

Original Research Article

Knowledge, attitude and practices of antibiotic usage among university students from Karachi, Pakistan

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ABSTRACT

Background: Antimicrobial resistance has become a serious global problem. A potential post-antibiotic era is threatening present and future medical advances. In Pakistan, the usage of antibiotic is unnecessarily high and due to over exposure to these drugs, bacteria are developing resistance against these drugs. It is necessary to improve public awareness about the rational use of antibiotics in order to bring a change in consumer's behaviour. Therefore, present study was undertaken to assess the existing knowledge, attitude and practices related to antibiotic usage among university students.

Methods: A cross-sectional study was carried out among university students from Karachi, Pakistan during May-June 2018. 200 students were approached to participate in the study of which 159 agreed to participate (males: 70, females: 89). Pretested questionnaire was distributed to the study subjects and the collected data was analyzed using IBM SPSS version 23.

Results: Substantial number of (33% and 50%) participants were unaware about the differences in antibiotic: anti-inflammatory drugs and antibiotic: antipyretics respectively. 29% of the participants thought it is right to stop antibiotics only based on symptomatic improvement. Thirty nine percent and eighty three percent participants believed that antibiotics should always be prescribed to treat flu like symptoms and pneumonia respectively.

Conclusions: Participants demonstrated average knowledge about antibiotics. Similarly, their attitude and practice toward antibiotic use was associated with misconceptions. An educational intervention is necessary to make them aware about rational use of antibiotics.

Keywords: Antibiotic, Antibiotic resistance, Karachi, Pakistan, University students

INTRODUCTION

Antibiotics function by attacking pathogenic bacteria on various levels in the human body. These medicines play a critical role in treating as well as preventing bacterial

infections. The usefulness of antibiotics against bacterial infections cannot be denied. However, an overuse of antimicrobial drugs, paucity of new drugs and the prevailing poor hygiene and infection control mechanisms (especially in developing countries) are

leading to the development of antimicrobial resistance.¹ Antimicrobial resistance has become a serious global problem.² A potential post-antibiotic era is threatening present and future medical advances. The current worldwide increase in resistant bacteria and simultaneously, the downward trend in the development of new antibiotics have serious implications.

Resistant bacteria dramatically reduce the possibilities of treating infectious diseases effectively and multiply the risks of complications and a fatal outcome for patients.³ There could be a return to the pre-antibiotic era, where many people could suffer or die from untreatable bacterial infections.⁴

Scientific studies from hospitals situated at different places in Pakistan have reported that bacteria isolated from various infections were becoming gradually resistant to traditional antibiotics.⁵ In Pakistan the usage of antibiotic is unnecessarily high and due to over exposure of these drugs bacteria are developing resistance against these drugs.

Different reports regarding the development of antibiotic resistance in Pakistan confirm the drastic increase of antibiotic resistance or even the development of multi drug resistance (MDR) across the country.⁶⁻¹³ In conclusion, resistance against frequently used antibiotics is increasing day by day in Pakistan like other under developed third world countries.

Hence, it is the need of the hour to develop strategies for future reduction of antibiotic resistance. Community education programmes regarding the rational usage of antibiotics must be carried out for general population as well as for health care professionals. As misuse of antibiotics poses a serious risk to infectious disease control and public health in general, it is necessary to improve public awareness, enforce strict antibiotic policies and bring a change in the behaviour of consumers.

Major resistance control strategies therefore recommend education of the public to promote appropriate antibiotic use.¹⁴ The type and nature as well as the extent of education to be given to the public, will depend on the kind of population to be addressed at any point in time.

The objective of this study was therefore to determine the knowledge, attitude and practice of antibiotic use among university students from Karachi, Pakistan, so as to determine the kind of antibiotic education and awareness strategies applicable to them.

METHODS

Questionnaire for the present study was designed in English based on previous studies. It consisted of close ended questions. Content and face validity were checked by a joint committee from Karachi, Pune and Hannover

consisting of epidemiologist, pharmacy professors, statistician and also a student representative. Author conducted a pilot study in 20 students from university of Karachi to determine the understanding of the questions by the participants, time required to complete the questionnaire. Based on this pilot study, author did some modifications in the questionnaire which helped us in interview process. Pilot study population was not a part of the main study.

A descriptive, cross-sectional, questionnaire-based study was carried out among university students from Karachi, Pakistan during the time period of May-June 2018. All volunteer male and female students enrolled in university study programs at Karachi, Pakistan and who understood English and willing to give a written informed consent were eligible to participate in the study.

The study was approved by the Institutional Ethics Committee of University of Karachi, Pakistan. The purpose of the study was explained in detail before starting the study and only participants voluntarily willing and ready to sign the informed consent were included in the study. The participants were assured of the confidentiality and anonymity of the information.

Two hundred students were contacted by study team member in their classrooms and were given a brief introduction about the research project. Those who desired to participate were explained the purpose and objectives of the study.

Based on the eligibility criteria (those who gave a written informed consent and are registered university students from Karachi, Pakistan) 159 students were selected for the present study. Students were face to face interviewed in the student office with prior appointment by a study member from a team of 5 trained Master of Pharmacy Students. The purpose of the research was explained to the respondents, anonymity and confidentiality were guaranteed and maintained.

The researchers complied with the international ethical guidelines for research. The data was recorded into the predesigned data record form (DRF) by interviewers. Each interview lasted for about 15minutes. Data collected from individual DRF was entered in Microsoft excel and was verified by the authors other than interviewers.

Data were analyzed by using descriptive statistical methods and a bivariate analysis was conducted. P-value ≤ 0.05 was considered as significant. IBM SPSS version 23 was used for statistical analysis.

RESULTS

The present study had 159 study participants consisting of 70 (44%) males and 89 (56%) females as shown in the Table 1. Response rate for the present study was 80% (159/200). As shown in Table 2, eighty-nine percent

(141/159) participants out of which significantly more female (94%, 84/89) than male participants (81%, 57/70) had heard about antibiotic before. These figures were taken as denominators for further analysis.

Substantial number (33% and 50%) of participants were unaware about the differences in antibiotic-anti-inflammatory drugs and antibiotic-antipyretics respectively. Only 87% of the participants felt that physician's directions should be followed while taking antibiotics. Twenty-nine percent of the participants thought antibiotic could be discontinued after symptomatic improvement while 37% felt it was not

necessary to have a follow-up visit after taking an antibiotic.

Table 1: Demographic information.

Variable	Base answer	Male n (%)	Female n (%)	Total n (%)
Gender		70 (44)	89 (56)	159 (100)
Education				
BS		49 (70)	78 (88)	127 (80)
MS		17 (25)	5 (5)	22 (13)
PhD		4 (5)	6 (7)	10 (7)

Table 2: Knowledge about antibiotic usage.

Variable	Base answer	Male n (%)	Female n (%)	Total n (%)	χ^2 value	p-value
Have you heard of "ANTIBIOTICS" before?	Yes	57 (81)	84 (94)	141 (89)	6.54	0.01
Do you think antibiotics are the same as anti-inflammatory agents?	No	31 (54)	64 (76)	95 (67)	7.34	0.00
Do you think antibiotics are the same as antipyretics?	No	26 (46)	44 (52)	70 (50)	0.62	0.43
Who should provide education about usage of antibiotics?	Health care professionals	5 (9)	5 (6)	10 (7)	19.2	0.00
Should patients follow physician's directions while taking antibiotics?	Yes	47 (82)	76 (90)	123 (87)	1.96	0.16
Is it okay to stop taking an antibiotic regimen if symptoms are improving?	No	30 (52)	71 (84)	101 (71)	16.9	0.00
Should patients return for follow-up visit after taking antibiotics?	Yes	25 (43)	64 (76)	89 (63)	15.2	0.00
Should flu-like symptoms always be treated with antibiotics?	No	29 (51)	58 (69)	87 (61)	4.74	0.02
Should pneumonia always be treated with antibiotics?	No	15 (26)	10 (12)	25 (17)	4.83	0.02
Should you take antibiotics according to the instructions on the package?	Yes	40 (70)	59 (70)	99 (70)	0.00	0.99
Do some antibiotics cause adverse effects?	Yes	41 (72)	71 (85)	112 (79)	3.29	0.06
Do you think that it's harmful to follow physician's directions while taking antibiotics?	No	32(56)	64 (76)	96 (68)	6.28	0.01
Do you think that taking less antibiotics than prescribed is healthier?	No	21 (36)	54 (64)	75 (53)	10.2	0.00
Mean knowledge score		52%	65%	60%	2.04	0.15

Substantially low number of participants i.e. 61% and 17% felt that flu-like symptoms and pneumonia respectively should always be treated with antibiotics.

Thirty and twenty-one percent of the participant felt that antibiotics should be taken according to package instructions and antibiotics can cause adverse effects respectively. Mean knowledge score was better for female (66%) compared to male (52%) participants. As shown in Table 3, ninety-one percent of the study participants said they would follow the physician's

directions for antibiotic use. Only 62% of the participants said they would go for follow-up visit after taking antibiotic. Fifty-five percent and 82% participants said they would prefer antibiotic prescription in case of flu-like symptoms or pneumonia respectively. Thirty-three percent of the participants expressed satisfaction on the doctor's decision to prescribe antibiotic without explanation. Female participants (60%) had better attitude score than male (50%) participants.

As shown in Table 4, 69% and 40% participants said that they would take antibiotics with water and would keep

antibiotic syrup in the refrigerator respectively. Only 65% and 60% participants replied that they would visit doctor in case of consuming wrong antibiotic and would not consume antibiotic if pregnant respectively. Forty-seven participants said they share their antibiotics with sick

family members. While taking antibiotics 74% participants said they follow doctor's instructions, 18% stop antibiotics without consultation, 13% said they change antibiotic dosage and 6% said they do not take antibiotics regularly when advised by doctor.

Table 3: Antibiotics usage attitude.

Variable	Base answer	Male n (%)	Female n (%)	Total n (%)	χ^2 value	p-value
Would you follow the physician's directions about antibiotic use?	Yes	51(89)	77(92)	128(91)	0.19	0.65
Would you visit for follow-up after taking antibiotics?	Yes	26(46)	61(73)	87(62)	10.48	0.001
If you had flu-like symptoms, would you prefer a prescription containing antibiotics?	No	22(39)	41(49)	63(45)	1.43	0.23
If you had pneumonia, would you prefer a prescription containing antibiotics?	No	9(16)	16(19)	25(18)	0.24	0.61
If your doctor prescribed antibiotics but did not explain the reason, would you be satisfied?	No	35(61)	59(70)	94(67)	1.19	0.27
Mean attitude score		50%	60%	57%	2.02	0.15

Table 4: Practice toward antibiotic use.

Variable	Base answer	Male n (%)	Female n (%)	Total n (%)	χ^2 value	p-value
How would you take antibiotics?	With water	30(53)	67(80)	97(69)	11.46	0.00
Do you keep antibiotic syrup in the refrigerator?	Yes	30(53)	26(31)	56(40)	6.66	0.01
If you took the wrong antibiotics, what would you do?	Visit doctor	36(63)	55(65)	91(65)	0.08	0.78
If you are pregnant, should you take antibiotics?	No	36(63)	48(57)	84(60)	0.51	0.48
If your family member is sick, do you give your family members your antibiotics?	No	24(42)	51(60)	75(53)	4.72	0.03
While taking antibiotics do you,	Yes	35(61)	69(82)	104(74)	7.54	0.006
• Follow the physician's instructions	No	45(79)	71(85)	116(82)	0.72	0.39
• Stop without consultation	No	48(84)	75(89)	123(87)	0.78	0.37
• Decrease dosage without consultation	No	51(89)	81(96)	132(94)	2.74	0.09
• Take the medicines irregularly?						
If ill with flu-like symptoms and the doctor does not prescribe antibiotics, what would you do?	No	19(33)	58(69)	77(55)	18.1	0.00
• Visit another doctor for antibiotics	No					
• Buy antibiotic elsewhere	Yes					
• Not be concerned	No					
• Request that the doctor prescribe antibiotic						
If you had pneumonia and your doctor did not prescribe antibiotics, what would you do?	No	16(28)	33(39)	49(58)	0.07	0.78
• Visit another doctor for antibiotics	No					
• Buy antibiotics elsewhere	Yes					
• Not be concerned	No					
• Request that the doctor prescribe antibiotics						
If you experienced adverse effects from taking antibiotics, what would you do?	Yes	16(28)	21(25)	37(26)	4.05	0.044
• Stop taking antibiotics	Yes					
• Visit the doctor						
Return for more antibiotics after finishing the prescription	No	30(53)	61(73)	91(65)	5.92	0.015
Mean practice score		56%	65%	64%	0.07	0.78

In case of having flu-like symptoms and doctor not prescribing antibiotics, only fifty-five percent of the participants described correct practice of not visiting another doctor, not buying antibiotics anywhere, not getting concerned, and not requesting doctor to prescribe antibiotic. Similarly, in case of having pneumonia and doctor not prescribing antibiotics, only fifty-nine percent of the participants described correct practice of not visiting another doctor, no buying antibiotics anywhere, not getting concerned, and not requesting doctor to prescribe antibiotic. In case of experiencing adverse effects from taking antibiotics, only 26% of the participants said they would stop taking antibiotics and visit doctor to consult. Sixty-five percent participants said they buy more antibiotics after finishing the prescription. Mean practice score was better for female (65%) compared to male (56%) participants.

DISCUSSION

This study was aimed at assessing present knowledge, attitude and practice of antibiotic use among university students in Karachi to evaluate the type of education and awareness campaigns suitable for them. Mean knowledge score about antibiotics and their use in this study was 60%, their attitude and practice towards the use of antibiotic use was associated with several misconceptions.

Therefore, a rigorous understanding of the gaps in knowledge, attitude and practice would be helpful in designing educational campaigns that can help limit antimicrobial resistance due to ill practice and misinformation. It was observed that, eleven percent participants (18/159) had not heard of antibiotics before the conduct of this study. This was even though they belonged to a metropolitan city of Pakistan were studying at the university, having access to print and electronic media, and must have had possibilities of visiting hospitals/chemists. A study done in general public in Karachi reported more unawareness (17%) but studies from India (4%) and Nigeria (9%) reported lesser unawareness compared to our study.¹⁵⁻¹⁷

It was also seen that participants were not able to differentiate between antibiotics and anti-inflammatory agents (37%)/antipyretics (50%). A study from Taiwan reported more unawareness (Anti-inflammatory, 49%, antipyretics, 55%) among general public.¹⁸ This difference could be the result of differences in the study population. Regarding issue of the use of antibiotics only till symptomatic improvement, this results (29%) are better than a study done among university students from Turkey (39%).¹⁹ This non-compliance was a misconception regarding the use of antibiotics and those involved are at the risk of infection relapse, colonization with antibiotic resistant organisms and complicated disease outcomes.²⁰⁻²² A study from India reported better results (pneumonia; 74%) regarding participants feeling

of definite need of antibiotics in pneumonia than the present study (pneumonia, 83%).¹⁶ Questions on attitude compared to knowledge aspects revealed that almost equal number of participants preferred the antibiotic prescription in case they had pneumonia. But in case of flu (55%) more participants preferred the antibiotic prescription as compared to same question under knowledge aspect (39%). Thirty three percent participants showed an attitude that it is alright for a doctor to prescribe antibiotics without explaining reasons. Participants might have acquired this knowledge and attitude from the practice of undue over prescription of antibiotics in Pakistan which was unnecessarily high and due to over exposure of the drugs bacteria are developing resistance against these drugs.²³

Questions looking at practice aspects of antibiotics among participants showed that 31% and 60% participants were unaware of how to take antibiotics and storage of antibiotic syrups respectively. A similar study from India showed 92% and 77% participants were unaware of how to take antibiotics and storage of antibiotic syrups respectively.¹⁶ These results show that neither doctor nor chemist/pharmacist gives advice regarding consumption of antibiotics.

According to a Gallop survey, Pakistan scored the lowest in the world on the Global Doctor-Patient Communication Assessment test in year 2011 with five points in contrast to the highest score 66 points that was recorded for Ireland.²⁴ The community pharmacies in Pakistan are known to be managed by a diversity of dispensers in terms of their qualification, knowledge and experience.^{25,26} Inadequate knowledge of the dispensers working at community pharmacies in Pakistan has been reported.^{25,27} This shows that doctors, chemists/pharmacists are failing to inform patients regarding use and storage aspects of antibiotics.

Only sixty five percent participants said that they would follow a practice of visiting doctor immediately in case of consuming wrong antibiotics. Forty seven percent participants had a practice of sharing their antibiotics to sick family member. Forty percent participants were not aware about consumption of antibiotics during pregnancy. A study from India reported better antibiotic practice of visiting doctor (87%) in case of consuming wrong antibiotics, not sharing antibiotics with sick family member (75%) and not consuming antibiotics in case of pregnancy (79%).¹⁶ The results regarding sharing of antibiotics are similar to a cross sectional study regarding antibiotic use among general public from Karachi, Pakistan. This study showed that about half (49.17%) of the respondents utilized antibiotics prescribed to any of their family member with same symptoms.¹⁵ A single course of antibiotics perturbs bacterial communities, with evidence that the microbial ecosystem does not return completely to baseline following treatment. Antibiotics in pregnancy should be used only when indicated, choosing

those with the narrowest range possible.²⁸ Female participant's mean scores for knowledge, attitude and practice were better than male participants. Similar trend was observed in the antibiotic study done in India.¹⁶

Studies have shown that, in general, women are more health conscious, and aware of their physical and mental symptoms. All these results in healthier lifestyles and better health care use. Women also communicate better about their problems, which helps the process of diagnosis.²⁹ This study showed poor knowledge, attitude and practice regarding the antibiotics among university students. Reasons for this might be varied but attributable to the following: lack of healthcare focus in the university education/curriculum, unethical prescription practices, availability of antibiotics without prescription, lack of patient education by either doctors or pharmacist and most importantly poor government rules and implementation of the same. Though proper use of antibiotics is linked to the educational background of participants, it is essential to further investigate the origin of the disparity between males and females and the factors that lead to different attitudes and behavior about these drugs.

CONCLUSION

It has been reported that antibiotic consumption in Pakistan between 2000 and 2015 increased by 65% from 800 million defined daily doses (DDD) to 1.3 billion DDD. The antibiotic consumption rate in the country witnessed a surge from 16.2 DDD to 19.6 DDD per 1,000 inhabitants per day. This was disclosed in research, titled 'Global Increase and Geographic Convergence in Antibiotic Consumption between 2000 and 2015'. Published in the 'Proceedings of the National Academy of Sciences' last month, the study dealt with 76 countries. It has been reported that Pakistan was the third highest consumer of antibiotics after India and China among the low- and middle-income countries.

Over the years, antimicrobial resistance has manifested itself as a major public health threat in almost all countries, including Pakistan. Multi-drug resistant organisms have severely limited choices of antibiotics for treatment of infectious diseases. Pakistan being a densely populated country with poor healthcare, the mortality and morbidity rates attributed to infections remain high. Coupled with rising and emerging antimicrobial resistance these are likely to escalate much further.

Pakistan ministry of national health services, regulations and coordination has developed and endorsed a comprehensive national action plan for the problem of antimicrobial resistance. Despite these efforts there is a need for extensive and thorough awareness regarding the use of antibiotics. It is necessary that all the major stakeholders-doctors, pharmacists, industry professionals, and health ministry personnel should jointly manage the issue of lack of antibiotic knowledge and subsequent

menace of antibiotic resistance. Even though this study is done in limited number of participants and only in Karachi, it has highlighted the lacuna that deserve immediate attention. Author hoped that it will help initiate further research into the problem of irrational use of antibiotics and subsequent development of bacterial resistance.

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REFERENCES

1. Zorzet A. Global Importance of Antibiotics and consequences of antibiotic overuse. AAAS Annual Meeting. 2015;12-6.
2. Garg R. Tackling antimicrobial resistance: optimizing use of an older antibiotic-amoxicillin. Ind J Clin Pract. 2014;24(9):843-5.
3. Cars O, Nordberg P. Antibiotic resistance-The faceless threat. Inter J Risk Safety Med. 2005;17:103-10.
4. Appelbaum PC. 2012 and beyond: potential for the start of a second pre-antibiotic era?. J Antimicrobial Chemotherapy. 2012;67(9):2062-8.
5. Kaleem F, Usman J, Hassan A, Khan A. Frequency and susceptibility pattern of metallo-beta-lactamase producers in a hospital in Pakistan. J Infection Developing Countries. 2010;4(12):810-3.
6. Shah SH. Susceptibility patterns of *Escherichia coli*: Prevalence of multidrug-resistant isolates and extended spectrum beta-Lactamase phenotype. JPMA. 2002;52:407.
7. Ali I, Kumar N, Ahmed S, Dasti JI. Antibiotic resistance in uropathogenic *E. coli* strains isolated from non-hospitalized patients in Pakistan. JCDR. 2014;8(9):DC01.
8. Tanvir R, Hafeez R, Hasnain S. Prevalence of multiple drug resistant *Escherichia coli* in patients of urinary tract infection registering at a diagnostic laboratory in Lahore Pakistan. Pak J Zool. 2012;44(3):707-12.
9. Bashir S, Haque A, Sarwar Y, Raza A. Prevalence of integrons and antibiotic resistance among. Arch Clin Microbiol. 2015;6(4).
10. Sohail M, Khurshid M, Saleem HG, Javed H, Khan AA. Characteristics and antibiotic resistance of urinary tract pathogens isolated from Punjab, Pakistan. Jundishapur J Microbiol. 2015;8(7).
11. Kidwai SS, Nageen A, Ghaznavi S, Bashir F, Ara J. Antibiotic susceptibility in commonly isolated pathogens from urinary tract infection in a cohort of subjects from low socioeconomic strata. Pak J Med Sci. 2017;33(2):254.
12. Dodani S, Nasim A. Changing trends in antimicrobial resistance pattern in *klebsiella* species bacteremia in an out-patient hemodialysis unit over

- 6years (2010-2015) in a tertiary care hospital in Pakistan. *Open Forum Infect Dis.* 2017;4:156.
13. Ullah F, Malik SA, Ahmed J. Antimicrobial susceptibility pattern and ESBL prevalence in *Klebsiella pneumoniae* from urinary tract infections in the North-West of Pakistan. *African J Microbiol Res.* 2009;3(11):676-80.
 14. Lee CR, Cho I, Jeong B, Lee S. Strategies to minimize antibiotic resistance. *Inter J Env Res Public Health.* 2013;10:4274-305.
 15. Naseem S, Iffat W, Shakeel S, Tariq S. Knowledge about antibiotic use amongst the public: a cross sectional study in karachi. *Infectious Dis J Pak.* 2016; 25(3): 49-54.
 16. Limaye D, Naware S, Bare P, Dalvi S, Dhurve K, Sydymanov A, et al. Knowledge, attitude and practices of antibiotic usage among students from Mumbai University. *Inter J Res Med Sci.* 2018;6(6):1908-12.
 17. Igbeneghu OA. Knowledge and practices in the use of antibiotics among a group of Nigerian university students. *Inter J Infection Control.* 2013;9(1).
 18. 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(1):53-9.
 19. Buke C, Hosgor-Limoncu M, Ermertcan S, Ciceklioglu M, Tuncel M, Köse T, et al. Irrational use of antibiotics among university students. *J Infection.* 2005;51(2):135-9.
 20. Carey B, Cryan B. Antibiotic misuse in the community-a contributor to resistance?. *Irish Med J.* 2003;96(2):43-4.
 21. Liu YC, Huang WK, Huang TS, Kunin CM. Inappropriate use of antibiotics and the risk for delayed admission and masked diagnosis of infectious diseases: a lesson from Taiwan. *Arch Internal Med.* 2001;161(19):2366-70.
 22. Sarkar P, Gould IM. Antimicrobial agents are societal drugs. *Drugs.* 2006;66(7):893-901.
 23. Afzal MS. Emergence of antibiotic resistance in pakistan; a clear problem for future. *J Vaccines Vaccin.* 2017; 8: 375.
 24. Market research and public opinion member of win/gallup international, doctor-patient global communication performance assessment by cat, insights from the worldwide independent network (win™) of market research, Fall, 2011. Available at: http://www.mareco.cz/assets/healthCare_1st.pdf.
 25. Rabbani F, Cheema FH, Talati N, Siddiqui S, Syed S, Bashir S, et al. Behind the counter: pharmacies and dispensing patterns of pharmacy attendants in Karachi. *JPMA.* 2001;51(4):149.
 26. Qidwai W, Krishanani MK, Hashmi S, Abu Ali R. Private drug sellers education in improving prescribing practices. *J Coll Physicians Surg Pak.* 2006;16(12):743.
 27. Butt ZA, Gilani AH, Nanan D, Sheikh AL, White F. Quality of pharmacies in Pakistan: a cross-sectional survey. *Inter J Quality Health Care.* 2005:307-13.
 28. Kuperman AA, Koren O. Antibiotic use during pregnancy: how bad is it?. *BMC Med.* 2016;14(1):91.
 29. Assari S. Why do women live longer than men? *World Economic Forum.* 2017. Available at: <https://www.weforum.org/agenda/2017/03/why-do-women-live-longer-than-men>. Accessed 1 November 2018).

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