

# Survey on Antibiotics – Usage Patterns, Perceptions, Common Side Effects and Knowledge and General Awareness on Antibiotic Resistance

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## ABSTRACT

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Antibiotic use in India has risen sharply, with about a 30% increase in their per capita use during the past decade. There is a significant amount of antibiotic abuse, self-medication, myths, and so on among the locals, which has led to the global problem of antibiotic resistance. As a result, the aim of this study was to assess the general public's level of knowledge and general awareness about antibiotics and its resistance. Questionnaire was designed as per our aim and was circulated randomly between 11th of February, 2021 and the 4th of March, 2021. Response rate: 95% (n=380/400) was achieved. According to the outcomes we obtained, the majority of respondents (290 out of 380) had learned of an antibiotic from a doctor or other medical professional. A substantial portion of the population had the misconceptions that taking antibiotics would weaken their bodies (n=142/380) or that antibiotics could differentiate between beneficial and harmful bacteria (n=136/380). The majority of allergies in the general population were caused by Sulpha-containing antibiotics, accounting for 55% of all allergy cases. According to the report, more than half of the population, or 69%, decided to discontinue after experiencing side effects. Respondents were asked if they knew about the antibiotic resistance to evaluate whether they are having the correct knowledge. Out of n=380 respondents, n=273 chose the correct choice. Considerable part of the population is unaware about the antibiotic resistance problem which is now a global issue. Substantial part of the population is unaware about the practices to be followed to control this problem. Hence, there is dire need to spread awareness regarding the same.

**Keywords:** Antibiotics usage, Self-medication, Allergy, Misconceptions, Antibiotic resistance, public knowledge

## I. INTRODUCTION

At any given point when any unfamiliar substance, for example bacteria enters our body, our immune system

recruits White Blood Cells as a part of a defense mechanism which act against this foreign substance and protects our body from infection. There are certain conditions in which White Blood Cells are not

sufficient to suppress the infection. Under such circumstances, antimicrobials are used. In the case of bacteria as a causative agent, we use antibiotics. According to WHO, “Antibiotics are medicines used to prevent and treat bacterial infections.” They kill or inhibit the growth of bacteria. Antimicrobials have played a significant role in reducing morbidity and mortality associated with infectious conditions. Medically used antibiotics can be natural such as Penicillin obtained from one microorganism fighting against another or it can be fully synthetic i.e., non-antibiotic antibacterial (such as sulphonamides and antiseptics). However, both classes have the same goal of killing or preventing the growth of bacteria.

Antibiotics work effectively as long as they are used optimally, if not done this may lead to the problem of antibiotic resistance. According to WHO, “Antibiotic resistance occurs when bacteria change in response to the use of these medicines.” The inappropriate and excessive antibiotic utilization in the community, in primary care, and in hospitals may result from a complex interaction between several factors such as, for example, the practices of physicians, the patients’ attitudes, beliefs, knowledge of antibiotic use, the self-medication, the patients’ perceptions regarding patient-physician interaction, the patients’ expectations, and the patients’ experience with antibiotics. Therefore, controlling antibiotic use requires a multifaceted approach with knowledgeable and engaged health-care professionals, pharmacists, health authorities, and consumers. (Napolitano, 2013). In this study, we learnt that many people follow incorrect practices such as many prefer to do self-medication by researching on the internet instead of reaching out to doctors. This may end up as consumption of the wrong antibiotic by the person and disturbing the normal flora of the body. Self-medication of antibiotics is associated with the risk of inappropriate drug use, which predisposes patients to drug interactions, masking symptoms of an underlying disease, and the development of microbial resistance.

The inappropriate drug use practices common in self-medication include short duration of treatment, inadequate dose, sharing of medicines, and avoidance of treatment upon the improvement of disease symptoms. (Nepal et al, 2018) Our research found that a significant portion of the population consumes antibiotics from previous prescriptions or prefers to keep them at home in case they are required in the future. Both are incorrect behaviours that can affect the body's healthy bacteria and contribute to resistance. Some do not even complete the antibiotic course after they feel better which may activate some bacteria left which were still not killed in the body to again cause the infections. This condition may also lead to resistance problems. There are certain infections that have symptoms that correlate with those of other infections, if you don't tell your doctor the right symptoms, he might be unable to determine the true cause and end up prescribing broad-spectrum antibiotics, which is one of the leading causes of antibiotic resistance. According to our poll, the majority of people believe antibiotics are used to treat cold and flu or influenza. Antibiotics work only against bacteria whereas cold and flu is a viral infection. Antiviral medications, or antivirals, are drugs that inhibit viruses rather than antibiotics. Antibiotics are also prescribed by some doctors to treat Colds and Flu. We learned about antibiotic myths in this report, such as how many people believe antibiotics weaken their bodies. Such misconceptions can lead to a fear of taking antibiotics, resulting in an increase in infection and also proper practices are not followed by people to prevent antibiotic resistance which may worsen the condition. Handwashing with plain soap is one of the most basic practices for preventing infections.

India topped the list having the list having the highest DRI (Drug Resistance Index) scores and also it has emerged as the world’s largest consumer of antibiotics with a 62 % increase in popping habits over the last decade India has emerged as the world’s largest consumer of antibiotics as per one of the article of

'Times of India', 2014. The inappropriate and excessive antibiotic utilization in the community, in primary care, and in hospitals may result from a complex interaction between several factors such as, for example, the practices of physicians, the patients' attitudes, perceptions, knowledge of antibiotic use, the self-medication, the patients' perceptions regarding patient-physician interaction, the patients' expectations, and the patients' experience with antibiotic. By looking at the current scenario of India, controlling antibiotic use requires a multifaceted approach with knowledgeable and engaged health-care professionals, pharmacists, health authorities, and consumers in order to reduce antibiotic resistance. The general population can play an important role in reducing the inappropriate and excessive utilization of antibiotics and it is necessary to understand their antibiotic use knowledge, attitudes, and behaviours and if any educational needs exist. All this can be known by carrying out the survey considering all these factors. Therefore, the objective of the current study was firstly to investigate the perception, usage patterns, side effects of antibiotics and attitudes, and behaviours regarding antibiotics of the random targeted general population. The secondary aim of this study was to identify the factors that were linked to the main outcomes of interest. Although antibiotic resistance can be considered to be an inevitable consequence of antibiotic use, injudicious use of antibiotics is a major factor facilitating the emergence of resistance worldwide. In many areas, the availability of antibiotics 'over the counter' or via the internet allows the non-prescriber to have free and unrestricted access to these agents. Once resistance has emerged, subsequent dissemination of resistant strains is facilitated by the selection pressure exerted by further antibiotic use, failure to adhere to infection control measures and by poor hygiene (notably in terms of

#### **D. Data Collection Strategy**

The questionnaire was divided into different subsections. The questions were simple and were framed in a manner so as to obtain genuine responses

hand hygiene, sanitary conditions and food preparation), which can occur both within and outside healthcare settings. (Kakkar et al, 2017).

## **II. METHODOLOGY**

### **A. Study Setting**

The study was carried out online using a platform known as Google forms due to restrictions on physical interactions during COVID-19 situation.

### **B. Study Design and Target Population**

A multi-sectional questionnaire was designed to determine the variation and characterize the current use of antibiotics and to examine the awareness on antibiotic resistance among the local population. Various research papers, journals, articles were referred before conducting this survey which provided a basis for the formulation of the questions to be included in the Google form. Our target population was the general public which included candidates irrespective of their age, gender, profession, education.

### **C. Sampling of Target Population**

Random circulation of the form was done between 11<sup>th</sup> February, 2021 and 4<sup>th</sup> March, 2021 and responses were collected through social websites like WhatsApp, Instagram and Facebook.

*Demographics considered for sampling:*

- 1) Age: Below 18, 18-25, 26-40, 41-50, 51-60, 60+
  - 2) Gender: Male, Female, Others
  - 3) Education: Secondary Education, 11<sup>th</sup> or 12<sup>th</sup> grade, Diploma, Graduate, Postgraduate, PhD, Professional Degree, Others
  - 4) Profession: Medical Professional, Researcher, Self-employed, Professor, Student, Homemaker, Unemployed, Others
  - 5) Stream: Science, Commerce, Arts
- as far as possible in order to gain the required information.

**E. Ethical Considerations**

Participants were assured that the content of this questionnaire is for the purpose of research only, the data provided by them will be kept strictly confidential and that the analysts would use it only for the purpose of statistical evaluation. By completing this survey, they gave their consent to participate in this study.

**F. Data Source**

The responses were generated in a spreadsheet via a link provided in the Google form for ease of analysis. The graphs that were generated automatically were used for verification of the data.

**G. Statistical Analysis**

The responses that were generated in the spreadsheet were categorized based on the demographics considered for our study. The questions were taken one at a time and sorted for our convenience, followed by usage of MS Excel tools like the Pivot table and others; AutoSum and COUNTIF formulae, and the data obtained was represented in the form of various graphs such as 2-D & 3-D bar and column graphs, 100% stacked column and bar graphs, pie charts, doughnuts charts, cylindrical graphs, conical graphs, etc.

**III. RESULTS**

A total of 380 responses were received through all means. A total of 143 (37.6%) males and 237 (62.4%) females participated in the study. 11 (2.9%) participants had completed secondary education, 31 (8.2%) passed 11th or 12th grade, 9 (2.4%) held a diploma, while most of them (198 i.e., 52.1%) were graduates. 75 (19.7%) of the participants were postgraduates, followed by 5 (1.3%) holding doctorate

degrees, 42 (11.1%) holding a professional degree and 9 (2.4%) others. The respondents were also asked about their professions, from which we learnt that 33 (8.7%) of them were medical professionals, 8 (2.1%) researchers, 53 (13.9%) self-employed, 15 (3.9%) professors, 174 (45.8%) students, 29 (7.6%) homemakers, 4 (1.1%) unemployed, 7 (1.8%) in service and 57 (15.1%) were from other sectors. Additionally, 9 (2.4%) respondents were below the age of 18, 202 (53.2%) belonged to the age group of 18-25, 55 (14.5%) were between 26 and 40, 75 (19.7%) between 41-50, 33 (8.7%) between 51-60 and 6 (1.6%) were more than 60 years old.

**A] Basic Knowledge And Practices**

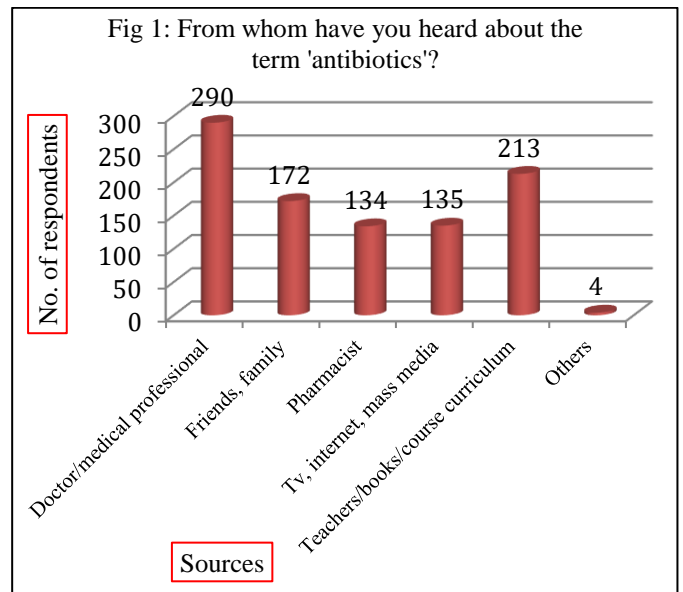


Figure 1: No. of responses of all participants to “From whom have you heard about the term 'antibiotics'?” Most of the respondents (290 out of 380) have heard about an antibiotic from a doctor or a medical professional, followed by teachers and books (n=213); friends and family (n=172); television and mass media (n=135) and pharmacists (n=134). (Figure 1)

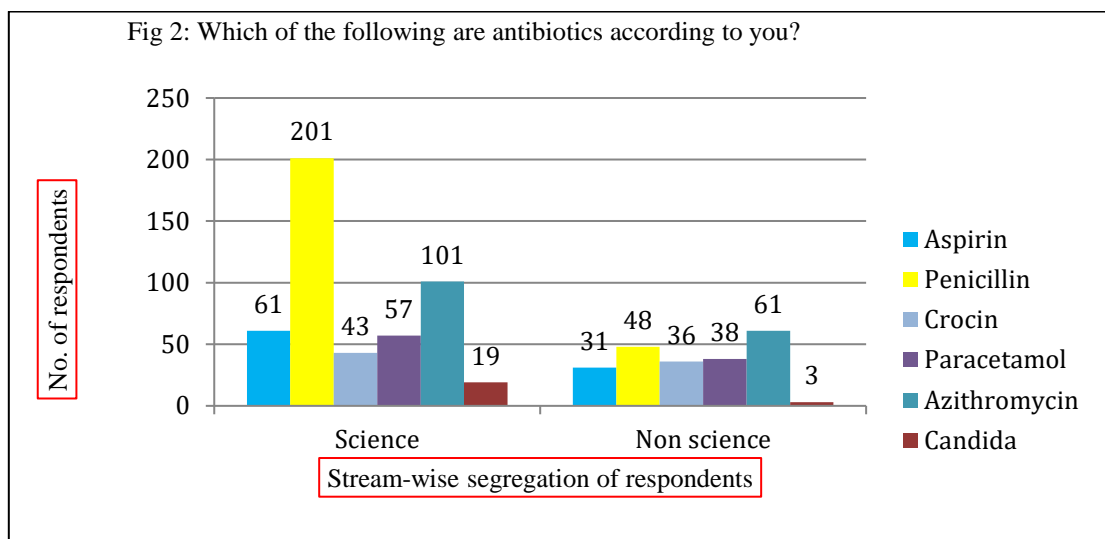


Figure 2: No. of responses of all participants to “Which of the following are antibiotics according to you?”

Upon being asked to select the antibiotics from a list of drugs, Science majors presented a higher proportion of **correct answers** (i.e., **Penicillin, n=201 and Azithromycin, n=101**) than their non-science counterparts. The variation between the numbers of right (Penicillin, n=48) and wrong answers (Paracetamol, n=38) was comparatively lesser in the latter category of respondents. (Figure 2)

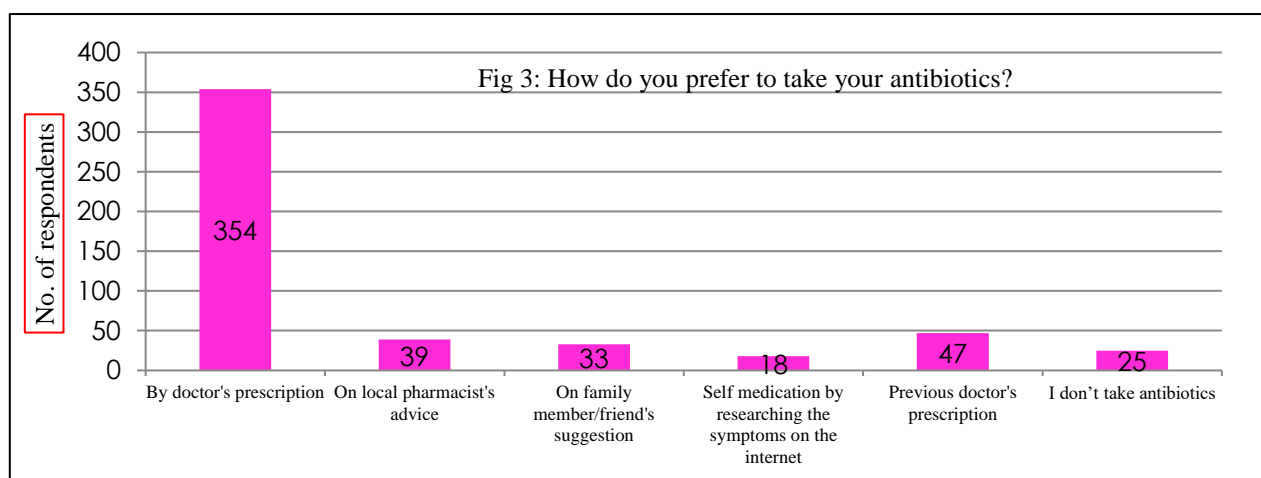


Figure 3: No. of responses of all participants to “How do you prefer to take your antibiotics?”

A majority of the participants (n=354) revealed that they tend to take antibiotics by a doctor's prescription - **a correct practice**, while the rest (n=137) indicated other means like on a local pharmacist's advice, on a family member or friend's suggestion, self-medication by researching the symptoms on the internet or by a previous doctor's prescription. (Figure 3)

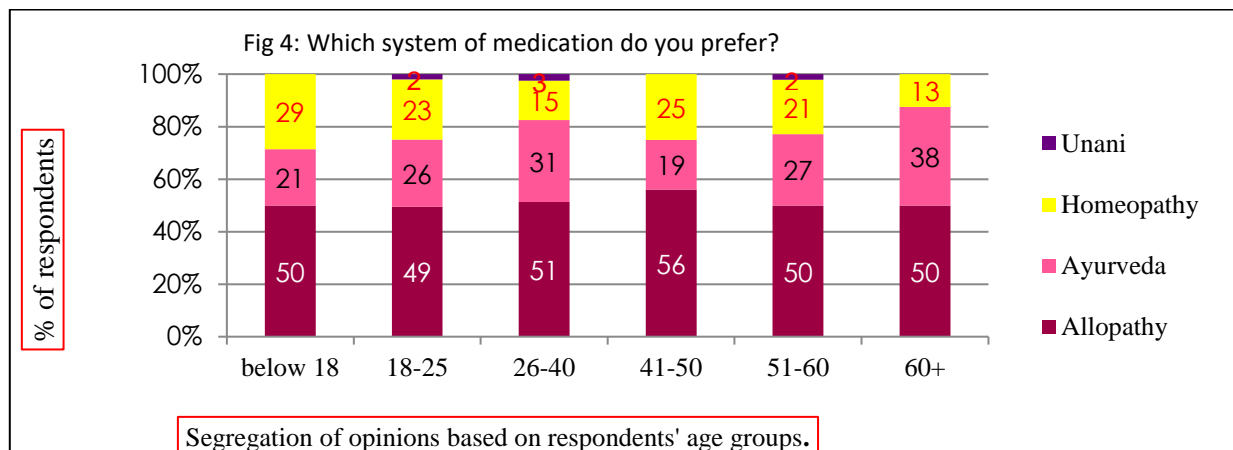


Figure 4: Percent of responses of participants to “Which system of medication do you prefer?”

About 50% of respondents from all age groups chose Allopathy as their preferred system of medication. Mostly, a higher number of people preferred Ayurveda than Homeopathy, and even more so in the 60+ age group. Unani was chosen by only a few (~2%). (Figure 4)

### B) Side-Effects

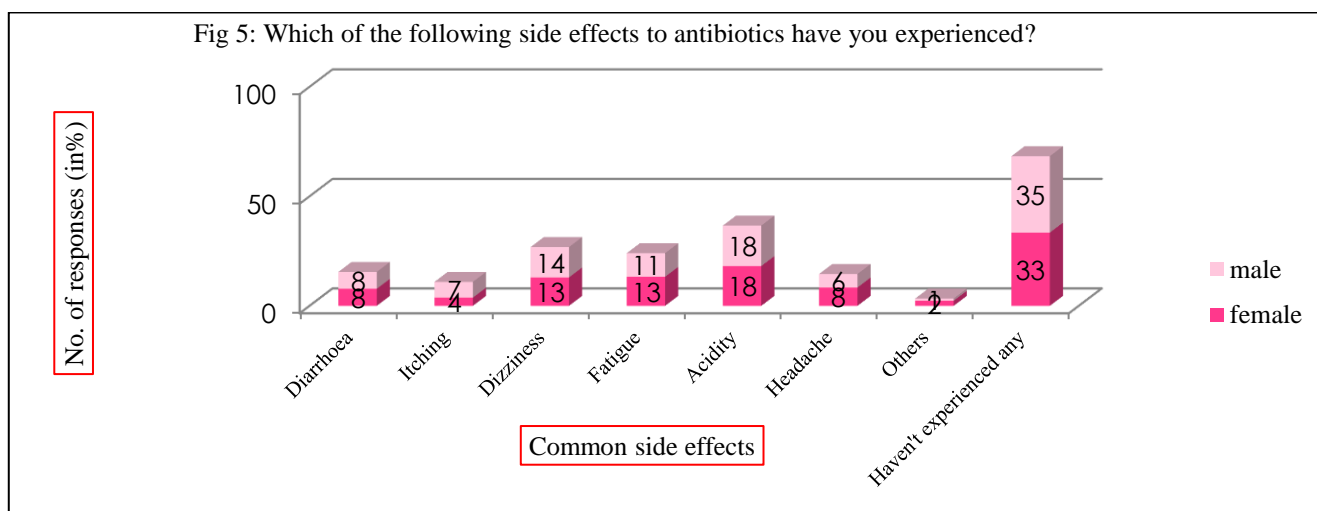


Figure 5: Percent of responses of all participants to “If you experience any side effect to an antibiotic, will you discontinue it?”

Although a large proportion of respondents said that they have not experienced any side effects to an antibiotic, a significant amount has faced acidity, followed by dizziness. Women appeared to have shown more side effects than men (fatigue: 11% males, 13% females; headache: 6% males, 8% females), with the exception of itching (7% males, 4% females). Additionally, both had experienced diarrhoea, dizziness and acidity to an almost equal level. (Figure 5)

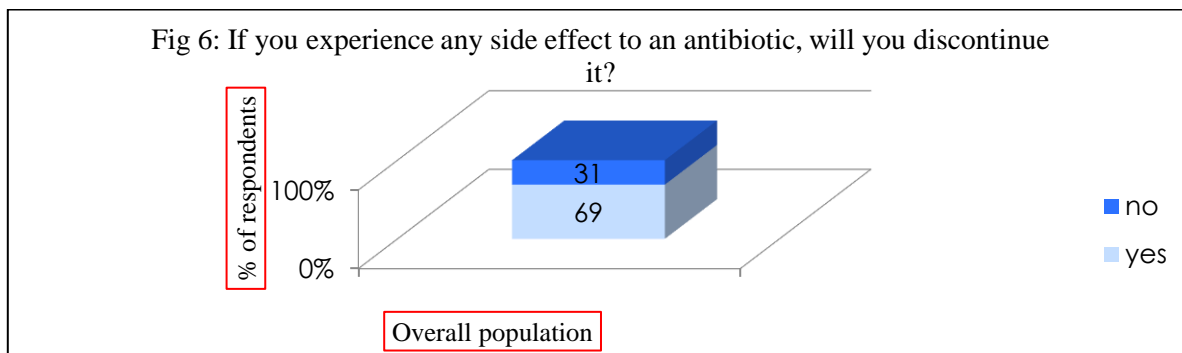


Figure 6: No. of responses (in%) of participants to “Which of the following side effects to antibiotics have you experienced?”

When the candidates were asked if they experience any side effects will they discontinue it, from **Figure 6** we learnt that more than half of the population i.e., 69% chose to discontinue. **Before taking any decision, they must first consult the doctor.**

C] Allergies

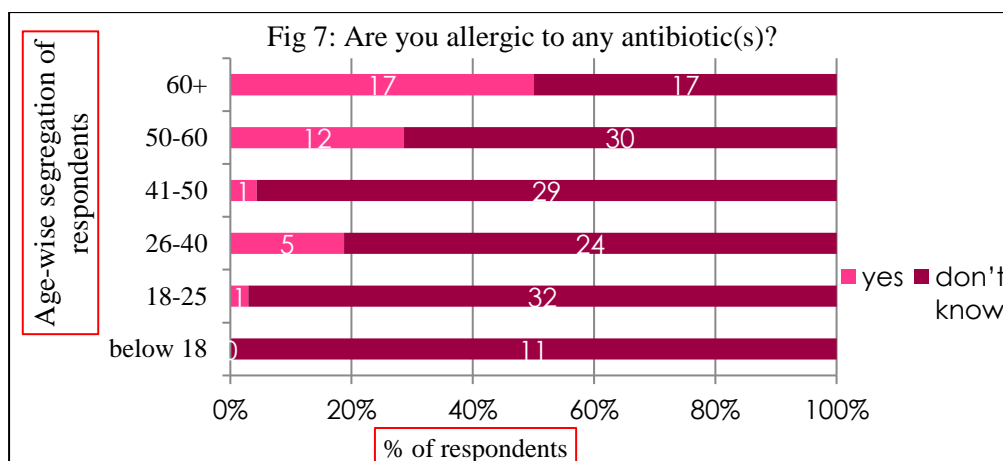


Figure 7: Percent of responses of participants to “Are you allergic to any antibiotic(s)?”

Upon being inquired about allergies, we learnt that there was a gradual increase in the occurrence of allergies with age (with an exception of the 41-50 age group). No certain allergies were found in participants who were below 18 years of age, on the other hand, half of the 60+ year old are allergic to some or the other antibiotic. **(Figure 7)** Higher occurrence of allergies in older people might have been an incentive for them to choose Ayurveda as an alternative, natural medicinal system.

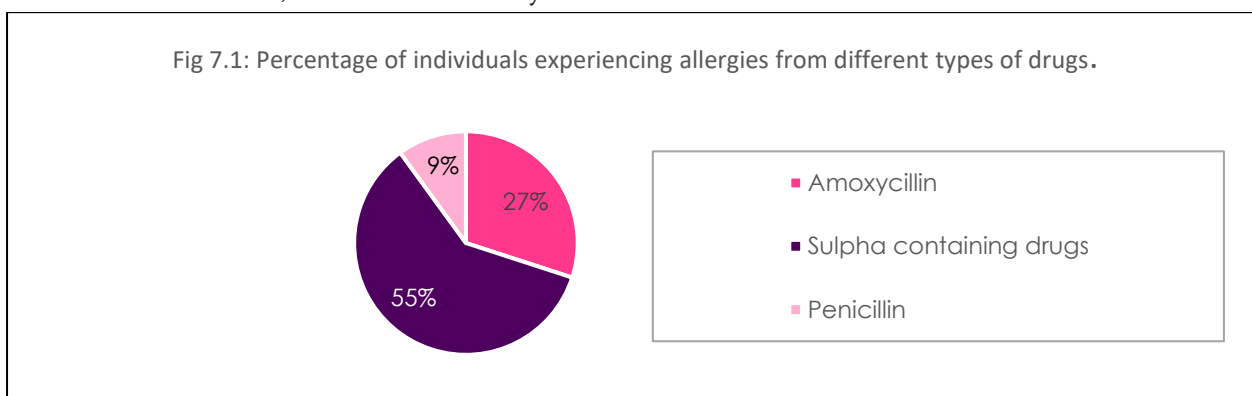


Figure 7.1: Percentage segregation of responses of only respondents who agreed having allergies to antibiotics to “Mention the name of antibiotic/drug you experienced allergies from.”



The most common allergies were found to be to sulpha-containing drugs (55%), followed by Amoxicillin (27%) and Penicillin (9%). However, the allergic population constituted only a small part of the total population. (~3%). (Figure 7.1)

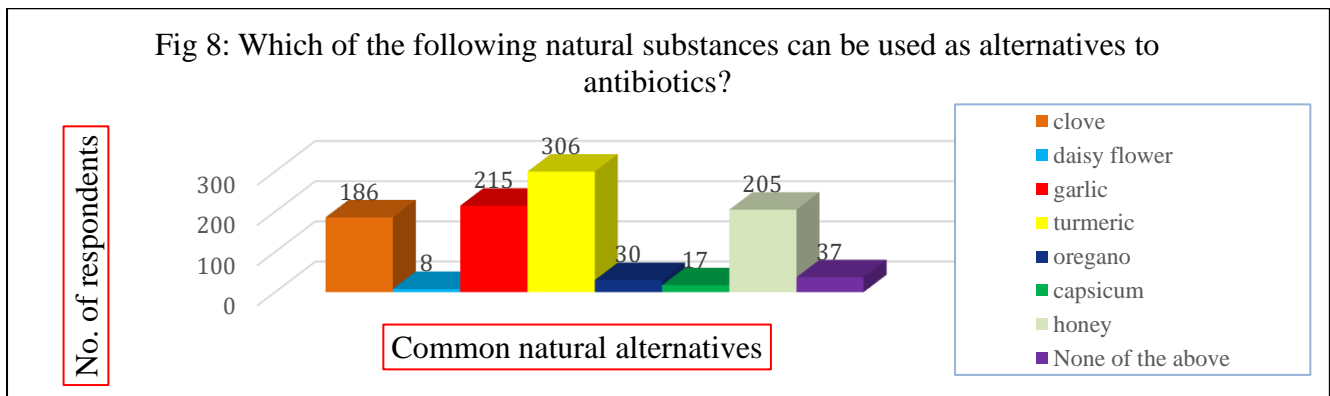


Figure 8: No. of responses of sample population (all respondents) to “Which of the following natural substances can be used as alternatives to antibiotics?”

(Figure 8) All the options given i.e., till honey can be used as alternatives to antibiotics. Participants displayed high familiarity towards the potential of turmeric being used as an antibiotic alternative (n=306), followed by garlic (n=215), honey (n=205) and clove (n=186). Low awareness was observed regarding the usage of oregano (n=30), capsicum (n=17) and daisy flower (n=8) for the same purpose.

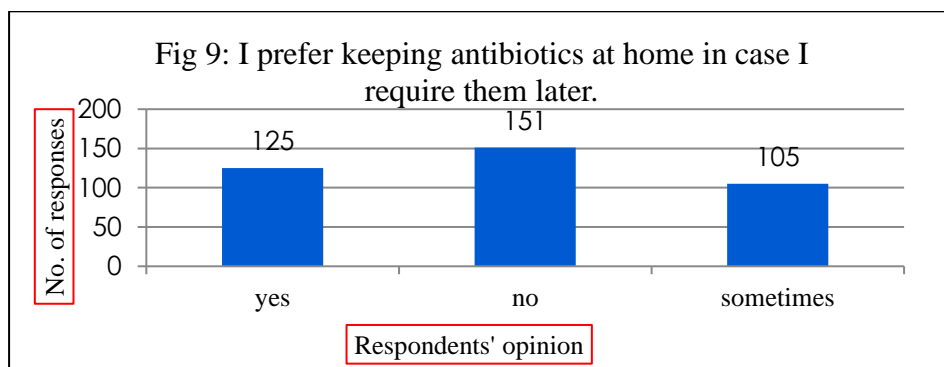


Figure 9: No. of responses of sample population (of all respondents) to “I prefer keeping antibiotics at home in case I require them later.”

230 respondents (n=125 certain, n=105 probable) said that they prefer to keep antibiotics at home for future use, which is an **incorrect practice**, while the remainder (n=151) discards them. (Figure 9)

#### D] Perception, Misconception, Misuse

This part of our survey includes the measuring of knowledge of the general public on antibiotic’s proper use and misuse and the false notion of the respondents about antibiotics. It also includes personal take of participants on antibiotics.



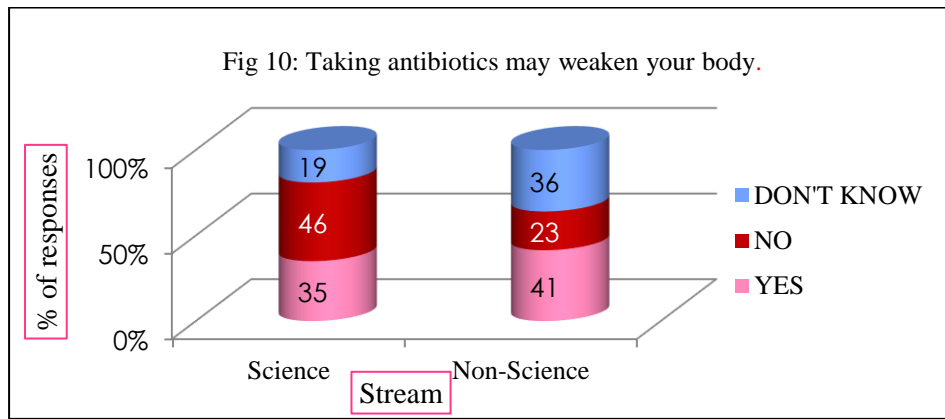


Figure 10: Percent of responses of respondents belonging to Science/Non-Science stream to “Taking Antibiotics may weaken your body.”

Respondent’s perception about the impact of antibiotic consumption on their body was observed. Out of 380 respondents overall, 237 were from Science background and 128 from Non-Science background whereas 15 of them had not disclosed their educational background. From **Figure 10**, we observe that 46% (n=109) of science respondents, double the percent of non-science respondents (23%, n=29) had selected the **correct option ‘No’** indicating that Science participants are more aware of the topic in general 41% (n=53) of non-Science participants and 37% (n=380) overall chose ‘Yes’ which is incorrect indicating that there is misinformation spread in people related to antibiotic consumption.

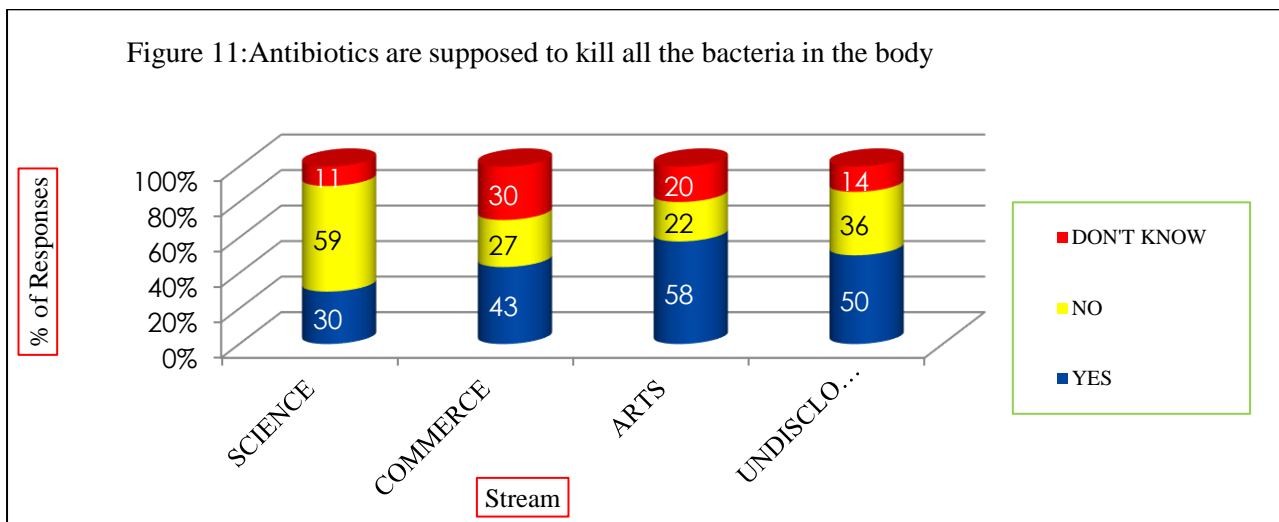


Figure 11: Percent of responses of respondents belonging to various streams to “Antibiotics are supposed to kill all the bacteria in the body.”

Respondent’s knowledge about side effects of antibiotic consumption was surveyed which is shown in **Figure 12**. And we learnt that 59% (n=141) of science participants had selected the **correct option ‘No’** compared to 27% (n=22) and 22% (n=10) of Commerce and Arts participants respectively indicating sound knowledge of science participants about the concept. 43% (n=36) of Commerce and 58% (n=26) of Arts selected the option ‘Yes’ as compared to only 30% (n=70) by Science participants. A high percent of Commerce-30% (n=25) and Arts-20% (n=9) selected the option ‘Don’t know’ as compared to only 11% (n=26) by science participants indicating lack of knowledge among non-Science individuals. Overall, it indicates that people may be more likely to take an antibiotic. (**Figure 11**)

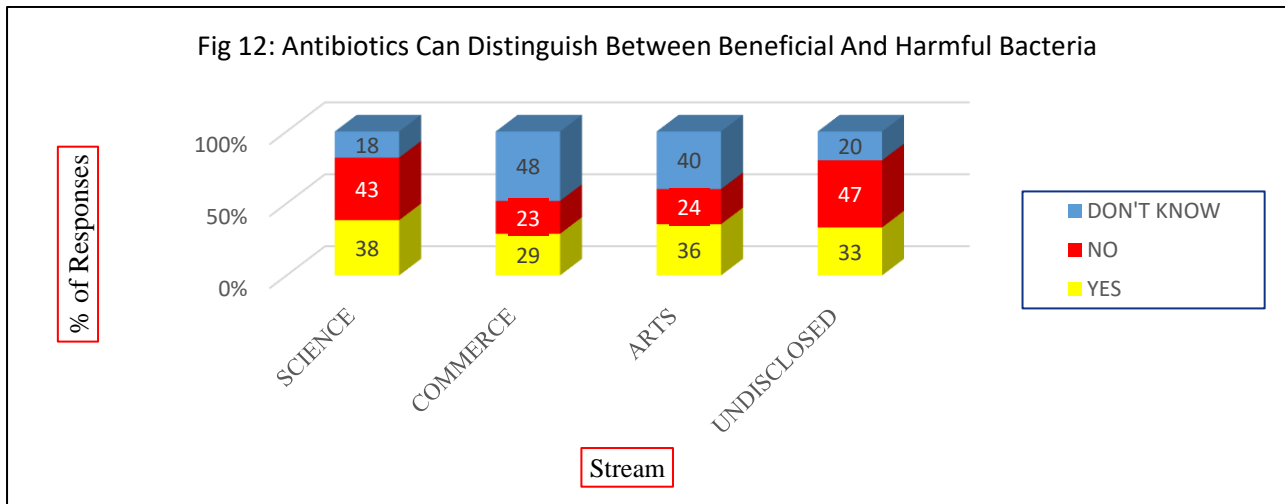


Figure 12: Percent of responses of respondents belonging to various streams to “Antibiotics Can Distinguish Between Beneficial and Harmful Bacteria.”

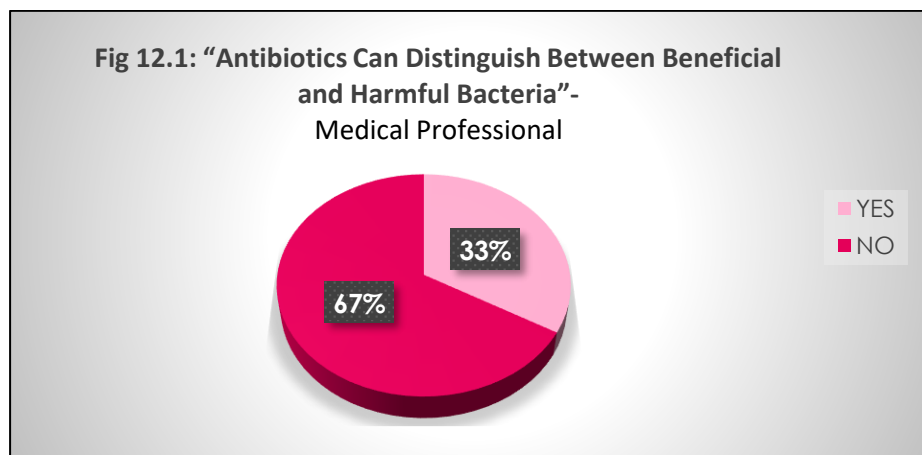


Figure 12.1: Percent of responses of respondents belonging to various streams to “Antibiotics Can Distinguish Between Beneficial and Harmful Bacteria.”

Figure 12. indicates that 43% (n=103) of science participants had greater number of participants as compared to 23% (n=19) Commerce and 24% Arts (n=11) participants who chose the **correct option i.e. ‘No’**. In **Figure 12.1** indicates that the number of **correct selections ‘No’** is twice i.e., 66.66% ~ 67% (n=18) as those of incorrect selections ‘Yes’ i.e., 33.33% ~ 33% (n=9) for medical professionals who are daily practitioners and are aware of antibiotic action as compared to other people in general. Similarly, 48% (n=40) of Commerce and 40% (n=18) of Arts participants selected the option ‘Don’t know’ indicating a weak awareness among non-Science participants (**Figure 12**).

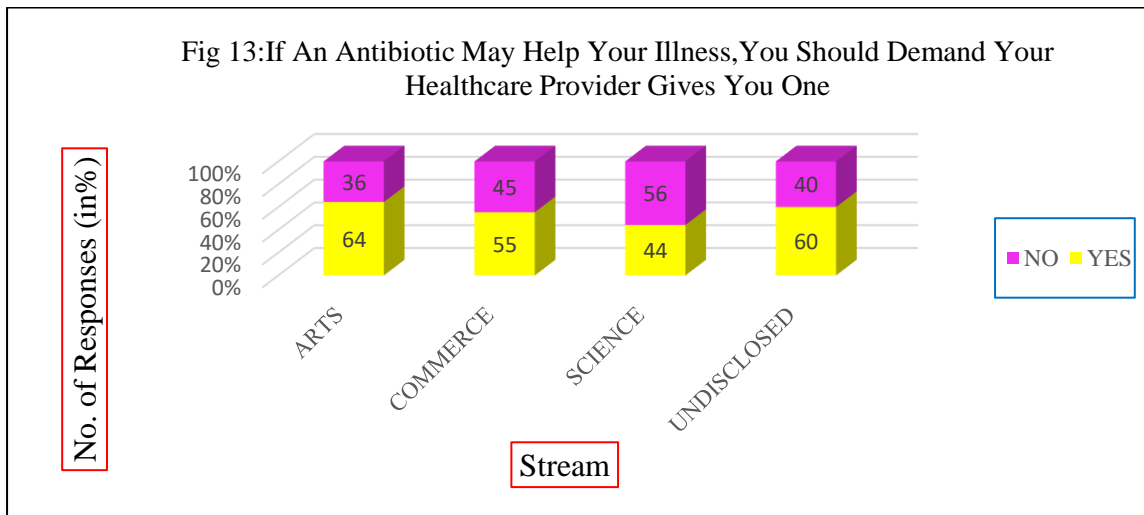


Figure 13: Percent of responses of participants belonging to various streams to “If An Antibiotic May Help Your Illness, You Should Demand Your Healthcare Provider Gives You One.”

When the respondents were asked whether they should demand healthcare provider to give an antibiotic, if they feel it will heal their illness. From **Figure 13**, it is clear that 56% (n=132) of science participants have selected the **correct option** i.e. ‘No’ significantly higher as compared to Arts- 36% (n=16) and Commerce- 45% (n=37).

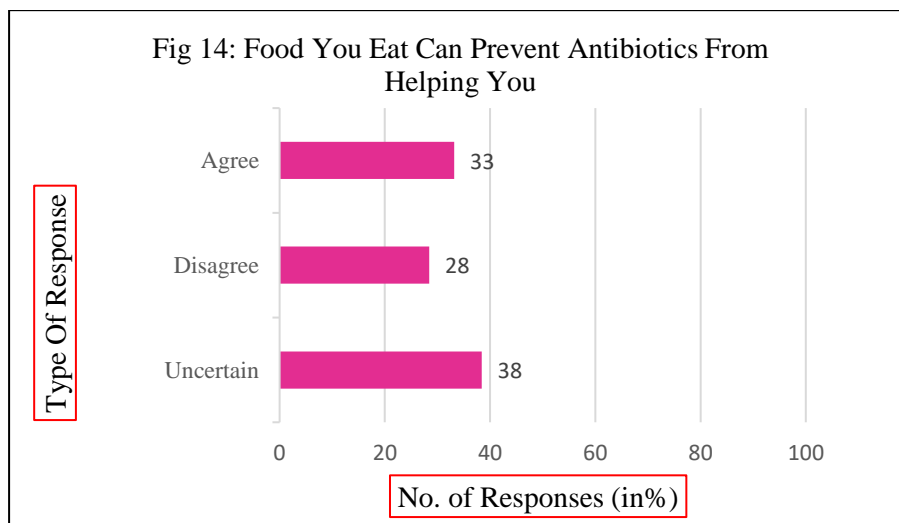


Figure 14. Percent of responses of all participants to “Food You Eat Can Prevent Antibiotics from Helping You.”

As we observe in **Figure 14**, 33% (n=126) of people ‘Agree’ i.e., they selected the **correct option** which is a good amount of awareness among individuals. As the general pattern observed throughout the survey that most people lack knowledge in antibiotics, a similar pattern is observed here with 38% (n=146) participants being unaware about the method of intake of food with medicines and 28% (n=108) answering incorrectly.

**E] Antibiotic Resistance**

The last part of this examination presents responses to questions investigating the degrees of consciousness of the issue of antibiotic resistance and the degrees of comprehension of this issue and how to address it.

**E.1] Idea/concept of antibiotic resistance among the sample population**

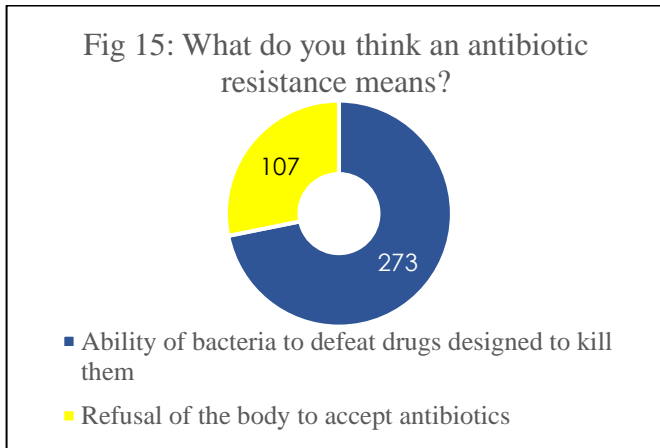


Figure 15: No. of responses from all respondents to “What do you think an antibiotic resistance means?” (Figure 15) Respondents were asked if they knew about the antibiotic resistance to check whether they are having the correct knowledge and the options included:

- 1) Ability of bacteria to defeat drugs designed to kill them (Correct Answer)
- 2) Refusal of the body to accept antibiotics

Out of n=380 respondents, n= 273 [among which the greater part of them were from science stream] addressed right and the rest of them i.e.,107 picked the wrong alternative.

**E.2] Perception of Antibiotic Resistance among the sample population**

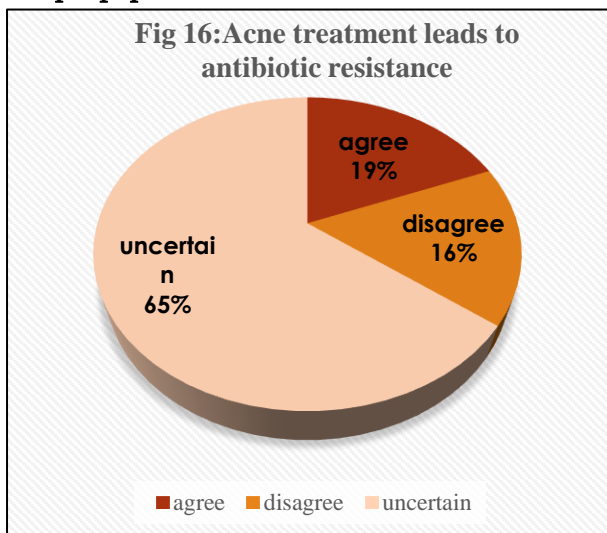


Figure 16: Percentages of responses from all respondents to “Acne leads to antibiotic resistance.”

To get more insight on respondent’s awareness on antibiotic resistance some basic questions were asked, one of which included whether acne treatment led to antibiotic resistance. More than 50% of respondents opted for “Uncertain” i.e., 65% i.e., they are completely unaware about it followed by ‘Agree’ (correct option) and ‘Disagree’ which was only 19% and 16% respectively. (Figure 16)

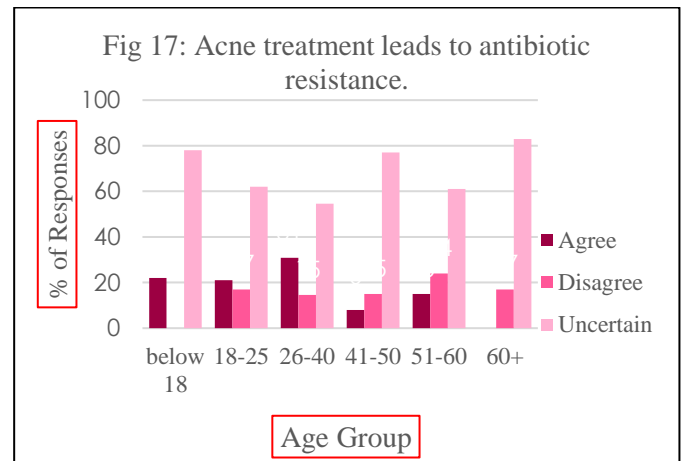


Figure 17: Percentages of responses from all respondents by taking the age demographic factor to, “Acne leads to antibiotic resistance”

This graph clearly demonstrates that more than 50% of the population from all age groups are completely unaware about acne treatment leading to antibiotic resistance. The highest respondents that chose the correct answer i.e., ‘Agree’ were from 26-40 (31%) followed by below 18 (22%), 18-25 (21%), 51-60 (15%), 41-50 (15%) and 60 and above (0%) didn’t choose the correct option at all. Figure 17 ‘below 18’ and ‘18-25’ age groups have more than 50% of the population which is completely unaware about the possibility of acne treatment causing antibiotic resistance. (These two age groups are more prone to acne. So, there are more chances of these two age groups going for acne treatment and hence they should be made aware about it.)

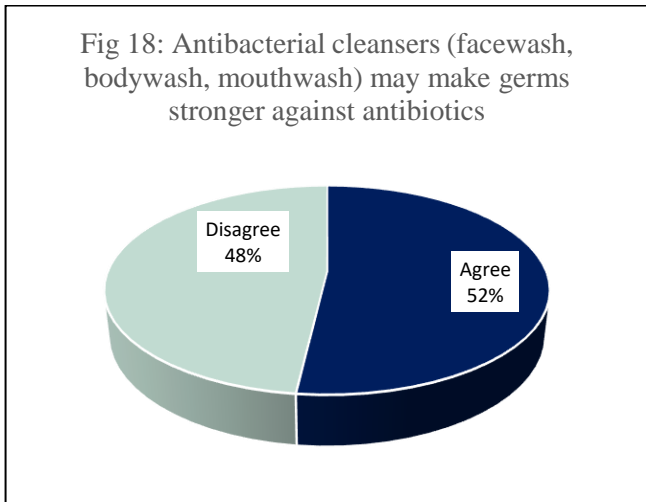


Figure 18: Percentages of responses from all respondents by taking the age demographic factor to, “Antibacterial cleansers (facewash, bodywash, mouthwash) may make germs stronger against antibiotics.”

(Figure 18) Respondents were posed inquiry related to cleansers which the general public use in their day-to-day life such as face wash, bodywash, mouthwash. They were asked whether these caused antibiotic resistance. 52% of the sample population **agreed** to this **which is the correct option** and 48% disagreed.

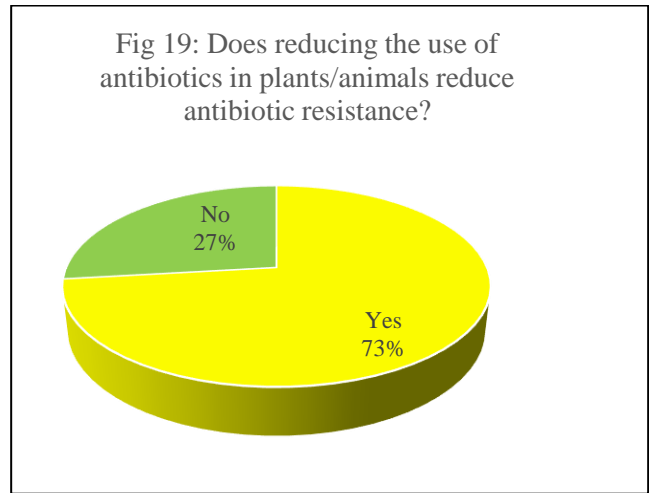


Figure 19: Percentages of responses from all respondents to, “Does reducing the use of antibiotics in plants/animals reduce antibiotic resistance?”

(Figure 19) In this graph approximately  $\frac{3}{4}$  of the population 73% (i.e., the major part of the population answered ‘Yes’ which is the wrong answer and only 27% respondents answered **correctly** i.e. ‘No’. Such huge no. of people choosing for the incorrect practice made us realise that there is a much dire need to spread awareness about antibiotics usage and its resistance.

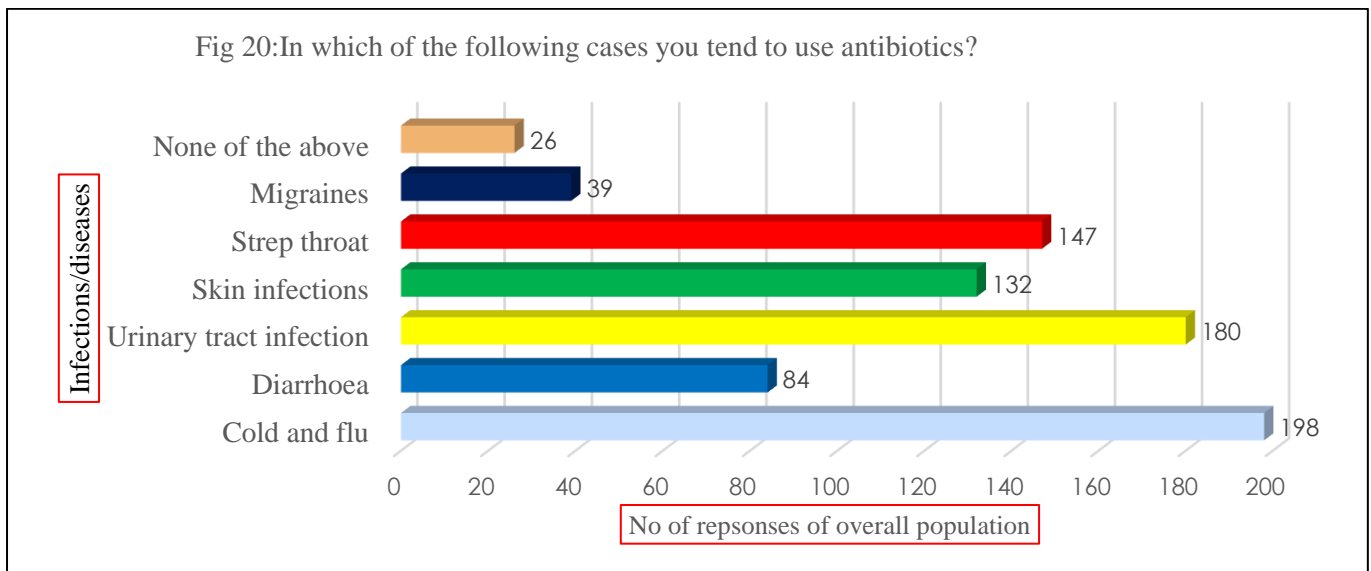


Figure 20: No. of responses from all respondents to, “In which of the following cases you tend to use antibiotics.”

(Figure 20) Respondents were asked about the conditions/cases they take antibiotics, majority of them i.e., 198 respondents voted for ‘Cold and flu’ which is a viral infection and 39 voted for ‘Migraine’ which is a disorder and not an infection. Both are **incorrect responses**.

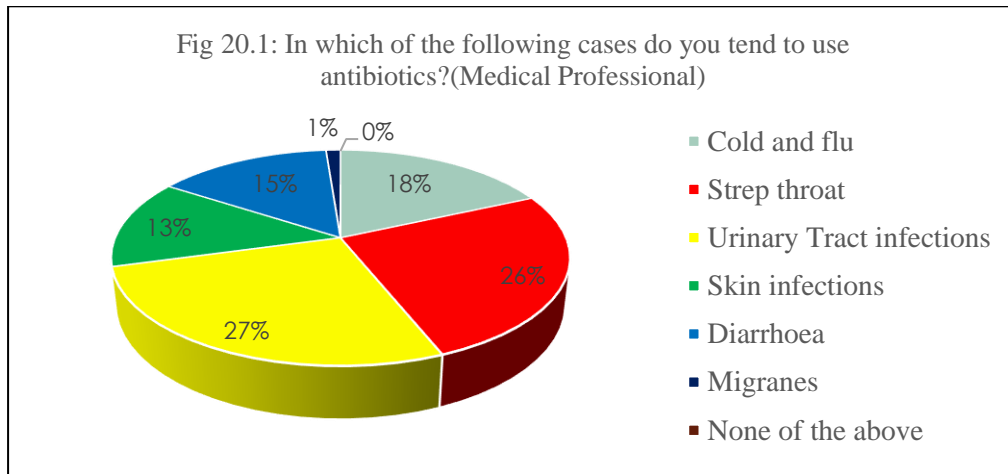


Figure 20.1: No. of responses from only Medical Professionals to, “In which of the following cases do you tend to use antibiotics?”

(Figure 20.1) Medical Professionals are the ones who prescribe us antibiotics so we decided to take the insight into their responses. We learnt that surprisingly 18% opted for Cold and flu, a viral infection and 1% for Migraines, a disorder.

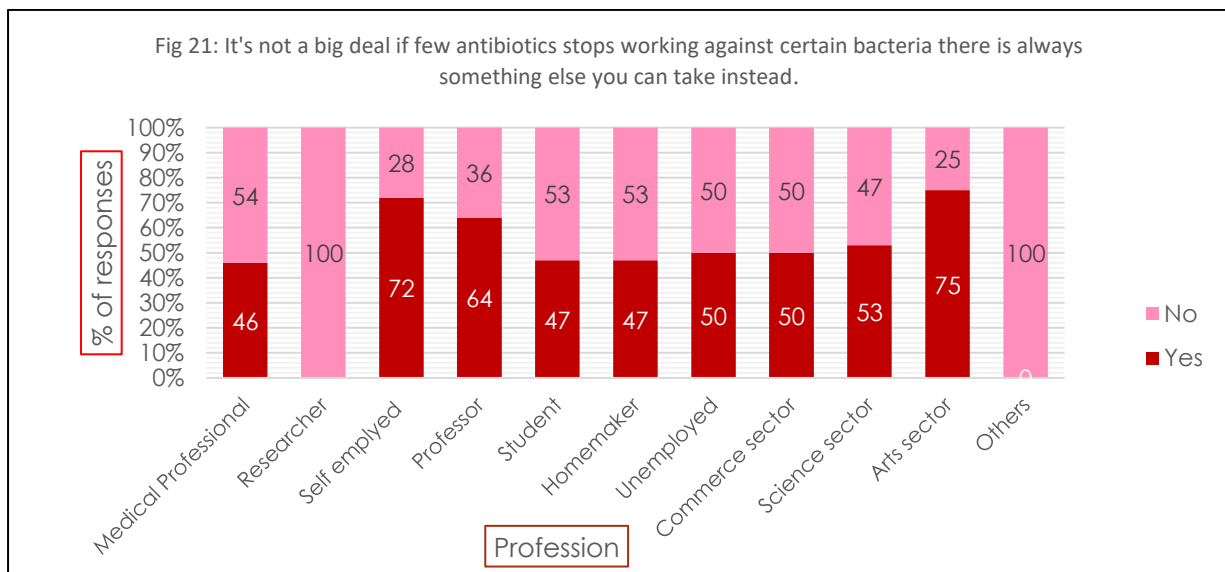


Figure 21: Percentages of responses from all respondents by segregating them on the basis of their mentioned profession to “It's not a big deal if few antibiotics stop working against certain bacteria there is always something else you can take instead.”

(Figure 21) We tried to know the respondents’ seriousness towards antibiotic resistance issue by asking them if it’s a big deal if few antibiotics stopped working against certain bacteria as there may be something else you can take instead and 51% overall answered ‘Yes’ which is incorrect and 49% overall answered **correct i.e. ‘No’**. A

significant amount of variation is seen when segregated on the basis of professions. Almost all categories had more than 50% of the population agreeing to this incorrect attitude towards antibiotics.

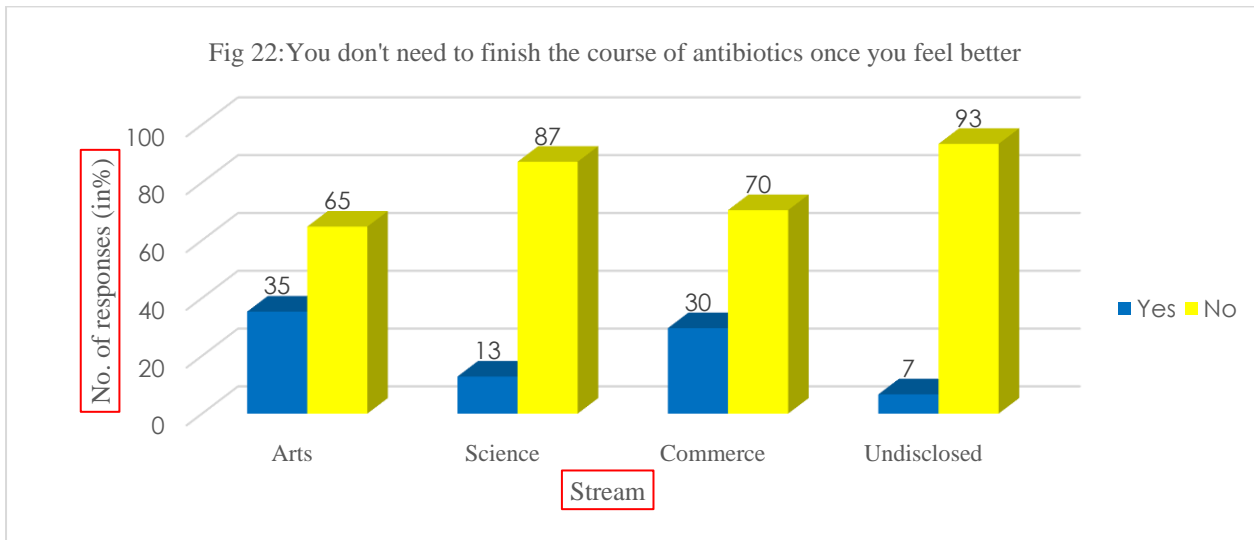


Figure 22: No. of responses (in %) from all respondents segregated on the basis of their stream mentioned to, “You don't need to finish the course of antibiotics once you feel better.”

(Figure 22) Respondents were inquired about whether they feel the need to continue antibiotic course even though they feel better to get the insight of the seriousness of the issue of antibiotic resistance which is affected a lot by the usage of antibiotics. We evaluated the responses on the basis of their stream and learnt that the percentage of the candidates the who answered incorrect i.e. ‘Yes’ were from arts background i.e., 35%, followed by commerce (30%), science (13%) and the undisclosed ones (7%). The correct practice is that even if you feel better you need to continue the course. Highest number of responses who answered correct were from undisclosed category (93%), followed by science (87%), commerce (70%) and the least but decent percent was of arts (65%).

### E.3) Respondents’ opinions to prevent Antibiotic Resistance

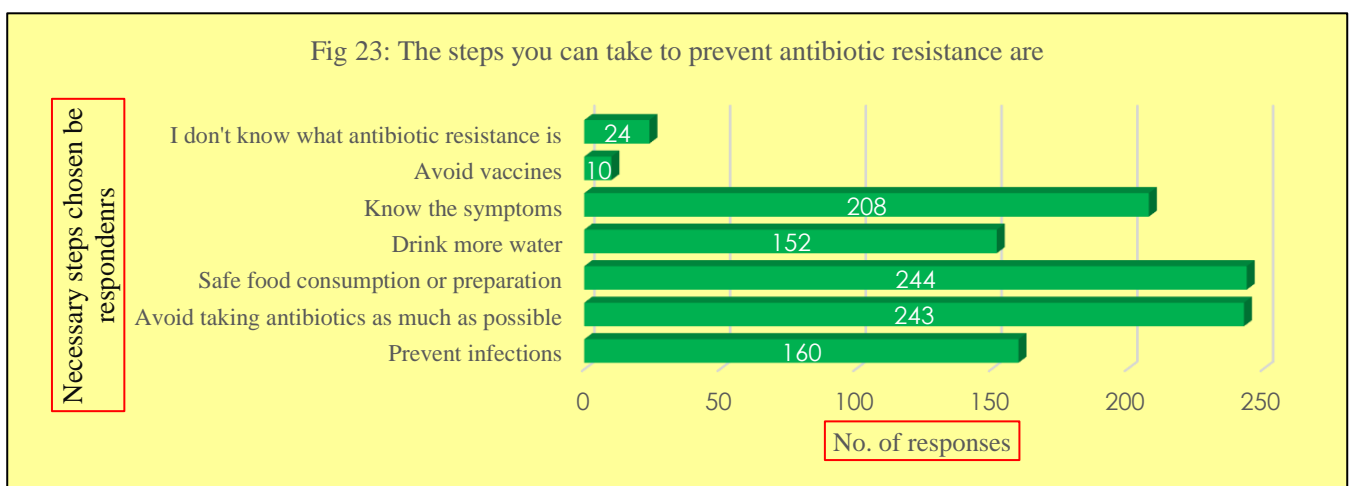


Figure 23: No. of responses from all respondents to, “The steps you can take to prevent antibiotic resistance are”



(Figure 23) The respondents were asked about their opinions to prevent antibiotic resistance and the correct answers were Prevent Infections, Safe food consumption/ preparation, Know the symptoms. Responses were highest for ‘Safe food consumption and preparation’ (n=244), followed by incorrect practice i.e., for ‘Avoid taking antibiotics as much as possible’ (n=243), ‘Know the symptoms’ (n=208), n=160 were for ‘Prevent infections’, ‘Drink more water’ was opted by n=152 respondents which may prevent infection but has no role in preventing antibiotic resistance, n=10 even opted for ‘Avoid vaccines’ which is the most inappropriate answer.

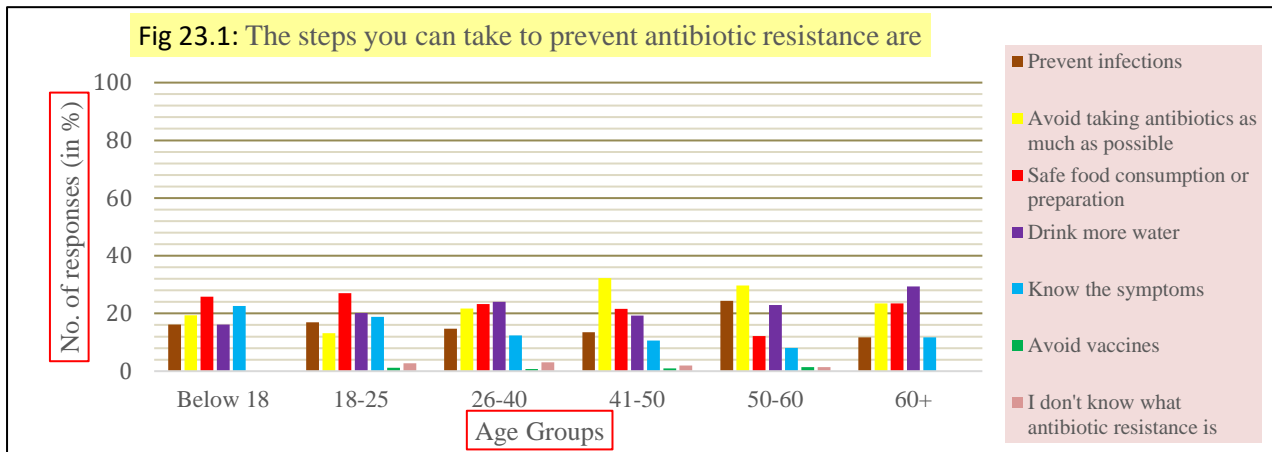


Figure 23.1: Percentages of responses from all respondents by taking the age demographic factor to, “The steps you can take to prevent antibiotic resistance are:”

	Prevent infections	Avoid taking antibiotics as much as possible	Safe food consumption or preparation	Drink more water	Know the symptoms	Avoid vaccines	I don't know what antibiotic
Below 18	16%	19%	26%	16%	23%	0%	0%
18-25	17%	13%	27%	20%	19%	1%	3%
26-40	15%	22%	23%	24%	12%	1%	3%
41-50	13%	32%	22%	19%	11%	1%	2%
50-60	24%	30%	12%	23%	8%	1%	1%
60+	12%	24%	24%	29%	12%	0%	0%

Table 23.a: Frequencies of responses from all respondents in percentage by taking the stream demographic factor to, “The steps you can take to prevent antibiotic resistance are:”

(Figure 23.1 and Table 23.a) The respondents were asked about their opinions on preventing antibiotic resistance, and their responses were categorised based on their age group, with the correct practices being: ‘Prevent Infections,’ ‘Safe Food Consumption/Preparation,’ and ‘Know the Symptoms.’. The ‘50-60’ age group had the largest proportion of respondents for ‘Prevent infections,’ accounting for 24%. The age group ‘18-25’ had a response rate of 27% for ‘Safe food consumption or preparation’ which was higher than the other age groups. Surprisingly, as compared to other age ranges, ‘Below 18’ had a higher response rate for ‘Know the symptoms’ i.e., 23%. For incorrect methods, there was also a significant amount of variance in all age groups. For example,

the highest number of people who chose ‘Avoid taking antibiotics as much as possible’ were in the ‘41-50’ age group.

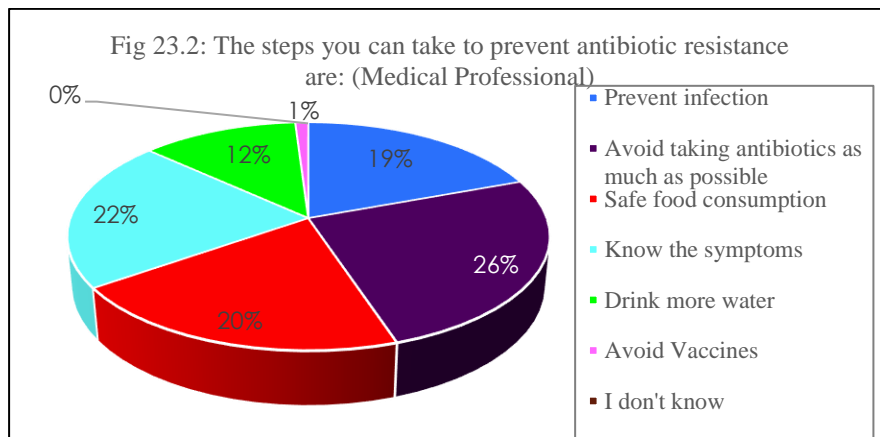


Figure 23.2: Percentages of responses from respondents who are Medical Professionals, “The best thing you can do to prevent antibiotic resistance is?”

(Figure 23.2) Among the medical professionals 19% chose ‘Prevent infections’, 20% chose ‘Safe food consumption/preparation’, 22% chose ‘Know the symptoms’ (these are the correct options).

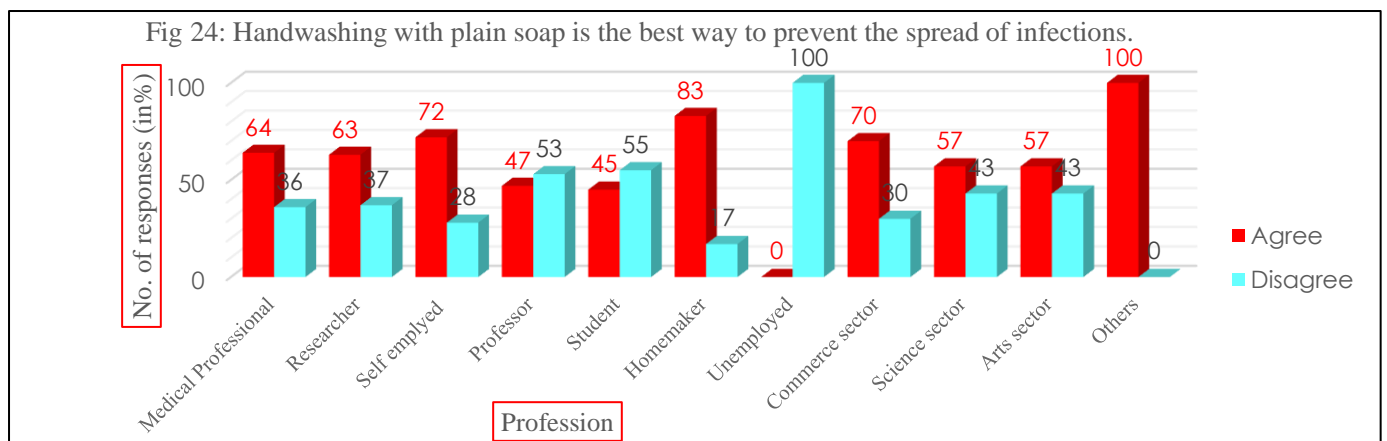


Figure 24: Percentages of responses from all respondents by segregating them according to profession mentioned by them to, “Handwashing with plain soap is the best way to prevent the spread of infections.”

Respondents from various professions were asked a very common but important question related to handwashing, which is the most important practice to prevent infections and maintain hygiene. The candidates were asked whether it’s a correct practice to use plain soap rather than soap with additional antibacterial properties and if we look at the graph, a huge amount of variation is seen. **57% (n=215) all over agreed to this practice which is the correct practice** whereas 43% (n=165) disagreed with this. Surprisingly, 36% Medical Professionals disagreed with this practice. (Figure 24)

#### IV. DISCUSSION

Antibiotic resistance is causing major health issues in India due to the high burden of infectious diseases,

unregulated sale of antibiotics, financial incentives for healthcare providers to prescribe antibiotics, patient expectations, rising incomes, and limited public health

response. The medical curriculum does not adequately focus on rational antibiotic prescribing. Physicians have been reported to overprescribe antibiotics because of financial incentives and patient expectations. Despite being costly, the consumption of antibiotics like carbapenems is increasing, possibly because of inappropriate prescribing and non-prescription sales. Evidence from China shows that eliminating financial incentives leads to an immediate reduction in the prescription of antibiotics. Self-administration of antibiotics bought without a prescription is also a serious concern. Thus, the smart use of antibiotics is the key to control the spread of resistance. Most of the major resistance control strategies recommend educating the general public to promote appropriate antibiotic use. (Patil et al,2019) In our study, a google survey form was circulated to 400 candidates out of which 380 consented to participate in the study. Our target population was the general public irrespective of their age, gender, profession, Education background. We conducted this survey to understand the correct usage of antibiotics and practices to be undertaken to prevent antibiotic resistance by the population. The responses which we got were segregated in various demographic factors such as age, gender, Profession, Stream.

In this study, we observed that the majority of people followed allopathy as their main system of medication. Similarly, Dr. Suryawanshi et al,2016 conducted a survey “to estimate medical vigilance related to awareness and status of allopathic, ayurvedic and homeopathic systems in rural population.” The only difference is that our population was urban rather than the rural one. In our findings, we observed that most of the people from the science background recognised the correct antibiotics from the options given as compared to respondents from other streams. The household study carried out by McNulty et al, 2019 on public understanding and use of antibiotics in England tested the knowledge of the public in a similar way. We tried knowing the usage pattern of antibiotic of

respondents by asking them certain question such as if they prefer keeping antibiotics at home for future use in which n=125 out of n=380 agreed to this inappropriate practice They were also asked if they do, they discontinue the course once they feel better, we learnt that n=62 out of n=380 agreed to this incorrect practice. Similar study was carried out by Jifar et al,2018 who conducted a research survey to assess Knowledge, Attitude, and Practice toward Antibiotic Use among Harar City and Its Surrounding Community, Eastern Ethiopia. According to our findings we realised that some respondents were suffering from certain side effects such as diarrhoea (12.6%), Itching (7.9%), dizziness (19.2%), Fatigue (17.6%), acidity (26.1%), Headache (11.1%), etc. A study and analysis were carried out by Carter et al,2016 of the American Public’s Perceptions and Knowledge About Antibiotic Resistance in which it mentioned side effects experienced by the public.

In our study we learnt that the candidates who are experiencing allergies are mostly due to Sulpha-containing antibiotics followed by amoxicillin and penicillin. A detailed review on allergy due to penicillin was carried out by Wanat et Al, 2018 which mentions patient’s and prescriber’s Views of Penicillin Allergy Testing and Subsequent Antibiotic Use. The respondents were asked regarding the alternatives given which can be used as natural antimicrobials in which all the alternatives given were correct but according to the responses, we got the highest number of individuals i.e., 80.5% opted for turmeric, followed by garlic 56.6%, honey 53.9%, clove 48.9%, oregano oil 7.9%, and the least for daisy flower 2.1%. From this we can estimate the percent of awareness regarding natural substances which can be used as antimicrobials and we observed a high amount of variation in the same. In the study carried out by Sharma et al, 2014 on antibiotic resistant organism: an emerging public health problem and role of Ayurveda in which he focuses to consider Ayurveda to treat bacterial infections rather than going for Allopathic treatments

which uses antibiotics which in turn may help in preventing antimicrobial resistance.

Furthermore, we found out that the majority of our sample population is taking antibiotics for cold and flu n=198 out of 380 and 39 out of 380 chose for migraine which is incorrect which can be one of the main reasons for antibiotic resistance. A similar study was conducted by Ateshim et al, 2019 on prevalence of self-medication with antibiotics and associated factors in the community of Asmara, Eritrea wherein it mentions self-medication of antibiotics for viral infections like cold and flu and other infections and the resistance caused due to it. Moreover, we tested the degree of awareness regarding the concept of antibiotics and we learnt that 107 people out of 380 believed antibiotic resistance as refusal of the body to accept antibiotics. In the study carried out by Carter et al, 2016 which was on American Public's Perceptions and Knowledge About Antibiotic Resistance tested the knowledge on antibiotic resistance in a similar way. As per our survey 'Below 18' and '18-25' age groups have more than 50% of the population completely unaware about the possibility of Acne treatment causing antibiotic resistance. {These two age groups are more prone to acne. So, there are more chances of these two age groups going for Acne treatment and hence they should be made aware about it. Hazanzadeh et al, 2008 had carried out an in vitro study on bacterial resistance on acne treatment. In certain treatments for conditions like Acne vulgaris (mostly the causative organism is Propionibacterium acnes) if the causative bacteria are not identified the doctor might prescribe a broad-spectrum antibiotic leading to the development of variant strains of bacteria leading to resistance. This finding was in compliance with another survey carried out on antibiotic resistance in acne treatment by Humphrey, 2012. Respondents were asked if it is a big deal if certain antibiotics stop working against few bacteria as heavy research is being conducted major part of the population i.e. 134 out of 380 agreed to this incorrect statement. This finding is in agreement with

the study carried out by Prigitano et al, 2016 on antibiotic resistance: Italian awareness survey 2016. There were many misconceptions regarding antibiotics among the public for e.g. taking antibiotics may weaken their body. Significant part of the sample population even thinks that antibiotics are supposed to kill all the bacteria in the body. However, non-science participants had a significant correct response rate although the concept is more foreign to their day-to-day understandings indicating that they are aware of specificity of action of an antibiotic to its target in the host. As people become more sensitive to taking antibiotics, the severity of an infection might increase which may be fatal to people who have such misconceptions. Many people believe that food that we consume doesn't affect antibiotic function which is untrue. Our diet greatly affects the degree of function of antibiotics in our body. These guidelines have been shown in detail in one of the online journals named 'Healthline'. The respondents were asked about their opinion on preventing antibiotic resistance in which we found a lot of variation. 160 out of 380 opted for prevent infections, 244 opted for safe food consumption/preparation while 158 for 'know the symptoms. These were the correct answers. Major part of the population also opted for the wrong options like avoiding antibiotics as much as possible (n=246), followed by drinking more water (n=208) and n=10 for avoid vaccines. These findings were compared with the guidelines given by WHO (Antibiotic Resistance, WHO, 2020). The participants were asked basic questions regarding whether handwashing with plain soap is better than an antibacterial soap, major part agreed to this practice which is correct as stated in the study done by Minnesota Department of Health.

## V. CONCLUSION

The finding that doctors have been the primary source of information for the majority, suggests a possibility of high consumption of antibiotics in the population. Teachers were found to be the second most prominent

source of information, and quite rightly so as a large number of respondents had their education background in science.

There is a need to educate the general public so as to enable them to distinguish antibiotics from other kinds of drugs, as it can be seen that Paracetamol and Crocin were commonly being confused as antibiotics. This finding further suggests that people might not be aware about the purpose of antibiotics and if they had known that it is used to fight bacterial infections, they would not have considered antipyretics and analgesics to be antibiotics. The message that antibiotics should strictly be taken by a doctor's prescription, should widely reach people, as self-medication is often a factor causing high frequency of side effects or cross reactions. Lack of authorized guidance can lead to ineffective antibiotic consumption owing to wrong dosage and/or wrong combination of an antibiotic with another antibiotic, or with another existing medication such as an oral contraceptive pill. We learnt that most of our survey candidates discontinue the antibiotic upon experiencing a side effect, however, it is suggested to consult a medical professional before reaching any decision. In many cases, if a person's symptoms are mild, the doctor may decide that he can continue taking the antibiotic if the benefits outweigh the side effects.

Higher occurrence of allergies in older people (as we found out from our survey) might have been an incentive for them to choose Ayurveda as an alternate, natural medicinal system. While the respondents seemed to know of the most common alternatives to antibiotics, we can make them more familiar with the relatively less popular ones as well (for example, capsicum). People whose bodies antibiotics are not suited and exhibit side effects, should be educated about an alternative medicine system.

However, an even greater need exists to make the general public follow the right antibiotic consumption practices, doing otherwise (for instance, we found out

that many of our participants prefer to keep antibiotics at home for future use) can be one of the main causes of side effects. An effort to reduce self-medication by the people at large has to be made. Misconceptions and misuse of antibiotics is a leading cause of antibiotic resistance; an issue we have elaborated in the latter section.

The general participant's selection behaviour indicated that Science participants in general were more aware of antibiotic usage, mechanism of action and impact of antibiotics on the body. Among several professions, medical professionals were well informed on usage and side effects of antibiotics. The study highlights that there has been a significant change in the status quo with respect to awareness of antibiotic usage and antibiotic resistance among the participants after taking the survey. Antibiotics do not adversely affect the body if it is taken optimally. However, taking too many antibiotics does not allow the body's immune system to act and develop. Among non-science participants, it was observed that there is misinformation spread amongst them in relation to antibiotic consumption. As perception of people becomes more sensitive to taking antibiotics, the severity of an infection might increase which may be fatal to people who have misconceptions regarding antibiotic consumption. Antibiotics are designed in a way so as to act only against its target. Non-Science participants were aware of specificity of action of an antibiotic to its target in the host although the concept is more foreign to their day-to-day understandings. We conclude that people may be more likely to take an antibiotic. Antibiotics for any illness can cause a disturbance of the normal bacterial flora e.g., leaving the gut intestine vulnerable to the growth of potentially disease-causing bacteria such as *Clostridium difficile*. A weak awareness among non-science participants to the mechanism of action of antibiotics on the body indicating that people do only take antibiotics cautiously under prescription/medical supervision and are generally less informed.

The concept of to a significant number of people in a sample population, 107 out of 380. Antibiotic resistance is a serious problem in society, and a lack of knowledge can exacerbate the situation. This condition will occur when antibiotics are not used properly. Antibiotics should only be taken with a correct prescription, and self-medication should be avoided at all costs. Overuse of antibiotics in treatments also causes antibiotic resistance. For example: acne treatment, in this particular situation large no. of antibiotics have been against *Propionibacterium acnes*. Hence, it has now become resistant to most antibiotics. When respondents were asked about if acne treatment led to antibiotic resistance, majority of the individuals of all age groups were unaware about this, especially the candidates below 25 age who are more prone to acne. There is a high possibility that these age groups may opt for the treatment, overuse can occur in this situation, also there are chances that a doctor may prescribe broad spectrum antibiotics if he couldn't diagnose the actual bacteria causing the problem which in turn may be the reason for antibiotic resistance. So, if self-medication occurs in this situation, it may elevate the problem. Antibacterial cleansers such as face wash, body wash can cause antimicrobial resistance and are not used for the correct purpose affecting the normal flora of the location of the body where the cleanser is used. Underuse of antibiotics is equally responsible as overuse of antibiotics for antibiotic resistance. When candidates were asked about if they agree to reducing antibiotics use in plants/animals reduce antibiotic resistance large no. of population agreed to this which is an incorrect practice. Improper/non-optimum use of antibiotics instigates the bacteria to cause mutations/changes within itself to overcome antibiotic effects and hence become resistant. Hence, correct dosage of antibiotics should be used to tackle the problem.

Taking the wrong antibiotic for a particular condition or disease also causes resistance. Antibiotics work only

against bacterial infection and not against any other microbe or disorder for e.g. migraine. Large no. of people use antibiotics for cold and flu which is a viral infection and from this survey we learnt that even some doctors prescribe antibiotics for the same which can affect the patient, which in turn may indirectly affect other populations too. So, consumption of antibiotics for this won't heal a person and in turn would disturb other normal bacterial flora of the body leading to resistance. We tried to know the respondents' seriousness towards antibiotic resistance issue by asking them if it's a big deal if some antibiotics stop working against certain bacteria.

Though heavy research is being carried out for new antibiotics we only have a limited number of antibiotics available. We must be responsible and should not count on being able to use something else if the resistant bacteria make you sick. Often, resistant bacteria have to be treated with stronger antibiotics. These stronger drugs may have more side effects and you may have to stay in the hospital, and have them given through a vein! We calculated from the survey that many people have the habit of discontinuing antibiotics once they feel better and not completing the course, which is not a correct practice and may be a contributing factor to the antibiotic resistance issue. Even if you feel better, you must take all of the antibiotics prescribed by your doctor. You must eliminate all of the germs that made you sick.

When we reviewed the survey findings, we discovered that the majority of people lacked awareness about antibiotic resistance as well as the use of antibiotics, which ultimately leads to resistance. To prevent antibiotic resistance, there is a need to raise public awareness about good major practices that should be practiced by the general public, such as:

- Prevent infections- By ensuring proper hand hygiene, one can avoid frequent infections, thereby reducing the need for antibiotics.



- Safe food consumption/preparation- This does not allow for resistant bacteria to enter our bodies.
- Knowing the symptoms well shall help the doctor to understand your condition more precisely, eliminating the need to prescribe a broad-spectrum antibiotic, thus lowering the chances of developing resistance.

When responses for opinions on antibiotic resistance prevention were segregated, a significant proportion of the population over the age of 50 opted for incorrect practices. These individuals are more likely to have weakened immune systems and be susceptible to multiple infections. People with weak immune systems may be more affected by antibiotic resistance than those with stronger immune systems; thus, adequate awareness of the current antibiotic resistance issue and practices to be followed to prevent it in society is needed so that people can live a healthier life. When respondents were asked about their belief whether plain soap is better than soap with additional antibacterial properties for preventing infection. This incorrect practice was disagreed by 165 of the 380 respondents. Again, a resounding no. sufficient to cause/increase resistance. Plain soap will remove the dirt and grease that attract bad bacteria and viruses. Plain soap does not promote antibiotic resistance in the bacteria that normally live on our hands or in our environment. Using antibacterial products unnecessarily increases the concentration of antibiotics in the water supply and in the environment and may contribute to antibiotic resistance.

The results of this survey have revealed that there is a lack of knowledge among medical professionals too, who are the ones who prescribe us medicines, which in turn affects the patients and could eventually affect the general population. As a result, there is an urgent need to raise awareness about the measures that everyone must take to control this resistance.

## VI. ACKNOWLEDGEMENT

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