

Knowledge Regarding Antibiotic Abuse amongst Dental Students of a Dental College in North India

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Abstract: *Aim: Dentists are probably contributing to the development of antibiotic resistance to certain level. Antibiotics are prescribed by dentists in dental practice, during dental treatment as well as for prevention of infection. The objective of this study is to comprehensively evaluate antibiotic prescription knowledge, its correct dosage and its basic requirement to be advised by dental students of a dental college in North India. This paper highlights the need for dentists to improve antibiotic prescribing practices in an attempt to curb the increasing resistance and other side effects of antibiotic abuse. Material and methods: A pre designed questionnaire was carried out on students of third year, final year and interns of a dental college of north India. A total of three hundred and twenty one students including all the batches attending clinical postings and lectures were included in the study. A questionnaire with 11 questions was prepared following a likart scale of 3 grading system with answers graded as "Yes, No and Don't know". Result: The response rate was 100%, 321 fully completed the questionnaire. All the analysis was done using SPSS version 18. A p-value of <0.05 was considered statistically significant. Chi-square test was done to evaluate significant differences between categorical variables. The analysis was performed twice, once with and once without the inclusion of don't know option for the responses to the questionnaire. Conclusion: Dental students require further education through lectures and revision classes to stay up to date on current concepts of antibiotics use as the level of knowledge was hardly intermediate and several deficits were identified.*

Keywords: antibiotics, WHO guidelines, antibiotics abuse, antibiotic resistance

1. Introduction

Antibiotics are medications directed against bacterial infections. These are drugs that are life-savers, yet extensively abused. This in turn lead to ineffectiveness of the drugs due to development of bacterial resistance.

When the first antibiotics were introduced in the 1940s, they were hailed as "wonder drugs", the miracles of modern medicine¹. Widespread infections that killed millions of people every year could now be cured with the correct use of antibiotics. Major diseases, like syphilis, gonorrhoea, leprosy, tuberculosis and streptococcal throat infections in children lost much of their sting. The risk of death from such dangerous diseases became curable and eventually vanished with the correct dosage schedule of antibiotics. The powerful impact of these medicines sparked a revolution in the discovery of new drugs. The human condition took a dramatic turn for the better, with significant jumps in life expectancy.

The National Centre for Disease Control (NCDC) has brought out a publication on National Antimicrobial Use Guidelines for Infection Disease, which paved the way for rationalising the use of antimicrobials in the health care facilities in our country, thereby reducing the development of antimicrobial resistance.² It is emphasized in the guidelines that antimicrobials should be prescribed only when they are necessary in treatment following a clear diagnosis. Not all patients need antibiotics; non-drug

treatment may also be suitable³. In this regard Government of India has launched a "National Programme on Containment of Antimicrobial Resistance" under the 12th five year plan (2012-2017).

Prior to 2007, patients with nearly every type of congenital heart defect received antibiotics one hour before dental procedures or operations on the mouth, throat, gastrointestinal, genital, or urinary tract⁴. In 2007, the American Heart Association (AHA) stated that for most people, taking antibiotics for routine dental procedures was no longer recommended. Based on this recommendation, the American Dental Association (ADA) followed suit that same year, changing its prophylactic antibiotic protocol. But many dentists still widely prescribe antibiotics for routine dental procedures, and are simply not following the updated recommendations. Most dentists don't realize that harmful bacteria from oral cavity can get into your bloodstream at any time. Simply flossing or brushing the teeth, or even chewing food can increase the transfer of bacteria into your blood. The truth is, practicing healthy dental hygiene is more beneficial to prevent bacteria from getting into bloodstream than antibiotics ever will.

The most common prescribed medicines by dentists are the antibiotics along with analgesics. Antibiotics are a safe drug that only attacks microbes, and there is no direct effect on the host. Many dentists have reported that their patient demand antibiotics prescription for the treatment of dental infection⁵ and general infections like common cold and

gastro intestinal infections etc. So it is often seen that there is an increasing habit of prescribing antibiotics amongst the practitioners as well which is totally inappropriate. We have taken antibiotics and other antimicrobials for granted. And we have failed to handle these precious, yet fragile medicines with appropriate care.

The routine use of antibiotics in dentistry, in both pre and post-surgical procedures, was stated by American Dental Council standard of care for many decades and is still widespread today. Many natural health experts believe that dentistry is the medical discipline guilty of some of the most common antibiotics abuse. When physicians prescribe antibiotics for unnecessary conditions, several negative consequences happen. First, the overuse of antibiotics promotes the natural mutation of common bacteria, ultimately resulting in the creation of new, resistant strains. In fact, health experts around the world blame the abuse of antibiotic drugs for today's epidemic of superbugs.

Drug-resistant bacteria are the new drawback of over-prescribing antibiotics⁶. The chance of having an adverse reaction is associated with antibiotic, and antibiotic, and also deplete the body of the necessary beneficial bacteria in intestines that is properly necessary to digest your food and protects your body from pathogens resulting into disturbance in the intestinal flora. With the proper use, in the correct context and with responsibility, antibiotics can save lives that are threatened by bacterial infections. But they will only remain effective if urgent changes are made to curb the spread of antibiotic-resistant bacteria and disease.

Dentists prescribe medications for the management of a number of oral conditions, mainly orofacial infections, since most human orofacial infections originate from odontogenic infections⁷. The prescribing of antibiotics by dental practitioners has become an important aspect of dental practice. For this reason, antibiotics account for the vast majority of medicines prescribed by dentists.⁸ Dentists prescribe between 7% and 11% of all common antibiotics (betalactams, macrolides, tetracyclines, clindamycin, metronidazole).⁹ Antibiotics are prescribed by dentists for treatment as well as prevention of infection. Indications for the use of systemic antibiotics in dentistry are limited, since most dental and periodontal diseases are best managed by operative intervention and oral hygiene measures. However, the literature provides evidence of inadequate prescribing practices by dentists, due to a number of factors ranging from inadequate knowledge to social factors.

Antibiotic resistance, a global concern, is particularly concerning in developing nations, including India, where the burden of infectious disease is high and healthcare spending is low¹⁰. The Global Antibiotic Resistance Partnership (GARP) was established to develop actionable policy recommendations specifically relevant to low- and middle-income countries where suboptimal access to antibiotics (not a major concern in high-income countries) is possibly as severe a problem as is the spread of resistant organisms.

Irrational and inappropriate use of antimicrobials is by far the biggest driver of drug resistance. Evidence shows that pathogens that have developed resistant to drugs in animals

can be transmitted to humans. So to avoid the loss of essential medicines which cures many millions of people, correct knowledge of antibiotics and correct dosage schedule should be followed by the dental practitioners to avoid the next global crisis.

The World Health Organisation in 2011 has set the theme of World Health Day as "Combat Antimicrobial Resistance : No Action Today, No Cure Tomorrow".¹¹ This shows a serious and global problem of antibiotic abuse and there is a growing consensus to urgently develop new strategies for prevention of resistance of bacteria to antibiotics. In recent years, an increasing number of researchers have focused their attention on antibiotic misuse, and pursued interest in knowledge, attitude and practice (KAP) towards antibiotics use of public,^{11,12,13,14} medical and dental practitioners.

The surveys have been done which reflect the general public's lack of understanding on proper use of antibiotics. Thereby, it reinforces the necessity that establish certain guidelines for public education on the use of antibiotics. Such guidelines would help rationalize public practice in relation to antibiotics use.^{15,16}

Dental students represent a highly practised group of dental personnel and their knowledge, attitude and behaviour in relation to public usage of antibiotics can greatly impact in the future on antibiotic-related issues India. No literature is reported in this part of the country, which necessitated a study of this kind.

This study hence aims to investigate dental students awareness in relation to antibiotics, its "use" and "abuse".

Aim

To assess awareness regarding antibiotic abuse among dental students of a dental college in North India.

Objectives

- To assess awareness regarding the use of antibiotics against different infections.
- To assess awareness regarding side effects / limitations associated with antibiotic abuse.

2. Methodology

This was a questionnaire based study carried out on students of third year, final year and interns of a dental college of north India. A total of three hundred and twenty one students including all the batches attending clinical postings and lectures were included in the study. A questionnaire with 11 variables was prepared based on a likert scale grading system with answers graded as "Yes, No and Don't know". (Questionnaire is attached as annexure). Questionnaire was pretested in a small group of students by doing a pilot study and the same questionnaire was adopted without any modification. The questionnaire contained 11 questions covering the knowledge of antibiotics, the reason for prescribing the drug, its correct use and dosage, frequency of drug abuse in systemic infections, its effectivity on bacterial and viral infections, knowledge of its side effect in affecting the intestinal flora and drowsiness, its duration as a complete dosage and awareness of the term "antibiotic resistance"

covering the concept of drug sensitivity and susceptibility. The questionnaire was handed to the students after explaining the purpose of the study. Any doubts regarding questionnaire were clarified by investigator. Adequate time was given for completing the questionnaire. The questionnaire format was adopted from the author “Ying Huang et al.”¹⁷ which was predesigned and validated questions in order to ensure the completeness and relevance of the topic.. The data was collected by administering a closed-ended 11 variable questionnaire including all the students available on the day of the study. The study was performed for 15 days. The students involved were from three batches of a dental college, including third year students, final year students and intern batch. Only these three batches were selected as they have the clinical exposure and as they prescribe antibiotics on a regular basis (though under the supervision of the staff). First and second year curriculum concentrates on preclinical work primarily hence they are not included. Third year, final year and interns were chosen for the study as these students have clinical exposure and also prescribe antibiotics on a regular basis, though under supervision of staff.

3. Results

The obtained data was analysed using SPSS 18.0 version.

A total of 321 students participated in the present study. Out of which third years constituted 31.2% of the sample, 31.2 % were final year students and interns constituted 37.2% among the total sample size of 100 % (table 1)

A p-value of <0.05 was considered statistically significant. Chi-square test was done to evaluate significant differences between categorical variables. The analysis was performed twice, once with and once without the inclusion of don't know option for the responses to the questionnaire.

Graph 1 depicting the distribution of students, year wise. Table 2 shows that all the 3rd years and the interns who participated in the study knew exactly as to why the antibiotics were prescribed while 4% of the final years had no idea regarding the same.

It was surprising to note that 12% of the final years did not know that different antibiotics were available for different systemic infections while 4% of the third years express the same. 2.5 % of the interns were unaware of the fact that different antibiotics formation are available for different infections which is statistically significant at <0.001. (Table 2)

Among the 3rd year students, 84% had the idea that antibiotics are effective for bacterial infection. 94% of final year students surely answered that antibiotics are used for bacterial and 94.2% interns responded correctly whereas the uncertainty antibiotics use for viral infections was 0% among the 3rd years 2.0% in final years and 1.7% of interns which was significant at 0.002. (Table 2)

On questioning effectiveness of antibiotics against viral infections 76% of the 3rd years gave the correct answer as compared to 59% of the final years and 56.2% of the interns

which was statistically significant at p<0.001. It is disastrous to know from present study that almost 50% of the interns has the misconception of antibiotics been used for viral infections , 42% thought antibiotics could be used for viral infections while 1.7 % has no idea regarding the same. (Table 2)

No significant difference was found on knowledge of correct antibiotic dosing schedule amongst all the three batches with the p level of 0.282. (Table 2)

Surprisingly amongst the focussed group participants 95% of 3rd years and 91% of final years students knew about the side effects caused by antibiotics, which came out to be more than interns scoring 79.3 % which is significant at p level < 0.004. (Table 2)

The difference with the knowledge of antibiotics was also seen amongst all the three batches with interns having the least idea to 61.2%, final years scoring 75.0 % and third years leading with 80 % score stating that antibiotics can cause secondary infections. (Table 2)

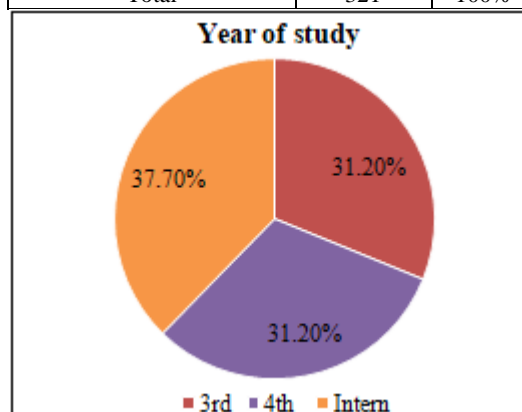
When asked if its desirable to stop antibiotics early once symptom free, no significant difference was seen among the respondents from final years and inters scoring 60 % - 60.3% and third years with least knowledge which is 57.6%. (Table 2)

It is overwhelming to note that majority knew that it is mandatory to finish the course of antibiotics even if the symptoms are improving.

The last question was related to antibiotics resistance knowledge. The majority of participants were aware that antibiotics resistance is a phenomenon for which a bacterium loses its sensitivity to antibiotics and that misuse of antibiotics can lead to antibiotic resistance. With a good 94% of 3rd years, 81% of final years and 84.3% of interns being aware of antibiotics abuse which was though not significant at p level of 0.06. (Table 2)

Table 1

Year of Study	N	%
3 rd	100	31.2%
4 th	100	31.2%
Intern	121	37.7%
Total	321	100%



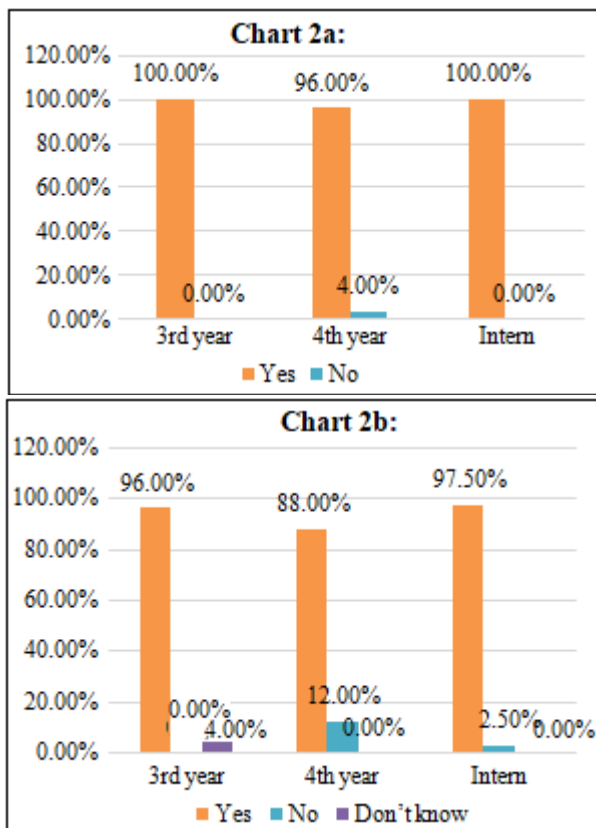


Table 2: Distribution and comparison of the response for the questionnaire responses with respect to the year of study

		Year of Study						p-value†	p-value‡
		3 rd		4 th		Intern			
		N	%	N	%	N	%		
Q 1	Yes	100	100.0%	96	96.0%	121	100.0%	-	0.011; Sig
	No	0	.0%	4	4.0%	0	.0%		
Q 2	Yes	96	96.0%	88	88.0%	118	97.5%	<0.001; Sig	<0.001; Sig
	No	0	.0%	12	12.0%	3	2.5%		
	Don't know	4	4.0%	0	.0%	0	.0%		
Q 3	Yes	84	84.0%	94	94.0%	114	94.2%	0.002; Sig	0.001; Sig
	No	16	16.0%	4	4.0%	4	3.3%		
	Don't know	0	.0%	2	2.0%	3	2.5%		
Q 4	Yes	15	15.0%	39	39.0%	51	42.1%	<0.001; Sig	<0.001; Sig
	No	76	76.0%	59	59.0%	68	56.2%		
	Don't know	9	9.0%	2	2.0%	2	1.7%		
Q 5	Yes	61	61.0%	52	52.0%	67	55.4%	0.282; NS	0.898; NS
	No	31	31.0%	30	30.0%	34	28.1%		
	Don't know	8	8.0%	18	18.0%	20	16.5%		
Q 6	Yes	95	95.0%	91	91.0%	96	79.3%	0.004; Sig	0.009; Sig
	No	2	2.0%	7	7.0%	15	12.4%		
	Don't know	3	3.0%	2	2.0%	10	8.3%		
Q 7	Yes	80	80.0%	75	75.0%	74	61.2%	0.009; Sig	0.027; Sig
	No	9	9.0%	18	18.0%	25	20.7%		
	Don't know	11	11.0%	7	7.0%	22	18.2%		
Q 8	Yes	36	36.4%	35	35.0%	32	26.4%	0.114; NS	0.44; NS
	No	57	57.6%	60	60.0%	73	60.3%		
	Don't know	6	6.1%	5	5.0%	16	13.2%		
Q 9	Yes	92	92.0%	90	90.0%	100	82.6%	0.204; NS	0.164; NS
	No	6	6.0%	9	9.0%	16	13.2%		
	Don't know	2	2.0%	1	1.0%	5	4.1%		
Q 10	Yes	58	58.0%	58	58.0%	116	95.9%	<0.001; Sig	<0.001; Sig
	No	26	26.0%	24	24.0%	4	3.3%		
	Don't know	16	16.0%	18	18.0%	1	.8%		
Q 11	Yes	94	94.0%	81	81.0%	102	84.3%	0.06; NS	0.011; Sig
	No	4	4.0%	17	17.0%	17	14.0%		
	Don't know	2	2.0%	2	2.0%	2	1.7%		

Chi-square test; †p-value with Don't know option; ‡p-value with Don't know option excluded.

4. Discussion

This study aims at assessing the knowledge of dental students towards antibiotics abuse in the form of questionnaire. Our study provides useful information about the knowledge and the practices of dental students with respect to antibiotic resistance and usage, which may be utilised to plan suitable educational interventions that aim at improving the antimicrobial prescribing and use.

The questionnaire was distributed to dental students in a dental college. Even though these students were not yet fully responsible for prescribing, many deficiencies were noted in their practices. It is the responsibility of the institution and the dental educators to solve any such deficiencies so that graduating students become highly competent in their professional practice.^{18,19} In the Dental College, students take a pharmacology course in the second year that covers prescribing, but it accounts for only six hours of the curriculum, which is too little time for such an important topic that directly affects patient safety.^{20,21} but still 3rd year students seem to have better knowledge of antibiotics uses, its side effects and awareness of antibiotics resistance which is a nationwide problem in the present scenario when compared with the final year students.

Clinical training for undergraduate students often focuses on diagnostic rather than therapeutic skills. Especially in final year when students aim to complete their practical work mainly they unintentionally ignore the consequences caused by the medicines and they just copy the prescription of their clinical teachers or seniors which many a times doesn't meet the existing standard treatment guidelines which may cause many side effects to the patient without meeting the prime cause or ones requirement. In this study we came across many such questions about antibiotics which were wrongly answered by final years or they were uncertain showing their mal practice and lack of revision of the subject to be referred. In this case books may not be of much help either later once it becomes their part of practice.

But surprisingly, inspite of the casual attitude, the reported practices of our study showed that the knowledge of intern participants with regards to antibiotic use were found to be satisfactory. Findings shows, that interns were aware as to why the antibiotics are prescribed, its common side effects, its dosing schedule and the principle causes of the resistance against antibiotics.

Pharmacology training for most dental students concentrates more on theory than on practice. The material is often drug centred and focuses on indications and side effects of different drugs. But in clinical practice the reverse approach has to be taken, from the diagnosis to the drug. Moreover patients vary in age, gender, size and sociocultural characteristics, all of which may affect treatment choices. All this is not always taught in dental schools, where the number of hours spent on therapeutics may be low compared to traditional pharmacology teaching. As a result although

pharmacological knowledge is acquired, practical skills remain weak.

We have all heard of bacteria that have become resistant to antibiotics, having thus 'evolved', and now threatening humans with an epidemic. If we examine the literature we come to know that in most cases, there were bacteria prior to the introduction of the antibiotic that already had the resistance. The other bacteria were selected away by the antibiotic and we are left with the resistant bacteria. For example, there was a 1988 University of Alberta study of bacteria on the bodies of Arctic explorers frozen in 1845.

Investigators discovered that some of the bacterial strains were resistant to antibiotics. As for antibiotics, most students chose penicillin, mainly amoxicillin, which is appropriate since it is the first choice in dentistry,²² however, student erroneously prescribe antibiotics instead of an NSAID. No student mentioned antibiotic combinations, especially for complicated cases of infection, which could compromise systemic health, mainly in patients with heart conditions. In such cases, the American Heart Association recommends high doses of different antibiotics, such as amoxicillin, ampicillin, clindamycin, cephalosporin, etc, 30 to 60 minutes before beginning the dental procedure.²³ For antibiotics, the professor always needs to approve and sign the prescription.

Drug Controller General of India under the gamut of Central Drugs Standard Control Organization is responsible for approval of licenses of specified categories of drugs such as blood and blood products, IV fluids, vaccines and sera in India. The central government have established 4 zonal offices of CDSCO at Mumbai, Kolkata, Chennai, and Ghaziabad, which works in close collaboration with the state control administration and assist them in securing uniform enforcement of the Drug Act.

The result of this study is that although pharmacological knowledge is acquired, practical prescribing skills remain weak. In one study, dental graduates chose an inappropriate or doubtful drug in about half of the cases, wrote one-third of prescriptions incorrectly, and in two thirds of cases failed to give the patient important information. Some students may think that they will improve their prescribing skills after finishing undergraduation, but research shows that despite gains in general experience, prescribing skills do not improve much after graduation also. Bad prescribing habits lead to ineffective and unsafe treatment, exacerbation or prolongation of illness, distress and harm to the patient, and higher costs. They also make the prescriber vulnerable to influences which can cause irrational prescription. Later on, new graduates will copy them, completing the circle. Change in existing prescribing habits is very difficult but mandatory. So good training is needed before poor habits get a chance to develop. World health organisation Action Programme on Essential Drugs has launched a manual exclusive for dental students (guide to good prescription).²⁴

It would appear from this study that the student's knowledge regarding proper use of antibiotics doesn't improve as they progress in their studies attaining more of dental curriculum. Similarly, the awareness of antibiotic abuses and development of drug resistance in bacteria shows the

demand of improvement for final years and interns. Our study clearly reveals that the third year respondents has a more positive behaviour on the usage of antibiotics compared to higher grade dental students including interns despite they get more exposure to patients, prescription and should understand consequences of antibiotics abuse during their practice session more. We analyse that the most senior (year 4) scores on knowledge towards antibiotics use were lower than those of their junior colleagues (year 3) indicating that there could be some negative impact on public health.

The results of our study showed that the knowledge of when antibiotics should be used, the efficacy of antibiotics as well as the risk of antibiotic resistance is inadequate in participants illustrated <50% correct response. Confusion among the dental students regarding whether antibiotics are effective against bacteria and viruses was unclear. Actually, it was argued that many people do not understand the differences between bacteria and viruses and believed that antibiotics work against both (McKee et al., 1999). The knowledge concerning these issues is striking. Significantly, respondent's knowledge regarding antibiotic use was associated with age. Younger respondents (3rd year dental students) were more likely to know about antibiotics. The excessive use of antibiotics must be reduced by giving priority to knowledge-based education programs for younger generation in Indian community. However, it is not this simple as in India people have the tendency of buying medicines from the pharmacist directly without any prescription. It is a well known fact that the uncontrolled use of antibiotics could lead to substantial and serious problems with the emergence and prevalence of resistant microbial strains, which is a worldwide problem (Hawkey, 1998) Resistance to antibiotics drugs has been linked to levels of consumption (Austin et al., 1999; Linares, 1998) with evidence of a cause-effect relationship (Steinke and Davey, 2001).

A news report by the World Bank (Vice-News) said that human antibiotics resistance coupled with the rise of superbugs could potentially kill 10 million by 2050 and ruin some countries economy²⁵. People are beginning to demand more organic food these days that includes meat of animals which remain untreated by antibiotics. Researches show that when this type of meat is consumed by humans they form antibiotic resistance that means we are becoming limited with the treatment of infectious bacterial diseases which cannot be treated by antibiotics anymore resulting into global increase of infections.

India is one of the world's largest producers of antibiotics and United States is its number 1 customer. The billion-dollar industry helps make affordable drugs for millions of people but it comes at a steep price. Hyderabad known as India's pharma capital has been recently reported for contributing to antibiotic resistance by polluting the drinking water (river water) with the hazardous waste coming out from pharmaceutical factories which is making common illness to increase and hard to treat with the risks giving rise to the next "superbug". This is the dark side of India's drug boom. It is ironical to know that many cities like Hyderabad including our capital-Delhi has developed a resistance against many drugs which are used making the treatment

difficult to impossible These bacteria's in media are known as "Superbugs". The worse part is that now even medical practitioners have begun to develop the fear that now the diseases would be so hard to treat because there may not be a drug to treat them at all. medical professionals should come face to face to discuss the rising epidemic. Culture sensitivity is wisely advisable before starting any kind of medications to avoid resistance. It is alarming to note that WHO has published a list of 12 superbugs; most of them which are present in India.²⁶

This study supports the facts that there is a lack of knowledge of the use of antibiotics in practice and that dental students need clear advice on when and what to prescribe, for how long and in what dosage. The prevalence of unrestricted acquisition of antibiotics, the pattern of physician's prescriptions and the impact of these factors on antibiotics resistance need to be monitored.

Limitations: The inherent defect of closed-ended questions is that respondents cannot answer however they wish; this defect can become an asset, however, as the responses may not be confusing provided the researcher with lot many categories to investigate and less hypothesis error.

5. Conclusion

This survey of dental students reveal that the north Indian dental curriculum significantly needs improvement with their knowledge related to antibiotics misuse and its consequent effects. We propose the addition of a special class/course on rational prescription of antibiotics, its correct dosage, its major side effects and emphasize more on the advance knowledge of antibiotics resistance causing global warning to the students regularly as a part of their curriculum till they get into the habit of following an proper protocol issued by World Health Organisation regarding guidelines for dentistry medicine.

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Annexure

Questionnaire

Please answer all the questions

- 1) Do you know why antibiotics are prescribed?
 Yes No
- 2) Are different antibiotics available for different systemic infections (throat infection, RTI, UTI,GIT Infections etc) ?
 Yes No Don't know
- 3) Are antibiotics effective for bacterial infection?
 Yes No Don't know
- 4) Are antibiotics effective for viral infection?
 Yes No Don't know
- 5) Do you know the correct dosing schedule?
 Yes No Don't know
- 6) Do you know that antibiotics have possible side effects?
 Yes No Don't know
- 7) Do you know that antibiotics disturbs intestinal flora as a side effect?
 Yes No Don't know
- 8) Is it desirable to stop antibiotics early when symptom-free?
 Yes No Don't know
- 9) Should antibiotics be taken in full course to be effective?
 Yes No Don't know
- 10) Are you aware that antibiotics may be ineffective if full course is not taken previously?
 Yes No Don't know
- 11) Are you aware of the term "antibiotic resistance"?
 Yes No Don't know