

"Public's Perception, Knowledge, Attitude and Behaviour on Antibiotic Resistance- A survey in Davangere City, India"

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Abstract

The questionnaire based study was carried out with the focus to assess the awareness, behavioural attitude and practice towards antibiotic usage and development of its resistance among the patients visiting outpatient Department of Periodontics, Bapuji Dental College and Hospital of Davangere, Karnataka.

Of all the participants who took part in the study, 74.2% patients had no knowledge and 75% of them were unaware of ill effects of antibiotic resistance. 70% patients showed confusion between Antibiotic and Antiviral drugs. On assessing patient's behavioural attitude towards practice of antibiotics, 80.4% patients were found to practice incomplete antibiotic course and 64.5% patients shared their antibiotics with a sick family member. During emergencies, 74.7% patients used the kept antibiotic stock without seeing the expiry date. 86.2% patients found to have a practice of taking previously prescribed antibiotic again for the similar incidence without consulting a doctor. 74.5% patients expected to get antibiotic prescription whenever they consult a doctor.

Although the results of this study cannot be generalized to other cities of India, unawareness of antibiotic resistance and poor behavioural attitude towards the antibiotic usage can be a concern for Karnataka state or even a contributing factor of antibiotic resistance in India. It highlights the need of educational interventions to increase the alertness about the consequences of antibiotic misuse and/or abuse and also to develop responsible behavioural attitude to practice antibiotic usage. The vital role played by them in prevention of antibiotic resistance can produce a powerful impact not only on individuals but also on the community to combat this universal threat.

Keywords: Antibiotic Usage, Antibiotic Resistance, Public Health, Knowledge, Attitude, Health Education

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Introduction

A milestone in the history of medicine was the discovery of penicillin that took place in 1928 by the British physician and bacteriologist Alexander Fleming. It was in 1940, during World War II, that Penicillin saved countless lives and this led to the discovery and development of many natural and synthetic antibiotics. Previously there were some diseases that were considered life threatening but with the advent of antibiotics, they were soon considered little more than irritants. In present antibiotic era, a massive outpouring of advertisements by pharmaceutical companies and publications of clinicians (Medical & Dental) created a myth that "antibiotics would cure all illness and even is not hurtful on extensive use."¹

A widespread misuse and/or abuse of antibiotics and genetic plasticity of bacteria resulted in the development of resistance against these miracle drugs. The resistant

bacteria survive, exchange their resistant traits and continue to multiply to cause more harm to the host. Thus, the World Health Report 2007 stressed the matter of antibiotic resistance as one of the major threats to public health security in the 21st century.¹

Antibiotic resistance has been a low-priority area in most developing and many developed countries. Being the most commonly sold drug classes, the irrational and overuse of antibiotics results not only in the emergence of resistant bacterial strains but also becomes an economic burden on national health system. To highlight the issue, "Antimicrobial Resistance: no action today, no cure tomorrow" was selected as the theme of World Health Day in 2011.² The widespread nature of the problem has made some experts to speculate about a "post-antibiotic era." A newest report by WHO about antimicrobial resistance, including antibiotic resistance, reveals that this serious threat is no longer a prediction for the future, it is happening right now in every region of the world and has the potential to affect anyone, of any age, in any country.³

The possible causes for the overuse of antibiotics include the following: (i) lack of microbiology facilities or unwillingness of patients to undergo tests;⁴ (ii) repetitive prescriptions of antibiotics by doctors to any patient with a fever (taking it as a sign of bacterial infection) (iii) also as postsurgical prophylactic regimen especially when doctors are concerned that, the patient

will not return for follow up;⁴ (iv) the patient's expectation of being given an antibiotic over-the-counter or a prescription for one at the doctor's office;⁴ (v) incentives offered from pharmaceutical companies to doctors to make a profit from drug sales;⁵ (vi) public's lack of knowledge about the appropriate use of antibiotics;^{4,6} and vii) poverty driven misuse and /or abuse of antibiotics.

Prescription patterns of various medical and dental practitioners were considered as an important factor for antibiotic resistance to emerge and spread. Consequently, literature and scientific evidence are being published to increase responsiveness among all health care professionals to reduce unjustified antibiotic prescriptions. On the contrary; self-medication, noncompliance by the patients were found to augment the antibiotic resistance threat.⁷

In many countries like India, France, Europe, Australia; campaigns have been conducted to provide knowledge about correct and appropriate antibiotic usage but still the risk continues. This could be due to the lack of awareness amongst the public about "antibiotic resistance and its adverse effects."⁸ An individual's inappropriate attitude about the use of antibiotics has been found to be a major global risk factor for antibiotic resistance.⁹ There are group of cross-sectional studies on the knowledge of patients about antibiotic usage,¹⁰⁻¹⁸ however, very few studies have assessed the patient's awareness as a contributing factor for development of antibiotic resistance.^{9,19,20,21}

In developing country like India, because of large population, tailoring of educational interventions requires valuation of the public's knowledge, principally about antibiotic resistance; and also their behavioural attitude & practice towards antibiotic usage which acts as a potential contributing factor for development of antimicrobial resistance. Thus, the present study was aimed to assess the awareness, behavioural attitude and practice towards antibiotic usage which would direct towards the development of its resistance in patients of Davangere, Karnataka, India by using close ended questionnaire. Once the causes and severity of the problems are identified, awareness programs can be developed to control antibiotic abuse. Such initiatives to identify the severity can help to plan necessary preventive measures with greater intention to help future generation.

Method

Patients with >18 years of age were selected from the Outpatient Department of Bapuji Dental College and Hospital, Davangere, Karnataka, India. Patients who were in medical, paramedical profession or who had family relative in such profession, who were unaware about the term "Antibiotic" and unwilling to participate in the study were excluded from the study. A total of 500 patients of both sexes (189 males and 311 females) participated in this survey. Each patient enrolled in the

survey, conducted in full accordance with the World Medical Association Declaration of Helsinki, was given a detailed verbal & written description of the proposed study in their own language & signed consent for participation was obtained. Ethical approval for the study was obtained from the Institutional Review Board of Bapuji Educational Association, Davangere (Ref. no BDC/2013-14). A Typed close ended questionnaire, in English and local language- "Kannada", was given to all the patients.

The study was conducted by a single examiner and complete anonymity of all the data collected was maintained. A structured questionnaire containing 10 questions was prepared. Phase validation of the questionnaire was performed by the subject experts like general physician, oral physician, general surgeon, oral and maxillofacial surgeon and also to a Periodontist. Final questionnaire was developed on agreement of all the subject experts. 5 questions were set to assess the patient's awareness about antibiotic resistance and its adverse effects on public health. Another 5 questions were set to assess the behavioural attitude of the patient which can lead to antibiotic resistance.

Statistical Analysis

The completed questionnaires were collected from the participants. Selected options for each questions were tabulated on an excel sheet and the results were subjected for statistical analysis. The descriptive analysis of data was done on the basis of mean and median values.

Results

A total of 615 questionnaires were distributed, out of which 500 patients completed the questionnaire and the response rate was 81.3%. The mean age of the patients who participated in the survey was 32.44±14.35 years (Fig. 1) among which, the male participants (37.8 %, 189/500) were in lower number than the females (62.2 %, 311/500) (Fig. 2). Education level of the participants varied from high school or lower (25.4%, 127/500) to university education (74.6%, 373/500) (Fig. 3).

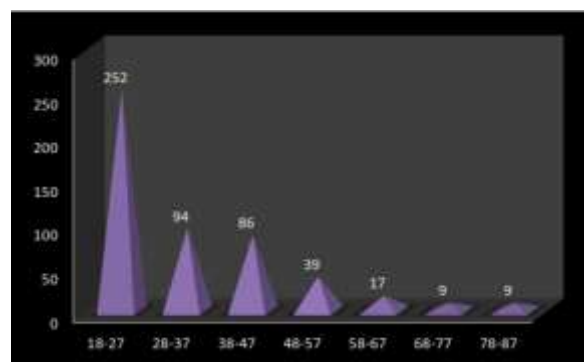


Fig. 1: Age distribution of participants

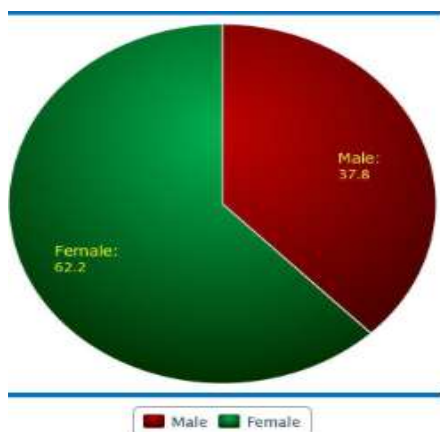


Fig. 2: Gender distribution of participants

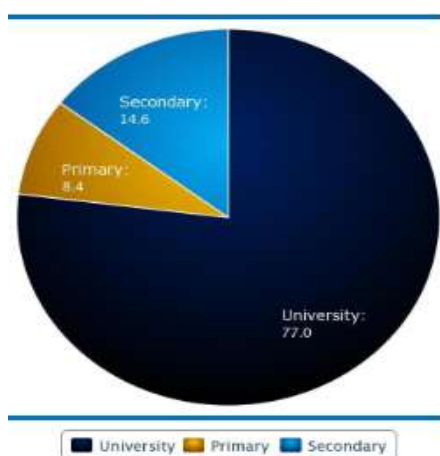


Fig. 3: Education level of participants

Questions Set to Assess Patient's Awareness about Antibiotic Usage & Development of Its Resistance (Table 1)

Of all the patients who took part in the study, only 25.6% (128/500) reported that, they had heard about antibiotic resistance. 45% (225/500) patients were not aware about the seriousness of the issue and 29.4% (147/500) patients did not know about antibiotic resistance.

25% (125/500) patients knew about development of bacterial resistance to antibiotics & that could be fatal to themselves and even to their family members. Rest 28% (140/500) patients gave negative answer and 47% (235/500) patients were not aware about it.

71.4% (357/500) patients agreed that, usage of antimicrobials without doctor's prescription by any other ways is harmful. While 8.2% (41/500) patients believed that, self-medication or taking medication on advice of medical shopkeeper, any non-medical person (Relatives/ Friends/ Neighbours) or even by seeing advertisement on Internet/ Television/ Newspapers are not harmful. 20.4% (102/500) patients were not aware about it.

30% (150/500) patients showed a positive knowledge about basic difference between Antibiotic and Antiviral drugs and their usage. 33% (165/500) patients believed that, there is no such difference between usage of antibiotics and antivirals. 37% (185/500) of patients did not know about the development of resistance due to misuse of antibiotic in place of antivirals without doctor's advice.

61.2% (306/500) patients believed that, promiscuous use of antimicrobials is harmful. 18.4% (91/500) patients felt such use to be safe and 20.6% (103/500) were not aware about the consequences of indiscriminate use of antibiotics.

Table 1: Questions to assess patient's awareness about antibiotic usage & development of its resistance

Questions	Response	Frequency	Percentage
1. Have you heard about antibiotic resistance?	Don't Know	147	29.4
	No	225	45
	Yes	128	25.6
2. Bacteria are becoming resistant to antibiotics & that could be fatal to me or my family.	Don't Know	235	47
	No	140	28
	Yes	125	25
3. Usage of antimicrobials without doctor's prescription by any of the following ways is harmful. - Self-medication - On advice of Medical Shopkeeper - On advice of Non-Medical Person - Seeing advertisement on Internet/ Media/ Newspapers	Don't Know	102	20.4
	No	41	8.2
	Yes	357	71.4
4. Antibiotics & Antivirals are two different drugs. Using antibiotics for viral infections without doctor's advice can increase its resistance.	Don't Know	185	37
	No	165	33
	Yes	150	30

5. Indiscriminate use of antimicrobials can cause more harm than good	Don't Know	102	20.4
	No	92	18.4
	Yes	306	61.2

Table 2: Questions to assess behavioral attitude & practice of the patient which can lead to antibiotic resistance

Questions	Response	Frequency	Percentage
1. I normally stop taking prescribed antibiotics when I start feeling better.	No	99	19.8
	Yes	401	80.2
2. If one of my family members is sick, I usually give my antibiotics to them.	No	178	35.6
	Yes	322	64.4
3. I normally keep antibiotic stock at home and I take it without seeing the expiry date during emergencies.	No	127	25.4
	Yes	373	74.6
4. I usually take previously prescribed antibiotic again for the similar incidence.	No	70	14
	Yes	430	86
5. My doctor should always prescribe antibiotic (Injection/ Tablet) for my illness whenever I visit them. I will consult another doctor to prescribe antibiotic if my doctor disagreed to do so.	No	128	25.6
	Yes	372	74.4

Questions set to Assess Patient's Behavioural Attitude Which Can Lead to Antimicrobial Resistance (Table 2)

Of all the participants who took part in the study, 80.2% (401/500) patients agreed that, they stop taking prescribed antibiotics when start feeling better. Only 19.8% (99/500) patients revealed that, they complete the full regimen prescribed by the doctor.

64.4% (322/500) patients revealed that, they have a habit of sharing their antibiotics with a sick family member. Only 35.6% (178/500) patients do not practice sharing of their antibiotics with anyone.

74.6% (373/500) patients keep antibiotic stock at home and use it without seeing the expiry date during emergencies. Only 25.4% (127/500) patients check for the expiry date and discard the leftover antibiotics.

86% (430/500) patients found to have the practice of taking previously prescribed antibiotic again for the similar incidence without consulting a doctor. Only 14% (70/500) patients would like to consult a doctor before taking any antibiotic even for the similar illness.

74.4% (372/500) patients expect their doctor to prescribe antibiotic (Injection/ Tablet) for their illness, whenever they consult. This group of patients would like to consult another doctor to prescribe antibiotic if the former disagreed to do so. Only 25.6% (128/500) patients disagree to have such expectations from the doctor during consultation.

Discussion

Antibiotic resistance has been called as one of the world's most pressing public health problem.²⁰ Persistent increase in resistant strains and less responsive to antibiotic treatment is of top concern of 21st century. An attempt to educate the health care professionals by means

of various scientific publications can be useful to reduce the resistance problem to some extent. But lack of awareness among patients about various adverse effects of antibiotic misuse and/ or abuse and poverty driven practice in developing countries can amplify the threat to a serious level.¹⁶ Thus, smart use of antibiotics is the key to control the spread of resistance.²⁰ Most of the major resistance control strategies, recommend education for the general public to promote appropriate antibiotic use.^{22,23}

Though awareness programs are carried out by WHO,⁵ 74.4% patients seeking dental care in Bapuji Dental College and Hospital, Davangere, were found to have no knowledge about antibiotic resistance being a major threat, while only 9% of Chinese people were unaware of "Antibiotic resistance" term.⁹ Where knowledge and awareness level about antibiotic resistance was measured much higher in patients visiting a British Hospital¹³ but then recent meta-analysis²¹ found 59.4% samples to be unaware about the same. These variations may be attributed to the patient's level of awareness, education, standard of living, economy of the country, and also to the non-calibration of the sample size.

Every time a person takes antibiotics, sensitive bacteria are killed, but resistant germs may be left to grow and multiply. These antibiotic-resistant bacteria can quickly spread in the family members, schoolmates, and co-workers, & threatens the community with a new strain of infectious disease, which is more difficult to cure and more expensive to treat.²⁴ The level of knowledge about the adverse effects of antibiotic resistance was found to be 25.0% among the patients of present study. On contrary high level of agreement (80.7%) was found in the study done by Andre et al.¹⁹

28% patients of this survey did not agree that, antibiotic resistance is a life threatening problem. Similarly, in a study done by Vanden et al, 58% of patients were unaware about the possible health dangers of antibiotic resistance.¹⁰ Such unawareness and misguided beliefs could be potential danger to public health.

Lack of awareness about consequences of antibiotic overuse,¹⁷ over-the-counter availability of antimicrobials without doctor's prescription⁶ or self-medication⁸ can augment the antibiotic resistance threat to a serious level. In the present study, 71.4% patients agreed that, usage of antimicrobials without doctor's prescription or by any other ways is harmful. Similar percentage of awareness (70%) was also found in the students of Portugal.²⁶ In our study, 8.2% patients believed that, self-medication or taking medication on advice of medical shopkeeper, any non- medical person (Relatives/ Friends/ Neighbours) or by the influence of Internet/ Television/ Newspaper advertisements are not harmful. In support to this, 51.8% of Jordanians were found to use antibiotics on advice of their relatives.²⁶ Rate of acquiring antibiotics without doctor's prescription was found to be 7.8%⁹ and 9%¹⁴ in other studies.

Antibiotics should be used to treat bacterial infections, and they are not effective against viral infections like the common cold, most sore throats, and the flu. Repeated, widespread and improper uses of antibiotics are primary causes for the growth of drug-resistant bacteria. Like other studies,^{10,13,19} 37% patients of our study showed confusion regarding effectiveness of antibiotics against bacteria or viruses. In other studies, 27%¹⁰ and 19.1%¹⁹ of people believed that, intake of antibiotics during common cold made them to feel better more quickly and 32%¹⁰ of them felt that, it prevented the occurrence of more serious illness. In a cross-sectional study done in Portugal,²⁶ 4% of 9th grade students, 14% of 12th grade students and 29% of first year university students were aware that antibiotics are used to treat only bacterial infections. In a study done among people of Penang, 67.2% of respondents incorrectly thought that antibiotics can also be used to treat viral infections and 28.1% of them misused antibiotics as analgesics.¹⁵ Thus, most of the people hold misunderstanding about usage of antibiotics and antivirals. In the present study, also confusion and disagreement about uselessness of antibiotics against viral infections was found.

Patients on longer duration and multiple courses of antibiotic usage not only increases the population carriage of organisms resistant to first line antibiotics, but also force to use second line antibiotics by decreasing their effectiveness against serious life threatening infections. Notable in the present study was the adequate knowledge and restrictive attitude of 61.2% patients believed that the indiscriminate use of antimicrobial drugs being more harmful whereas 59.1% of respondents of Penang state¹⁵ were aware of antibiotic resistance phenomena in relation to overuse of antibiotics.

Of all the participants who took part in the study, 80.2% patients were found to practice incomplete antibiotic course when they start feeling better. Similarly 49.8% of adults of Changhua¹¹ were non-compliant whereas Kardas et al., in his systematic review and meta-analysis found 62.2%¹⁷ of mean compliance with prescribed antibiotic regimen. 64.4% patients of our study revealed to have a habit of sharing their antibiotics with a sick family member whereas it was only 8% in Hong-Kong population.¹⁴

74.6% patients of present study found to keep antibiotic stock at home and use it without seeing the expiry date during emergencies. 28.5% of Jordanians¹⁸ and 6.6% of Chinese⁹ had kept antibiotics at home for emergency. 86% patients of this study had a practice of taking previously prescribed antibiotic again for the similar incidence without consulting a doctor. 28.6%⁷ and 49%¹⁸ of respondents used leftover antibiotics without physician's consultation.

In our study, 74.4% patients expected their doctor to prescribe antibiotic (Injection/Tablet) for their illness whenever they consult a doctor. This group of patients would like to consult another doctor to prescribe antibiotic if their doctor disagreed to do so. 48%,¹⁰ 15.3%,¹¹ 26%¹⁴ and 47.3%¹⁵ of subjects were found to expect antibiotic prescription when they seek medical care for common cold or flu-like symptoms. In contrast, 87% of respondents of Sweden were found to show higher trust in doctors for not prescribing an antibiotic.¹⁹ Such inconsistent results show the importance of education and indicate the need of educational interventions to create awareness among patients.

University students of Portugal revealed to have higher knowledge about the inappropriate use of antibiotics and development of its resistance.²⁶ Appropriate knowledge of antibiotic usage in Chinese reduced both antibiotic prescription rate and drug expenditure.¹⁶ In our study, majority of the patients of Davangere city had an university education {77%} but results showed less trust in the low antibiotic prescribing doctors, lack of knowledge about antibiotic resistance and its consequences, and also poor behavioural attitude and practice towards antibiotic usage.

The perceptions of general public on conditions requiring antibiotic therapy, channels of obtaining antibiotics, their compliance to the treatment as prescribed are vital to control antibiotic resistance.¹⁴ Patient's behaviour and attitude is associated with their knowledge and beliefs.^{27,28} Patient's compliance to appropriate antibiotic usage can be enhanced by providing correct knowledge to the general public.²⁹

Various guidelines and information were published by the Centres for Disease Control and Prevention (CDC) under the heading of "Mission Critical: Preventing Antibiotic Resistance."³⁰ The CDC Guidelines for patients has stressed on the completion of prescribed antibiotic dosage, avoidance of sharing or use of leftover antibiotics, disposal of any leftover

medication following the prescribed course of treatment completion, non-expectation of antibiotic prescription for all illness from the doctor, and it also recommended to practice good hand hygiene and to get recommended vaccines.³⁰

Few suggestions to bring the awareness about CDC guidelines among common people are; i) Advertisement in local languages at various public places, commercials on televisions and before movie screening in theatres ii) Publication of educational literature in magazines, newspapers, internet and other mass media sources. iii) Distribution of educational informative pamphlets along with antibiotics to the patients by doctors, medical shopkeepers and other paramedical staff. Additionally, there is a need of educational programs specifically aiming towards the vulnerable groups by targeting their areas of misconceptions. Topics like "Various Bacterial and Viral Infections along with their Management Strategy" and also "Antibiotic Resistance and its Prevention" should be included in the curriculum of schools and colleges to create awareness among the youngsters. Motivation of patients to understand their responsibility, modifying their behavioural attitude & practice towards antibiotic usage are vital in reducing the antibiotic resistance. Knowledge about the appropriate antibiotic usage can reduce both antibiotic prescription rates and drug expenditure. Such knowledge also increases patient's information provision about possible side effects.¹⁶ Hence, at the end of the study, patient's queries regarding proper use of antibiotic, causes for the development of resistance and preventive measures were explained via power point presentations. Further study should evaluate the post-intervention effect on the same population to the same questionnaire with definite time interval to overrule the "Hawthorne's effect".

Efforts from both patients as well as doctors are prerequisite to prevent the loss of antibiotics in near future. Constant search for newer antibiotics, strict rule enforcement to prevent over-the-counter sell and regular up-gradation of doctor's & patient's knowledge is important to combat antibiotic resistance. Both, private and government health sectors, may need to work together in this direction for betterment of the future generation.

Conclusion

The present study found large numbers of participants to be unaware about "antibiotic resistance and its risk to the public health". Even though they showed decent knowledge about the consequences of indiscriminate use of antibiotics, but their restrictive attitude is an alarming issue and requires an emergency attention. Although the results of this study cannot be generalized to other cities of India, it can be a concern for Karnataka state or even a contributing factor of antibiotic resistance in India and world. Large population based multicentre studies may throw more light on the

severity of these serious problem to tailor the necessary intervention.

References

1. The world health report 2007. A safer future: global public health security in the 21st century. [Internet] World Health Organization. 2013 Nov 4 [cited 2014 Mar 23]. Available from: http://www.who.int/whr/2007/whr07_en.pdf?ua=1.
2. Margaret Chan. Antimicrobial Resistance: no action today, no cure tomorrow. [Internet] World Health Organization. 2011 Apr 7 [cited 2014 Mar 23]. Available from: <http://www.who.int/world-health-day/2011/en/>.
3. Antimicrobial resistance: global report on surveillance [Internet] World Health Organization. 2014 Apr 30 [cited 2015 Feb 20]. Available from: <http://www.who.int/mediacentre/news/releases/2014/amr-report/en/>.
4. Kotwani A, Wattal C, Katewa S, Joshi PC, Holloway K. Factors influencing primary care physicians to prescribe antibiotics in Delhi India. *Fam Pract* 2010; 27: 684-90.
5. Kotwani A, Wattal C, Joshi PC, Holloway K. Irrational use of antibiotics and role of the pharmacist: an insight from a qualitative study in New Delhi. *J Clin Pharm Ther* 2012;37:308-12.
6. Delhi Society for Promotion of Rational Use of Drugs. (WHO/SEARO). Promoting awareness amongst school children on rational use of drugs. Delhi; 2009.
7. Kardas P, Devine S, Golembesky A, Roberts C. A systematic review and meta-analysis of misuse of antibiotic therapies in the community. *Int J Antimicrob Agents* 2005;26:106-13.
8. Grigoryan L, Burgerhof JG, Degener JE, Deschepper R, Lundborg CS, Monnet DL et al. Attitudes, beliefs and knowledge concerning antibiotic use and self-medication: a comparative European study. *Pharmacoepidemiol Drug Saf* 2007;16:1234-43.
9. Wun YT, Lam TP, Lam KF, Ho PL, Yung WH. The public's perspectives on antibiotic resistance and abuse among Chinese in Hong Kong. *Pharmacoepidemiol Drug Saf* 2013;22:241-9.
10. Vanden Eng J, Marcus R, Hadler JL, Imhoff B, Vugia DJ, Cieslak PR et al. Consumer attitudes and use of antibiotics. *Emerg Infect Dis* 2003;9:1128-35.
11. Chen C, Chen YM, Hwang KL, Lin SJ, Yang CC, Tsay RW et al. Behavior, attitudes and knowledge about antibiotic usage among residents of Changhua, Taiwan. *J Microbiol Immunol Infect* 2005;38:53-9.
12. Huang SS, Rifas-Shiman SL, Kleinman K, Kotch J, Schiff N, Stille CJ et al. Parental knowledge about antibiotic use: results of a cluster-randomized, multicommunity intervention. *Pediatrics* 2007;119:698-706.
13. McNulty CA, Boyle P, Nichols T, Clappison P, Davey P. Don't wear me out-the public's knowledge of and attitudes to antibiotic use. *J Antimicrob Chemother* 2007;59:727-38.
14. You JH, Yau B, Choi KC, Chau CT, Huang QR, Lee SS. Public knowledge, attitudes and behaviour on antibiotic use: a telephone survey in Hong Kong. *Infection* 2008;36:153-7.
15. Ling Oh A, Hassali MA, Al-Haddad MS, Syed Sulaiman SA, Shafie AA, Awaisu A. Public knowledge and attitudes towards antibiotic usage: a cross-sectional study among the general public in the state of Penang, Malaysia. *J Infect Dev Ctries* 2011;28;5:338-47.
16. Currie J, Lin W, Zhang W. Patient knowledge and antibiotic abuse: Evidence from an audit study in China. *J Health Econ* 2011;30:933-49.

17. Kardas P, Devine S, Golembesky A, Roberts C. A systematic review and meta-analysis of misuse of antibiotic therapies in the community. *Int J Antimicrob Agents* 2005;26:106-13.
18. Shehadeh M, Suaifan G, Darwish R M, Wazaify M, Zaru L, Alja'fari S. Knowledge, attitudes and behaviour regarding antibiotics use and misuse among adults in the community of Jordan- A pilot study. *Saudi Pharmaceutical Journal* 2012;20,125-133.
19. André M, Vernby A, Berg J, Lundborg CS. A survey of public knowledge and awareness related to antibiotic use and resistance in Sweden. *J Antimicrob Chemother* 2010;65:1292-6.
20. Antibiotic Resistance: Questions & Answers. [Internet] Centers for Disease Control and Prevention. 2013 Nov 4 [updated 2013 Dec 18; cited 2014 Mar 23]. Available from: <http://www.cdc.gov/getsmart/antibiotic-use/antibiotic-resistance-faqs.html>.
21. Gualano MR, Gili R, Scaioli G, Bert F, Siliquini R. General population's knowledge and attitudes about antibiotics: a systematic review and meta-analysis. *Pharmacoepidemiol Drug Saf.* 2015;24(1):2-10.
22. Finch RG, Metlay JP, Davey PG, Baker LJ. International Forum on Antibiotic Resistance colloquium. Educational interventions to improve antibiotic use in the community: report from the International Forum on Antibiotic Resistance (IFAR) colloquium, 2002. *Lancet Infect Dis* 2004;4:44-53.
23. Ranji SR, Steinman MA, Shojania KG, Gonzales R. Interventions to reduce unnecessary antibiotic prescribing: a systematic review and quantitative analysis. *Med Care* 2008;46:847-62.
24. Antibiotic Resistance: Questions & Answers. [Internet] Centers for Disease Control and Prevention. 2013 Nov 4 [updated 2013 Dec 18; cited 2014 Mar 23]. Available from: <http://www.cdc.gov/getsmart/antibiotic-use/antibiotic-resistance-faqs.html>.
25. Sweeney LC, Dave J, Chambers PA, Heritage J. Antibiotic resistance in general dental practice: A cause for concern? *J Antimicrob Chemother* 2004;53:567-76.
26. Azevedo MM, Pinheiro C, Yaphe J, Baltazar F. Portuguese students' knowledge of antibiotics: a cross-sectional study of secondary school and university students in Braga. *BMC Public Health* 2009;23;9:359.
27. Davey P, Pagliari C, Hayes A. The patient's role in the spread and control of bacterial resistance. *Clin Microbiol Infect* 2002;8:43-68.
28. Mangione-Smith R, McGlynn EA, Elliott MN, McDonald L, Franz CE, Kravitz RL. Parent expectations for antibiotics, physician-parent communication, and satisfaction. *Arch Pediatr Adolesc Med* 2001;155:800-806.
29. Dorlands Medical Dictionary: antibacterial. Archived from the original on 2010-11-17. Retrieved 12 March 2014.
30. Mission Critical: Preventing Antibiotic Resistance. [Internet] Centers for Disease Control and Prevention. 2012 Nov 7 [updated 2012 Nov 7; cited 2014 Mar 23]. Available from: <http://www.cdc.gov/features/antibioticresistance>.