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A statistical study on awareness of antibiotic resistance among the general population

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Managing antibiotic resistance is a complex and multifaceted task. The Global Action Plan on Antimicrobial Resistance (GAP-AMR) and Global Antimicrobial Resistance and Use Surveillance System (GLASS), accepted by the WHO in 2015, has featured generating awareness of antibiotic resistance in the general population as well as health practitioners and professionals as one of its five key strategy points for the containment of antibiotic resistance dissemination. Survey studies, assessing the general population's awareness of antibiotics and antibiotic resistance, will help in better policy and infrastructure design, identify factors contributing to lack of understanding, and develop more effective awareness generation methods accordingly. In our study, we concluded that the majority of the sample population has little to no knowledge of appropriate antibiotic usage, antibiotic resistance, and repercussions of misuse of antibiotics and antibiotic resistance irrespective of being educated. The majority of the studied population is using antibiotics irresponsibly. Even if the studied population has access to digital technology and information on the appropriate use of antibiotics and antibiotic resistance on digital platforms, the studied group still lacks appropriate antibiotic use awareness, and the awareness of antibiotic resistance and its repercussions. Thus, we concluded that it is essential to organize regular physical awareness campaigns at the local level to develop consciousness around appropriate antibiotic use and antibiotic resistance to mitigate the risk of dissemination of antibiotic resistance.

Keywords: Antibiotics, Antibiotic resistance, Awareness Campaigns, GAP-AMR, GLASS

Introduction

Antibiotic resistance has become a global concern and health challenge¹⁻³. Increased consumption of antibiotics in different spheres of life has led to an increased risk of antibiotic resistance⁴. One of the major drivers of antibiotic resistance (AMR) is the irrational use/misuse/overuse of antimicrobials/antibiotics, among other factors^{2,5-6}. Lack of knowledge and awareness regarding the appropriate

use of antibiotics and antibiotic resistance has fast-tracked the emergence and dissemination of antibiotics globally^{7,9}. The global dissemination of antibiotic-resistant organisms of clinical relevance is not only affecting the environment but also impacting available treatment outcomes too¹⁰⁻¹⁵. Death rates related to antibiotic resistance are partially associated with the high level of antibiotic use and are predominantly high in middle- and low-income countries¹⁶⁻¹⁹. Antibiotic resistance has become an epidemic with the potential risk of being a pandemic²⁰. In 2015, the World Health Assembly adopted a global action plan on antimicrobial resistance (GAP-AMR) to counter the threat of antibiotic resistance. To fulfil the objectives of GAP-AMR, WHO started a global collaborative initiative called “Global Antimicrobial Resistance and Use Surveillance System” (GLASS) for the surveillance of antibiotic resistance globally. The main purpose of creating GLASS was to support the second objective of GAP-AMR *i.e.*, “strengthen knowledge through educational campaigns, surveillance, and research and to continue filling knowledge gaps, to inform strategies at all levels”. A global movement has been initiated by WHO to raise awareness of antibiotic resistance and to encourage the public and professionals to implement best practices to avoid further emergence and dissemination of antibiotic resistance²¹. Since the inception of this global movement, several studies have also been conducted worldwide to assess the awareness related to antibiotic resistance among the public²². Such studies have shown a palpable knowledge gap regarding antibiotic resistance among the general population²³. In India, few studies have been conducted to assess the awareness and knowledge of antibiotics and antibiotic resistance among the general population of different parts of the country to understand and estimate the level of awareness regarding antibiotic resistance and antibiotics²⁴⁻²⁶. The report published by the Observer Research Foundation has shown gaps in people's knowledge and practices regarding antibiotics and antibiotic resistance²⁶. Such survey studies are important for identifying the most common gaps in people's knowledge and framing suitable measures for promoting the appropriate

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policies related to the regulated use of antibiotics by the general public (consumer). The diversity among the population of the university campus in terms of age, education, societies, geographical area, and access to the internet/digital media/social media makes it appropriate for assessment of awareness surveys for pilot studies. To the best of our knowledge, no such local studies that investigated the awareness and knowledge of AMR among adults or public surveys of the general population (non-professionals) have been conducted in the state of Jammu and Kashmir till now. Thus, in the current study, we tried to assess the awareness related to antibiotic resistance and appropriate use of antibiotics among the people (students and staff) residing in the SMVDU university campus and factors associated with knowledge. We aimed to explore the relationship between the education level and the role and potential of technology/digital media/social media in propagating and publicizing antibiotic resistance awareness.

Materials and Methods

Sample collection

A questionnaire was prepared and distributed among the participants. The distributed questionnaire was related to antibiotic use, awareness of antibiotic resistance, and general personal information of the participants. A non-purposive convenient sampling method was applied to collect the data from 400 participants from the population at the Shri Mata Vaishno Devi University Katra (SMVDU)²⁶.

Data analysis

A descriptive analysis of the collected information was done to obtain percentages and frequencies²⁶. The correlation coefficient between selected four variables *i.e.* education qualification, exposure/access to social media, /internet, possession of the smartphone, and

exposure to available information on antibiotic use and antibiotic resistance awareness was also measured with the help of the SPSS tool²⁷.

Results

A total number of 400 participants responded to the provided questionnaire. Among the 400 participants, 62% (249) were females and 38% (151) were males. The responses were categorized into three age groups, Group I (18-35 years), Group II (36-53 years), and Group III (above 53 years). The majority of the participants *i.e.*, 76% (304) belonged to Group I, 18% (72) belonged to Group II and 6% (24) belonged to Group III. In age Group I, 66% (200) were females and 34% (104) were males; in age Group II 57% (41) were females and 43% (31) were males and in age Group III 33% (8) were females and 67% (16) were males. The distribution of the sample population based on their education was as such: 0.75% (3) were educated upto middle school (8th class), 2.5% (10) were educated upto higher secondary school (9th-12th class), 90.5% (362) were undergraduates (perusing bachelors or master’s degree) and 6.25% (25) were graduates (completed master’s degree) (Fig. 1).

Awareness among the sample population on antibiotics, antibiotic use, and antibiotic resistance

In the current survey, 92.75% (371) of the population claimed to be aware of “what antibiotics are” whereas, 7.25% (29) were unaware of antibiotics. In the case of awareness of antibiotic resistance, 72% (289) of the sample population was unaware. Out of a total, 85.25% (341) of the sample population replied positively when asked about the consumption of antibiotics during the last 2 months before the survey was conducted. The overall percentage of the sample population which was self-medicating antibiotics was 53.5% (214) whereas, 46.5% (186) of the sample

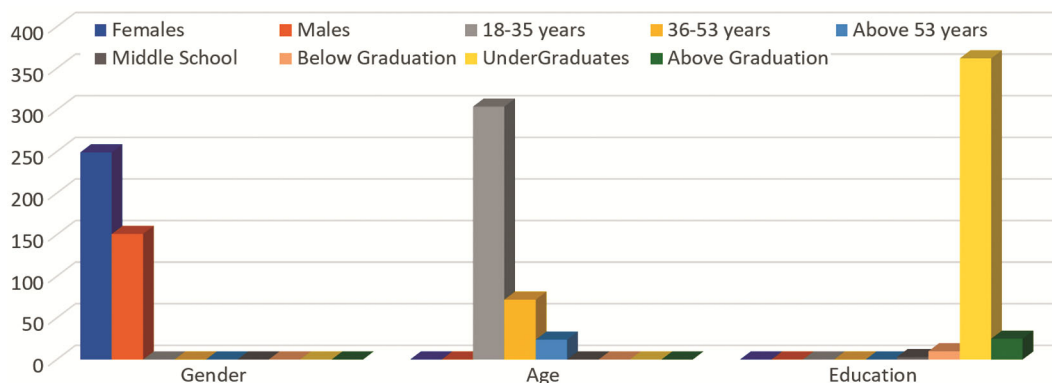


Fig. 1 — Distribution of the sample population based on gender, age, and education

population avoided self-medicating the antibiotics. 59% (237) of the sample population agreed that “antibiotics are used for the treatment of flu/cold/cough”. 78.25% (313) of the sample population believed that “antibiotics should not be consumed unnecessarily”. When asked about the use of antibiotics during cold/flu/cough, 57% of the participants responded positively. The percentage of the sample population that positively responded to statements regarding completing the prescribed antibiotic course, sharing prescribed antibiotics, and purchasing/consuming antibiotics with a doctor’s prescriptions were 68%, 64%, and, 85.5%, respectively. The group-wise distribution among the sample population is given in the table below (Table 1)

Out of the total, 64.5% of the participants were self-medicating. 73.5% of the self-medicating participants were using antibiotics for self-mediations or to treat cold/cough/flu, (Figs 2 & 3).

Access to technology and digital presence

Of the total, 99% (396) of the participants possess a smartphone and have a digital presence at least on one

digital platform. The distribution of access to digital media platforms (social media) or digital presence among the participants is shown in the table below (Table 2).

The percentage of the sample population that was exposed to informational topics such as antibiotic resistance, judicious use of antibiotics, abuse of antibiotics, or other related information was only 2.5% whereas, 90.75% was not exposed to such informational topics and 6.75% of the sample population was exposed only when they actively searched for the information.

The correlation coefficient between educational qualification and the type of smart device owned by the participants and exposure to informational topics were -0.200 and 0.258, respectively, and the associated p-values were 0.533 and 0.418, respectively. In the case of the correlation coefficient between possession of a smartphone and presence on a digital/social media platform, the value of the coefficient obtained was 1.000. A correlation coefficient of -0.258 and p-value of 0.418 was

Table 1 — Group-wise percentage distribution of responses of the sample population to the asked questions

Statement/Question	Age group I (18-35 years) (n=304)		Age group II (36-53 years) (n=72)		Age group III (Above 53) (n=24)	
	Yes	No	Yes	No	Yes	No
Do you have any idea about antibiotics	92.4%	7.6%	100%	0	75%	25%
Have you consumed/taken antibiotics within the last 2 months	86.5%	13.5%	80%	20%	83%	17%
Do you self-medicate antibiotics	56.5%	43.5%	52.8%	47.2%	67%	33%
Antibiotics are used for the treatment of cold/flu/cough only	62%	38%	45%	55%	67%	33%
One should avoid the unnecessary use of antibiotics	80.6%	19.4%	70%	30%	75%	25%
Do you know what is antibiotic resistance	33%	67%	12.5%	87.5%	8.3%	91.7%
One should complete the antibiotic course prescribed by the doctor even if you feel well within 2-3 days	66%	34%	68%	32%	92%	8%
Do you use antibiotics for the treatment of flu/cough/cold	63%	37%	35%	65%	50%	50%
One can share the prescribed antibiotics with his friends and Family	70%	30%	42.5%	57.5%	50%	50%
Antibiotics should not be purchased/consumed without the prescription of doctor	84%	16%	87.5%	12.5%	100%	0

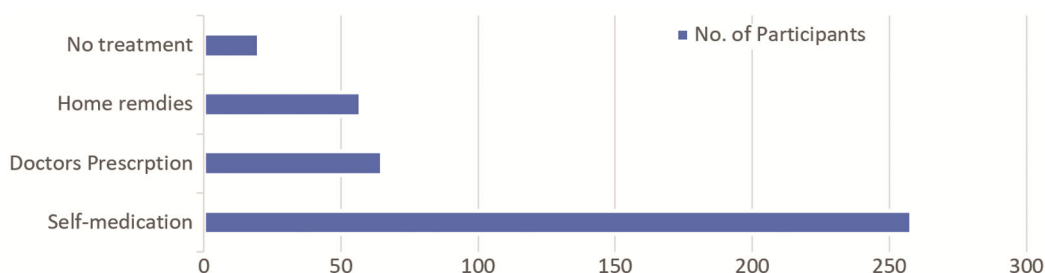


Fig. 2 — Distribution of choice treatment of cough/cold/flu among the participants

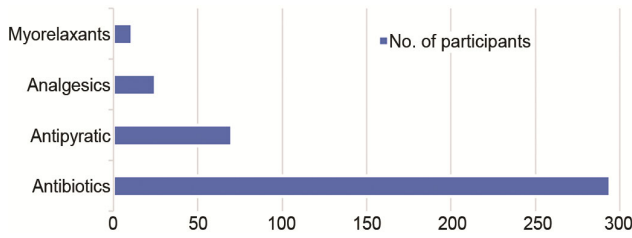


Fig. 3 — Distribution of participants using different drugs for self-medication

Table 2 — Percentage distribution of individuals having access to technology and digital presence

Item	Yes	No
Possession of smart phones	99% (396)	1% (4)
Access to different social media		
Item	No. of participants	
Messaging applications like WhatsApp	100% (396)	
Only Facebook	5% (20)	
Only Twitter	0	
Instagram and Facebook	82% (326)	
More than two social media accounts	13% 50	

observed between the statement, presence on digital/social media, and exposure to informational topics related to antibiotics, their appropriate use, and antibiotic resistance.

Discussion

The current survey study of 400 participants on the university campus found that the majority of the population claims to be aware of antibiotics, but there is a lack of awareness about antibiotic resistance. A descriptive analysis of the collected data shows that the majority of the sample population is unaware of appropriate antibiotic use in all three age groups. Three-fourths of the sample population agreed positively with the statement that unnecessary use of antibiotics should be avoided, but still consume antibiotics regardless. The agreement with the statement that “unnecessary use of antibiotics should be avoided” stems from general apprehension towards the use of drugs or medicine in general rather than knowledge about the appropriate use of antibiotics. The practice of self-medication among the sample population is also quite prevalent. During self-medication, a large portion of the population is consuming antibiotics based on previous experiences of either their own or others for the treatment of similar-looking symptoms. The majority of the sample population self-medicates with antibiotics to treat flu or cold, but in age group II, more than half of

the participants are aware that antibiotics are not effective for the treatment of colds or flu, preferring to use alternative methods such as home remedies like warm water, use of ginger, honey, turmeric, vitamin C, *etc.* While the majority of the total sample population shares their prescribed antibiotics, the majority of participants in age group II also refrain from sharing antibiotics. We can attribute the positive trend towards the appropriate use of antibiotics in age group II to their general avoidance of drugs rather than their awareness of antibiotics and antibiotic resistance. The p-value and correlation coefficient between education qualification, possession of a smartphone, and exposure to informational topics on antibiotic use and antibiotic resistance are statistically not significant, *i.e.*, there is no linear relationship between these variables. In other words, an individual's education qualification does not determine access to digital technology such as a smartphone or information about antibiotic use and resistance. Access to digital technology and digital presence does not ensure that an individual will be exposed to available information related to antibiotic use and antibiotic resistance. Our study aligns with many other studies done among different general population groups, which show a lack of awareness of the appropriate use and misuse of antibiotics and antibiotic resistance among the public^{25,28-33}. We observe a perfectly linear and statistically significant relationship between an individual's access to digital technology and their digital presence, which suggests that we can utilize digital media to reach a broader population, regardless of their educational background, to raise public awareness yet it does not ensure that it will meet the target of generating awareness among the public. Thus, to improve public awareness of antibiotic resistance and the appropriate use of antibiotics better communication strategies are required. Physical interaction in public spaces such as schools, hospitals, or neighborhood localities, along with booth campaigns and the development of communication strategies tailored to the targeted local population, can effectively enhance public awareness and promote appropriate antibiotic use behavior.

Conclusion

The survey reveals a significant gap between awareness and understanding of antibiotics and antibiotic resistance. Self-medication practices are widespread. Despite the majority agreeing on the

necessity to avoid unnecessary antibiotic use, many rely on past experiences to guide their antibiotic use, particularly for conditions like colds and flu, where antibiotics are ineffective. This consensus often arises from a general apprehension towards medication rather than informed knowledge. Notably, participants in age group II show a more responsible approach to antibiotic use, preferring alternative remedies and refraining from sharing prescribed antibiotics. This behaviour, however, appears driven by a broader avoidance of drugs rather than a specific awareness of antibiotic issues. The study also highlights that educational qualifications, possession of smartphones, and exposure to information on antibiotics and resistance do not significantly correlate. This indicates that access to digital technology alone is insufficient to ensure exposure to relevant information. While digital media presents an opportunity to reach a wide audience, it does not guarantee the dissemination of targeted educational content on antibiotics.

To conclude, innovative and localized communication strategies are essential to address the public's misconceptions and improve awareness. Physical interactions in communal spaces such as schools, hospitals, and local neighbourhoods, alongside booth campaigns and tailored communication efforts, will significantly enhance public understanding and promote responsible antibiotic use. Our findings echo the results of similar studies, underscoring the need for multifaceted public health campaigns to effectively combat antibiotic resistance and misuse.

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Conflict of interest

All authors declare no conflict of interest.

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