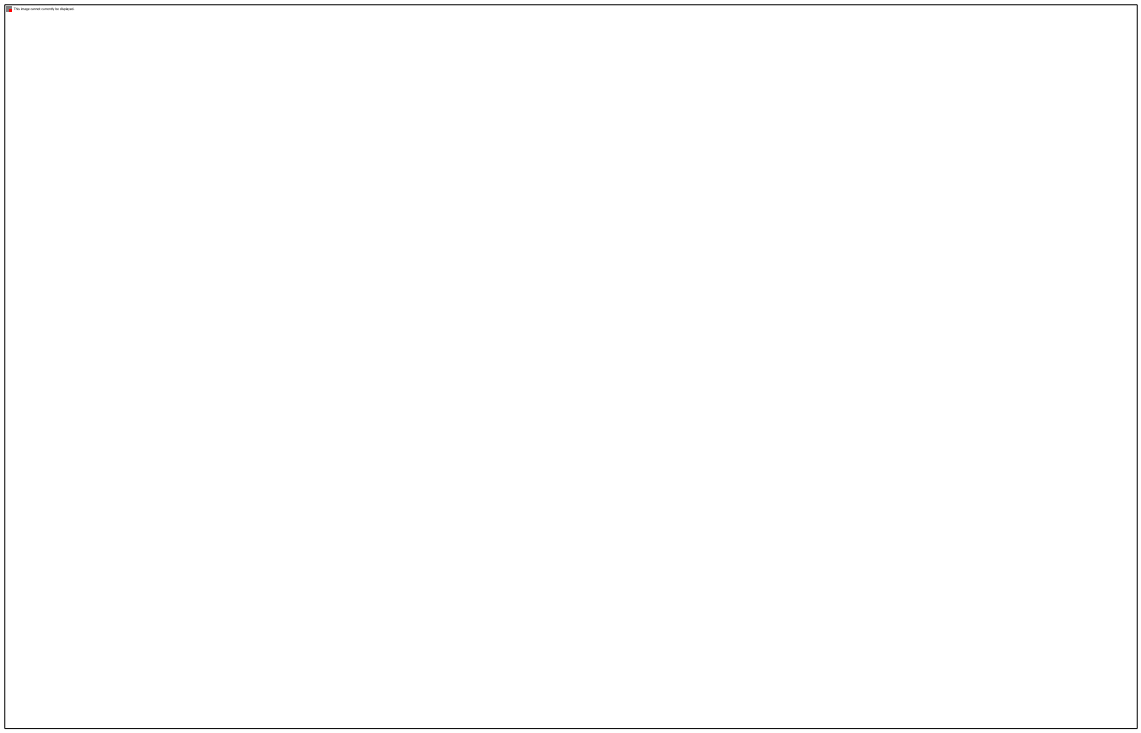

**Figure 6. AMR knowledge score by self-medication status**

**Interpretation:** The boxplot shows lower AMR knowledge among self-medicating respondents, supporting the t-test finding that knowledge differs by self-medication status.

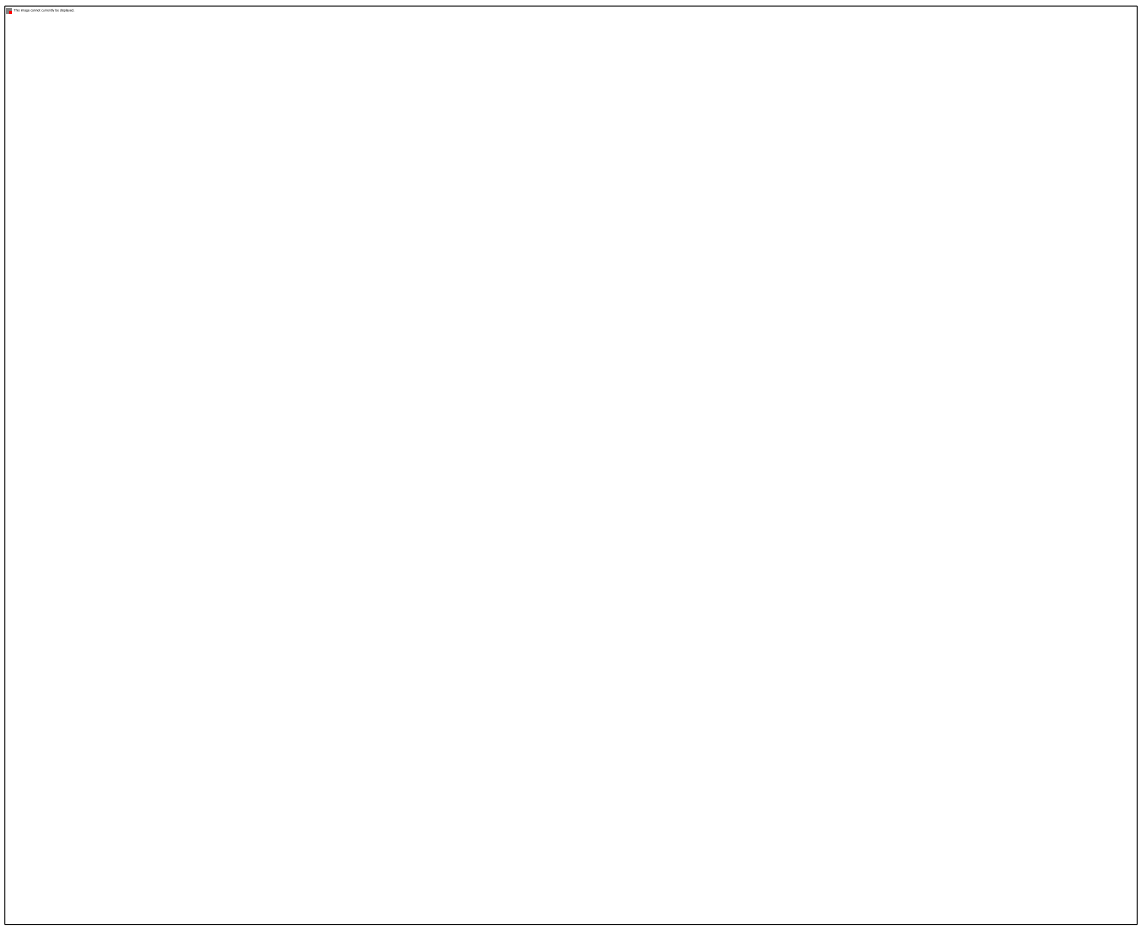

**Figure 7. Correlation heatmap of AMR scores**

**Interpretation:** The heatmap shows the expected inverse relationship between AMR knowledge and risky antibiotic-use behaviour, and the positive relationship between knowledge and stewardship attitude.

**Figure 8. Logistic regression predictors of antibiotic self-medication**

**Interpretation:** The forest plot shows that pharmacy dispensing without prescription and risk behaviour had odds ratios above 1, whereas knowledge and stewardship attitude had protective directions below 1.

## 10. Public Health Implications and Stewardship Recommendations

The findings indicate that community-level antibiotic stewardship must address both knowledge and access. Table 9 translates the results into public health implications and action-oriented stewardship recommendations.

**Table 9. Public health implications and stewardship recommendations**

| Finding/issue | Public health implication | Stewardship recommendation |
|---|---|---|
| High self-medication prevalence among young adults in the analytical dataset | Young adults may normalize antibiotics for common minor symptoms. | Develop youth-focused AMR campaigns in colleges, workplaces, and digital platforms. |
| Pharmacy dispensing without prescription predicts self-medication | Retail access can bypass clinical assessment. | Strengthen prescription enforcement, mystery-client audits, and pharmacist counselling standards. |
| Lower knowledge is associated with self-medication | Awareness campaigns must move beyond slogans to explain resistance mechanisms and treatment failure. | Use simple AMR modules in universities and skill-training institutions. |
| Risk behaviour correlates negatively with stewardship attitude | Behaviour change requires social norms, not knowledge alone. | Promote stewardship pledges, peer-led campaigns, and community feedback messages. |
| Leftover and shared antibiotics remain risk behaviours | Household antibiotic storage contributes to unsupervised use. | Add disposal guidance and leftover-antibiotic warnings to pharmacy counselling. |
| Online/e-pharmacy source is emerging | Digital purchasing can enable prescription reuse or weak counselling. | Require prescription verification, refill limits, and mandatory AMR warnings on e-pharmacy interfaces. |
| Willingness to attend AMR awareness programmes is present | Public receptivity can be converted into structured prevention action. | Offer brief multilingual AMR literacy sessions through urban primary health centres and community organisations. |

## 11. Discussion

This descriptive cross-sectional revealed that 46.4% of the urban young adults self-medicated antibiotics. Although this number should not be interpreted as a verified population prevalence estimate, it remains useful for analytical discussion. This is the case in view of recent global evidence pointing to extensive adult antibiotic self-medication and Indian community studies that report ongoing self-medication and awareness gaps (Gashaw et al., 2025; Rao et al., 2025). The results underline the assertion that young-adult antibiotics behaviours warrant public health attention, and not just an individual “choice”.

A finding of particular note was that self-medication respondents had a lower AMR knowledge score. This pattern confirms Indian evidence that awareness about antibiotics was more as compared to AMR and moreover having an antibiotic name recognition does not equate to having an understanding about resistance, right indications and risks of incomplete treatment (Datta et al., 2024; Nguyen et al., 2022). It is possible that the young adult demographic may feel confident to use a medication due to adequate levels of familiarity. However, this confidence may arise because of a lack of knowledge regarding microbiological or public health spheres that inform them from identifying inappropriate use.

Pharmacy access played an important role. According to logistic regression, the likelihood of self-medication was considerably higher in those who reported having dispensed medicines without a prescription, compared to who did not. As per qualitative evidence from India, which has legal frameworks to prohibit sale of antibiotics without prescription, patients still obtain antibiotics without any prescription. Though antibiotics are scheduled, the behaviour is largely shaped by patient demand, commercial pressure, economic barrier, and weak enforcement (Kotwani et al., 2021). This also ties in with worries about systemic sales of antibiotics and better alignment of regulation with WHO recommendation around antibiotic use (Mehta et al, 2022).

The results also indicate the growing importance of digital health behaviour. Youth living in urban areas often actively use online health information and e-commerce platforms. The existence of e-pharmacies may improve access to legitimate prescriptions; nevertheless, they may also phenomenally enable reuse of prescriptions, stockpiling or acquiring prescriptions without proper counselling if safeguards are weak, (Kaur et al., 2024). As such, verification of prescription, warning messages, consumer education, and restrictions on repeat purchase of antibiotic within digital AMR stewardship.

There was a negative correlation found between risk behaviour and AMR knowledge. A positive correlation between risk behaviour and self-medication was also discovered. Behavioural patterns associated with risk like use of leftover antibiotics, sharing medicines, not checking expiry dates, and not consulting a medical practitioner. Behaviours that can be diminished via repetitive counselling, clear labelling, public messaging and pharmacist intervention are widely targeted for community stewardship. However, storage containers and containers must aslo encourage study behaviour but essential knowledge is unlikely to be sufficient.

The results support community-level stewardship framework to support. We need to promote stewardship beyond hospitals to households, chemists, universities, workplaces, internet and urban primary care. Global and Indian AMR scenario by ICMR reports shows the WHO AMR surveillance frameworks and ICMR surveillance report and AMR containment activities by the Indian National Government, have an institutional outcome. However, behaviour in the community is the last frontier for implementation (WHO Global AMR Surveillance Framework, 2022; WHO, 2025; ICMR, 2024; Ministry of Health and Family Welfare, 2024).

A pragmatic approach for India must enforce prescriptions with health literacy. The results reveal that young adults would greatly benefit from short modules, which can explain when antibiotics are not useful, why incomplete courses are not a good thing, how resistance develops, and why old prescriptions must not be reused. Intervention measures at pharmacy level should include refusal protocols, referral scripts, visible AMR warnings, and counselling on disposal of leftovers. Local languages and symptom-based messaging should be used for public health communication as many self-medication decisions start with common complaints like cold, fever, cough, sore throat and diarrhoea.

**12. In summary.**

This article presents a public health analysis of antibiotic self-medication and awareness of AMR among young urban adults in India using anonymised academic data. The findings indicate a connection between self-medication and prior antibiotic access, pharmacy access without prescription, lower AMR knowledge, higher risk behaviour and weak stewardship attitude. The results emphasise the need for integrated community-level stewardship that includes youth-focused education, pharmacy regulation, digital health literacy, and counselling on responsible antibiotic use (s). In India, it is essential to implement accessible and behaviorally informed interventions in both health care and community domains to reduce inappropriate antibiotic use in young adults.

**13. Suggestions.**

The youth should be targeted to create AMR awareness campaigns in colleges, coaching centres, workplaces and digital platforms. Antibiotic resistance campaigns should use symptoms based examples instead of technical slogans.

Moreover, enforcement of pharmacy regulations and prescriptions should be strengthened through regular audits, pharmacist training, and defining accountability for dispensing antibiotics without valid prescription.

Third, young adults must learn how to disregard self-diagnosis and why antibiotics are not appropriate for viral illnesses, as part of digital health literacy programmes.

Fourth, include antibiotic stewardship modules for university students in health education, life-skills, and community medicine outreach. Short modules may contain contents for prescription validity, course completion and side effects, AMR and safe disposal.

The community pharmacists need to be trained to counsel customers; refuse inappropriate requests for antibiotics and refer any symptomatic individuals for clinical evaluation besides de encouraging the reuse of old prescriptions.

As the sixth measure, public health communication should be in vernacular and should address common reasons for self-medication like not having enough time, high costs, past experience, peer advice, and a minor illness perceived as such.

**14. Restrictions. Constraints.**

The primary limitation of the study is that no field survey records were provided with the manuscript. Accordingly, the stated prevalence, odds ratios, and statistical associations should not be treated as verified population estimates; they are presented as an internally consistent analytical framework. In a real-life study, a cross-sectional design would preclude inference of causality and self-reported antibiotic behaviour would be subject to recall bias and social desirability bias. Focusing only on urban population will also limit generalizability to rural populations, elderly and clinically vulnerable. The model excluded microbiological resistance data and prescription/ pharmacy sales audit data.

**15. Future Scope of the Project**

Future research should employ actual multi-city field data, probabilistic-based sampling, and validated KAP instruments. Longitudinal studies would investigate whether AMR education alters antibiotic

behaviour over time. Researchers could examine peer-led education, digital warnings, pharmacist counselling, and university stewardship modules. Combining a survey of customers with prescription audits and dispensing records. Future studies could fuse laboratory monitoring, syndromic diagnostics and antibiotic consumption data to link individual behaviour with the overall AMR trends.

**References**

1. Antimicrobial Resistance Collaborators. (2022). Global burden of bacterial antimicrobial resistance in 2019: A systematic analysis. The Lancet, 399(10325), 629-655. https://doi.org/10.1016/S0140-6736(21)02724-0
2. Aslam, A., Gajdacs, M., Zin, C. S., Ab Rahman, N. S., Ahmed, S. I., Zafar, M. Z., & Jamshed, S. Q. (2020). Evidence of the practice of self-medication with antibiotics among the lay public in low- and middle-income countries: A scoping review. Antibiotics, 9(9), 597. https://doi.org/10.3390/antibiotics9090597
3. Bhardwaj, K., Shenoy, M. S., Baliga, S., Unnikrishnan, B., & Baliga, B. S. (2021). Knowledge, attitude, and practices related to antibiotic use and resistance among the general public of coastal south Karnataka, India: A cross-sectional survey. Clinical Epidemiology and Global Health, 11, 100717. https://doi.org/10.1016/j.cegh.2021.100717
4. Datta, M., Mukherjee, P., & Ghosh, S. (2024). Awareness and knowledge of antibiotics and antimicrobial resistance among beneficiaries attending the general outpatient clinic of a tertiary-level hospital in India. Journal of Comprehensive Health, 12, 44-49. https://doi.org/10.25259/JCH_1_2023
5. Gashaw, T., Yadeta, T. A., Weldegebreal, F., Demissie, L., Jambo, A., & Assefa, N. (2025). The global prevalence of antibiotic self-medication among the adult population: Systematic review and meta-analysis. Systematic Reviews, 14, 49. https://doi.org/10.1186/s13643-025-02783-6
6. GBD 2021 Antimicrobial Resistance Collaborators. (2024). Global burden of bacterial antimicrobial resistance 1990-2021: A systematic analysis with forecasts to 2050. The Lancet, 404(10459), 1199-1226. https://doi.org/10.1016/S0140-6736(24)01867-1
7. Indian Council of Medical Research. (2022). Treatment guidelines for antimicrobial use in common syndromes 2022. Indian Council of Medical Research.
8. Indian Council of Medical Research. (2024). Antimicrobial Resistance Surveillance Network annual report 2024. Indian Council of Medical Research.
9. Kaur, P., Kaur, N., Singh, J., & Kaur, J. (2024). To assess the availability of antibiotics for online sale and comparison of e-pharmacies on key characteristics influencing safe and rational use of antibiotics: An exploratory analysis. JAC-Antimicrobial Resistance, 6(5), dlae158. https://doi.org/10.1093/jacamr/dlae158
10. Kotwani, A., Joshi, J., & Lamkang, A. S. (2021). Over-the-counter sale of antibiotics in India: A qualitative study of providers perspectives across two states. Antibiotics, 10(9), 1123. https://doi.org/10.3390/antibiotics10091123
11. Mehta, A., Brhlikova, P., McGettigan, P., Pollock, A. M., Roderick, P., & Farooqui, H. H. (2022). Systemic antibiotic sales and WHO recommendations, India. Bulletin of the World Health Organization, 100(10), 610-619. https://doi.org/10.2471/BLT.22.287908

12. Ministry of Health and Family Welfare, Government of India. (2024). Steps taken to combat antimicrobial resistance and enhance disease surveillance. Press Information Bureau, Government of India.
13. Nguyen, N. V., Marothi, Y., & Sharma, M. (2022). Knowledge, attitude, and practice regarding antibiotic use and resistance for upper respiratory tract infections among the population attending a mass gathering in central India: A cross-sectional study. Antibiotics, 11(11), 1473. https://doi.org/10.3390/antibiotics11111473
14. Rao, S., Basu, S., Rajaura, S., Zode, M., Singh, M. M., & Sharma, N. (2025). Knowledge, attitudes, and practices of antibiotic use and antimicrobial resistance in low-income urban Delhi, India: A community-based cross-sectional study. Antibiotics, 14(12), 1184. https://doi.org/10.3390/antibiotics14121184
15. World Health Organization. (2022). Global antimicrobial resistance and use surveillance system (GLASS) report 2022. World Health Organization.
16. World Health Organization. (2023). Antimicrobial resistance. World Health Organization.
17. World Health Organization. (2025). Global antimicrobial resistance and use surveillance system (GLASS) report 2025. World Health Organization.