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Knowledge, Attitudes and Practices in Antibiotic Use in Family Medicine Students

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Abstract

Background: Inappropriate prescriptions of antibiotics lead to ineffective and unsafe treatments and worsening of diseases. Medical students may have deficiencies in their prescription skills and they may need further training in the use of antibiotics for their practice. Medical skills in prescribing antibiotics can be improved through continuous medical education. The aim of this study was to assess the current levels of knowledge, attitudes, and practices (KAP) in antibiotic prescription in upper respiratory tract infections (URTI) among postgraduate family medicine students in Ecuador. **Methods:** A cross-sectional study with an on-line survey, based on micro-curricular contents, to evaluate KAPs regarding antibiotic prescription in URTI among postgraduate family medicine students in 5 provinces of Ecuador. **Results:** Two hundred and seventy-three physicians responded (94.1%). Most physicians treated between 1 and 5 URTI cases per day. The odds for inadequate knowledge and inappropriate practices in URTI among postgraduate family medicine students were 8.74 (95%CI, 4.94-15.46, $P < .001$) and 5.99, (IC95%, 2.66-13.50, $P < .001$) in physicians who were students of the first half of the study program. **Conclusion:** The knowledge in URTI was limited among physicians. Nonetheless, they expressed a positive attitude toward not using antibiotics in URTI. A postgraduate program can significantly improve the knowledge and practices related to antibiotic prescriptions in URTI.

Keywords

primary care, community health, antibiotic use, medications, respiratory infection

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Background

Inappropriate antibiotic prescription is an increasing problem among physicians in several low- and middle-income countries and it increases the risk of patients developing antibiotic-resistant microorganisms.[1,2] Antibiotic use occurs commonly in primary care in upper respiratory tract infections (URTI).[3] Regardless of the fact that the majority of URTIs are caused by viruses, antibiotics are still being prescribed for maladies such as common colds, acute rhinitis, or acute bronchitis.[4-7]

There are healthcare provider factors strongly associated with the prescribing behavior. Studies have shown that provider factors like age, gender, medical specialty, sociodemographic group, and previous personal experiences can influence in the prescription of antibiotics in primary care.[8] Factors like patient's demands, health provider's knowledge, use of clinical guidelines, professional experiences, treatment failure, and availability of drugs can also be mentioned as relevant factors for inappropriate antibiotic prescribing.[9,10] Furthermore, factors related to physical exams have also been associated with physicians' decisions of using antibiotics. In URTI cases, the findings of fever, purulent sputum, abnormal respiratory exams, and tonsillar exudate in the physical examination can also influence the decision to prescribe antibiotics.[11] Prescribing behavior is influenced by the physician's own knowledge, personal experiences, and cultural factors.

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In Latin American countries, the rate of antibiotic prescription in URTIs is between 24% and 40%.[12,13] The antibiotic prescription rate in URTIs in Ecuador is around 37.5%; however, 90.25% of these prescriptions made by physicians are unnecessary.[14] As per Ecuadorian healthcare laws, antibiotics are only sold under medical prescription and since physicians are responsible for this practice, it is necessary to assess the knowledge, attitudes, and practices (KAP) that underlie their prescribing behaviors. Physicians may have deficiencies in prescription skills and they may need more training in antibiotic use for their practice.[15-17]

Ecuador has many educational programs in Family Medicine. Currently, they are taught in twelve provinces in medical schools and these programs are aligned with the country's healthcare model.[18] Because medical skills in antibiotic prescription can be improved through continuing medical education,[19,20] it is important to explore whether a postgraduate program in family medicine could improve KAPs in antibiotic prescription in URTI cases in Ecuador.

Methods and Materials

Study Design and Population

This is a cross-sectional study which applied a survey to asses KAPs among postgraduate family medicine students of the Pontifical Catholic University of Ecuador (PUCE). The students have their clinical practice in 5 provinces of Ecuador (Esmeraldas, Imbabura, Manabí, Pichincha, and Santo Domingo de los Tsáchilas). These provinces correspond to the coastal and mountainous regions of Ecuador. A total of 290 students of the Family Medicine Program were chosen to participate in the survey. The survey was sent by e-mail to 290 students of the Family Medicine Program from October 2019 to December 2019; students were able to accept or decline participation in the study, the students had to accept an informed consent form before taking the survey.

Questionnaire

An on-line self-administered questionnaire was developed in order to evaluate KAPs about antibiotic prescription in URTI cases among students in the Family Medicine Program. The 18 questions were developed according to the micro-curricular contents of the program. The survey used a mixed questionnaire which included multiple-choice questions and Likert scales (1 = never, 2 = almost never, 3 = half the time, 4 = almost always, 5 = always) to explore KAPs in URTI cases. The questionnaire covered a broad range of domains which aimed to assess participants KAPs, including basic knowledge of URTI and antibiotic prescription practices. The survey was validated by an advisory committee integrated by family physicians, professors of the family medicine program and faculty experts. After validation, the survey was tested among general practitioners that were not included in the study. A total of 18 questions were used to assess KAP, 8 for knowledge, 5 for attitudes, and 5 for practices.

Data Analyses

Data were anonymously entered into the Statistical Package for Social Sciences (SPSS, version 21, Chicago, IL, USA) and a descriptive analysis was conducted. The analysis of categorical and continuous variables was carried out using proportions and means, respectively. A Cronbach's alpha test was conducted to assess internal reliability, the alpha score was 0.75, indicating a moderate level of reliability of the questionnaire.[21]

A scoring system was applied to measure the respondents' KAPs toward to prescription of antibiotics in URTI cases. The scores were calculated as a continuous variable by summing the participant's correct responses to each question. A 2-level category was established and 60% of the correct answers in each domain were taken as a discrimination value. Scores in knowledge were categorized into adequate and not adequate; meanwhile, scores in attitude were classified into conservative and not conservative and the scores in practices as appropriate and not appropriate. Statistical tests helped determine the association between each score category and several variables through a logistic regression. This type of regression analyzed the relationship between a dependent variable, scores of each KAP domain and some independent variables, controlling for potential confounders. The independent variables were chosen by theoretical relationship to the dependent variable and through a bivariate logistic regression model. All variables with $P < .25$ in the univariate analysis were included in the multivariate logistic regression analysis to determine the factors that were independently associated with each of the 3 dependent variables. In order to choose among the models to be used, we used Akaike's Information Criteria (AIC).[22] The formulas for the final models in each KAP domain were:

$$Log(Klevel) = b0 + b1 * periodProg + b2 * gender + b3 * region$$

$$Log(Alevel) = b0 + b1 * periodProg$$

$$Log(Plevel) = b0 + b1 * periodProg$$

where *Klevel* refers to the level of knowledge of the interviewee, *periodProg* is the period of time of the family medicine program that the respondent had completed at the moment of taking the survey, *gender* is the gender of the student, and *region* is the geographic region. In addition, *Alevel* refers to the level of attitude and *Plevel* is the level of practice.

Table 1. Characteristics of the Sample.

Variable	n (%)
Gender	
Male	97 (35.53)
Female	176 (64.46)
Age Mean (SD)	31.1 (2.82)
Time (years) since the student graduated	6.2 (2.31)
Sector of practice medicine	
Public	200 (73.26)
Private	54 (19.78)
Public and private	19 (6.95)
Geographic region	
Coastal region	136 (49.81)
Mountainous region	137 (50.18)
Program period	
First half	132 (48.35)
Second half	141 (51.64)
Level of medical practice	
First level	186 (68.13)
Second level	63 (23.07)
Third level	24 (8.79)
Medical consultations per day	
1-5 patients/day	8 (2.93)
6-10 patients/day	57 (20.87)
10-15 patients/day	84 (30.76)
>15 patients/day	124 (45.42)
URTI cases per day	
1-5 cases	249 (91.20)
6-10 cases	20 (7.32)
10-15 cases	2 (0.73)
>15 cases	2 (0.73)
Attention time per patient	
≤15 minutes	18 (6.59)
15-30 minutes	251 (91.94)
>30 minutes	4 (1.46)

Abbreviations: SD, standard deviation; URTI, upper respiratory tract infection.

Results

The characteristics of the sample are shown in Table 1. A total of 273 students of the Family Medicine Program responded the survey, which represents a response rate of 94.1%. The responders were mainly women 64.5% (76/273) with an average age of 31.1 years old. Furthermore, 51.6% (141/273) of the students were in the second half of the program and most of them 68.1% (186/273) were working in primary care. 45.4% (124/273) of the participants indicated that they carried out more than 15 medical consultations per day and 91.2% (248/273) of them reported that they treated between 1 and 5 cases of URTI per day. Most physicians, 91.9% (251/273), took between 15 and 30 minutes per patient.

Evaluation of Knowledge

Eight questions evaluated basic knowledge in etiology, diagnosis, and treatment on URTI (Table 2). Questions KQ4 and KQ5 had the highest frequency of correct answers (71.1% and 67.4%, respectively); these questions evaluated the issues of etiology and diagnosis in URTI cases. However, other questions that evaluated similar topics, KQ6 and KQ7, had the lowest frequency of correct answers, 53.1% and 58.6%.

Questions that evaluated knowledge about the adverse effects of common drugs used in the treatment of URTIs, KQ3, and KQ8, had the lowest frequency of correct answers (24.2% and 30.8%, respectively). Additionally, the ones that evaluated treatment of choice and reasons to use antibiotics, KQ1 and KQ2, had a lower-than-expected number of correct answers (53.1%).

After evaluating all the answers from the knowledge questions, it became apparent that 45.4% (124/273) of the physicians achieved a score of at least 60%; and out of these, 76.6% (92/124) achieved a score greater than 75%.

Our final multiple logistic regression model included the level of knowledge as a dependent variable and the period of the program, gender, and geographic region as independent variables. We found a significant difference in level of knowledge for all the variables included in the model. Using the percentage of participants who were in the second half of the study program as the reference point for the study variable and holding the gender and geographic region variants constant, it became noticeable that the odds of inadequate level of knowledge among physicians of the family medicine program was 8.74 times greater in the physicians who were in the first half of the program period. When adjusting the model for gender and geographic region, the odds of inadequate level of knowledge was 1.99 times greater for female gender and 1.85 times greater for those who were working in the coast region (Table 3).

Evaluation of Attitudes

Five questions evaluated participants' attitudes toward the management of URTI cases (Table 2). All questions, except question AQ4, were answered in a majorly correct way, showing a conservative attitude toward antibiotic use in URTI cases. Question AQ4 evaluated participants' perception of accessible resources for education in the use of antibiotics in URTI cases. About 50.9% of physicians feel that there are insufficient resources.

After obtaining data from all of the questions that evaluated attitudes, it became evident that 77.7% (212/273) of physicians showed a conservative attitude toward antibiotic prescription. We did not find a significative relationship between the period of the program and participants' attitudes (OR: 1.46, IC95%, 0.82-2.59, $P = .192$).

Table 2. Questions of Knowledge, Attitudes, and Practices in URTI.

Knowledge questions	Correct n (%)	Incorrect n (%)
KQ1. Treatment of choice in GAS	145 (53.11)	128 (46.88)
KQ2. Prevention in complication in GAS	145 (53.11)	128 (46.88)
KQ3. Adverse effects of antibiotics used in URTI	66 (24.17)	207 (75.82)
KQ4. Etiology in AOM	194 (71.06)	79 (28.93)
KQ5. Criteria for use antibiotics in URTI	184 (67.39)	89 (32.60)
KQ6. Usefulness of laboratory test in URTI	145 (53.11)	128 (46.88)
KQ7. Criteria for use antibiotics in URTI	160 (58.60)	113 (41.39)
KQ8. Adverse effects of other drugs used in URTI	84 (30.76)	189 (69.23)
Overall score	124 (45.42)	149 (54.57)
Attitude questions	Conservative n (%)	Not conservative n (%)
AQ1. Views on delayed antibiotic prescription	199 (72.89)	74 (27.10)
AQ2. Decision for immediate antibiotic prescription	188 (68.86)	85 (31.13)
AQ3. Confident of antibiotic prescription	241 (88.327)	32 (11.72)
AQ4. Availability of information resources	134 (49.08)	139 (50.91)
AQ5. Decision for antibiotic prescription	199 (72.89)	74 (27.10)
Overall score	212 (77.65)	61 (22.34)
Practices questions	Appropriate n (%)	Not appropriate n (%)
PQ1. Frequency of antibiotic prescription decision	175 (64.10)	98 (35.89)
PQ2. Use of institutional prescription protocols	260 (95.23)	13 (4.76)
PQ3. Use of continuing medical education resources	202 (73.99)	71 (26.00)
PQ4. Use of clinical practice guidelines	261 (95.60)	12 (4.39)
PQ5. Decision-based way on prescription	66 (24.17)	207 (75.82)
Overall Score	230 (84.24)	43 (15.75)

Abbreviations: GAS, Group A *streptococcal pharyngitis*; URTI, upper respiratory tract infection; AOM, acute otitis media.

Evaluation of Practices

Five questions evaluated practices in the management of URTI cases (Table 2). All questions, except question PQ5, aimed to assess appropriate practices in antibiotic use in URTI cases. Question PQ5 evaluated decision making in antibiotic prescription, 75.8% (207/273) of physicians said that they do so based on experience.

After obtaining information from all the questions that evaluated practices, it became clear that 84.2% (230/273) of physicians showed appropriate practices. We found a significative relationship between the period of the program in which the participants were at the moment of answering the survey and their practices in antibiotic prescription (OR: 5.99, IC95%, 2.66-13.50, $P < .001$).

Discussion

This study is the first to explore physicians' KAPs in antibiotic prescription in URTI cases among physicians in Ecuador. It intends to ascertain whether a postgraduate program in family medicine could change KAPs in training physicians. The results demonstrate that knowledge in URTI cases and antibiotic prescription among junior physicians in Ecuador is limited but attitudes and practices related to the prescription of this kind of medicine are virtuous.

Our findings are similar to previous studies that show lack of knowledge in the prescription of antibiotics[23-25]; even though this study is among the first few to quantify it. Knowledge in URTIs among physicians was limited in this study, less than half of the responders had an adequate knowledge according to the survey. Although participants answered questions related to basic topics such as etiology adequately, questions with topics related to criteria, decision making, and treatment of choice were incompetent.

Antibiotic prescription has been proposed to be influenced by intrinsic prescriber factors; for instance, gender, years of practice, residence, and continuous medical education.[26] We found that gender and geographic region are factors related to antibiotic prescription in this particular group of physicians; nevertheless, other studies have not shown similar results in this aspect.[27,28] This result can be explained through the evidence suggesting that in Ecuador there are important cultural differences between regions and this factor could very easily influence the way in which a curriculum is implemented.[29,30]

Table 3. Odds Ratios for Inadequate Level of Knowledge in URTI.

Variable	Odds Ratio (95% CI)	*P*-value
Program period		
Second half (REF)	1.00	
First half	8.74 (4.94-15.46)	<.001
Gender		
Male (REF)	1.00	
Female	1.99 (1.10-3.60)	.022
Region		
Mountainous region (REF)	1.00	
Coastal region	1.85 (1.05-3.25)	.031

Abbreviations: URTI, upper respiratory tract infection; CI, confidence interval; REF, reference.

The identification of prescription-related factors is very important when designing interventions to improve the practices regarding the prescription of antibiotics.[31,32] Studies have confirmed that continuous medical education is an effective approach toward improving physicians' knowledge and prescription behavior.[33,34] Interventions can be classified by the level in which they would be applied, so there are interventions in the administrative level, patient level, and physician level. At the physician level, interventions include educational materials, group education, computer-assisted decision-making systems, form-filling control, restrictive form-filling processes, and financial incentives[34]; all of which focus on short- and medium-term interventions to achieve an improvement in the knowledge on antibiotic prescription practices. Consequently, a reduction in antibiotic use should be accomplished. We did not identify studies evaluating a postgraduate medical program for improving KAPs in prescribing antibiotics. Therefore, our study could be the first to show that a continuous medical education through a postgraduate program in family medicine would improve the knowledge about URTI cases and their correlation to antibiotic prescription in general practitioners.

Lack of knowledge and preparedness in general practitioners may be related to a limited exposure and preparation for clinical practice.[35] This situation could be improved by increasing the number of opportunities to develop the skills for prescribing drugs in a controlled and supervised environment. In postgraduate education, role models encourage active participation and teach advanced skills,[36] a postgraduate program in family practice offers those opportunities through a modelling teaching experience by an experienced doctor.

Studies that explore subjective perceptions that could influence antibiotic prescription are mostly qualitative. Due to their methodology, those studies are unable to establish a possible relationship or a magnitude of association between the two.[26] The present study explores aspects in decision-making in antibiotic prescription, delayed prescription, immediate prescription and availability of information resources. All the questions of the survey were answered adequately. Medical students show agreement with better stewardship toward the prescription of antibiotics, including strategies of a delayed antibiotic prescription or not prescribing antibiotics at all, showing that attitudes are relatively conservative. The establishment of an antibiotic stewardship program should be encouraged, as this has been proven to benefit in contributing to a more rational use of antibiotics. These strategies are effective in reducing the use of antibiotics for medical conditions where they are not advised or necessary.[37,38]

We found a fair score in practices among physicians and a significative relationship between the period of the program in which they were at the moment of the survey and their prescription practices. Although, we identified a discordance between the overall score and the specific question regarding decision-making related to prescriptions, most physicians answered that they do it based on experience but they use the appropriate tools in clinical practice. A study conducted in Singapore showed that physicians agreed to use clinical practice guidelines (CPGs) on the use of antibiotics in URTI cases; however, less than half of the consulted doctors expressed that those guidelines would not change their prescribing practices.[9] A study conducted by Solà et al[39] identified that physicians' perception of the usefulness of CPGs is affected by the disagreement between its theoretical content and the daily practice; therefore, the decision-making in clinical practice can differ from the objectives of CPGs. It can be hypothesized that tools like institutional protocols and CPGs are used by this group of physicians as a tool for diagnosis and to a lesser extent for decision-making in treatment options, because the lack of national CPG and the use of international guidelines may not support decision-making for treatments available in specific local contexts. Further studies are required to understand the perception of physicians regarding the usefulness of CPGs.

Self-reported data obtained by self-administered surveys can have limitations. Lack of comparability of the results

with data on real scenarios should be considered because in this kind of surveys responders tend to answer correctly. Thus, reliability can be affected. Moreover, it was impossible to cross-check survey responses with actual prescription practices, hence the study might have incurred in social desirability bias.[40] Besides, it was unfeasible to establish the quality and quantity of antibiotic prescription. Other limitation is the use of convenience sampling with doctors from a single university, so our findings should be interpreted with caution when generalizing to all programs in the country, because we could have incurred in selection bias.

A strong point of this study was the high response rate achieved, as well as the design of a multiple-choice questionnaire as compared to other methods of measuring the degree of agreement in KAPs studies using only Likert scales. Furthermore, the content of the questionnaire was developed based on a micro-curricular program; consequently, it can be assumed that all physicians have been taught equally. Additionally, the survey tool was rigorously validated by experts and faculty members, and pretested among general practitioners to evaluate reproducibility, reliability, and consistency.

Given the very limited literature about the effect of postgraduate programs in medical education in KAPs, we believe this study adds value in understanding the topic. We recommend doing future studies in order to compare KAPs in real scenarios.

Conclusion

Knowledge in antibiotic prescription in URTI cases among family medicine students in Ecuador is limited. A postgraduate program in general practice can significantly improve the knowledge and practices related to antibiotic prescription in URTI cases. Future studies are needed to establish whether clinicians' KAPs influence the quality and quantity of antibiotic prescription.

Authors' Note

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Author Contributions

Concept and design: XS, AL, PL. Acquisition of data: AL, PL. Analysis and interpretation of data: XS, AL, PL. Drafting of the manuscript: XS, AM, RJ. Critical revision of the paper for important intellectual content: AM, RJ, AMo. Statistical analysis: XS, RJ. Provision of study materials or patients: AL, PL. Administrative, technical, or logistic support: XS, AM, RJ, AMo. Supervision: XS.

Declaration of Conflicting Interests

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Ethical Approval

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References

1. Cox JA, Vlieghe E, Mendelson M, et al. Antibiotic stewardship in low- and middle-income countries: the same but different? *Clin Microbiol Infect*. 2017;23:812-818.
2. World Health Organization. WHO global strategy for containment of antimicrobial resistance, World Health Organisation. *WHO Glob Strateg Contain Antimicrob Resist*. 2001:1-105. http://apps.who.int/iris/handle/10665/66860
3. Gonzalez-Gonzalez C, López-Vázquez P, Vázquez-Lago JM, et al. Effect of physicians' attitudes and knowledge on the quality of antibiotic prescription: a cohort study. *PLoS One*. 2015;10:e0141820.
4. Gonzales R. Antibiotic prescribing for adults with colds, upper respiratory tract infections, and bronchitis by ambulatory care physicians. *JAMA*. 1997;278:901.
5. Stone S, Gonzales R, Maselli J, Lowenstein SR. Antibiotic prescribing for patients with colds, upper respiratory tract infections, and bronchitis: a national study of hospital-based emergency departments. *Ann Emerg Med*. 2000;36:320-327.
6. Kenealy T, Arroll B. Antibiotics for the common cold and acute purulent rhinitis. *Cochrane Database Syst Rev*. Published online June 2013. doi:10.1002/14651858.CD000247.pub3
7. Smith SM, Fahey T, Smucny J, Becker LA. Antibiotics for acute bronchitis. *Cochrane Database Syst Rev*. 2017;6(6): CD000245. Published 2017 Jun 19. doi:10.1002/14651858.CD000245.pub4
8. Lopez-Vazquez P, Vazquez-Lago JM, Figueiras A. Misprescription of antibiotics in primary care: a critical systematic review of its determinants. *J Eval Clin Pract*. 2012;18:473-484.
9. Lee T-H, Wong JG, Lye DC, et al. Medical and psychosocial factors associated with antibiotic prescribing in primary care: survey questionnaire and factor analysis. *Br J Gen Pract*. 2017;67:e168-e177.
10. Abdel-Qader DH, Albassam A, Ismael NS, et al. Awareness of antibiotic use and resistance in jordanian community. *J Prim Care Community Heal*. 2020;11:2150132720961255. doi:10.1177/2150132720961255

11. McKay R, Mah A, Law MR, McGrail K, Patrick DM. Systematic review of factors associated with antibiotic prescribing for respiratory tract infections. *Antimicrob Agents Chemother*. 2016;60:4106-4118.
12. Holloway KA, Ivanovska V, Wagner AK, Vialle-Valentin C, Ross-Degnan D. Prescribing for acute childhood infections in developing and transitional countries, 1990–2009. *Paediatr Int Child Health*. 2015;35:5-13.
13. Cordoba G, Caballero L, Sandholdt H, et al. Antibiotic prescriptions for suspected respiratory tract infection in primary care in South America. *J Antimicrob Chemother*. 2017;72:305-310.
14. Sánchez Choez X, Armijos Acurio ML, Jimbo Sotomayor RE. Appropriateness and adequacy of antibiotic prescription for upper respiratory tract infections in ambulatory health care centers in Ecuador. *BMC Pharmacol Toxicol*. 2018;19:46.
15. van der Voort T, Brinkman DJ, Benemei S, et al. Appropriate antibiotic prescribing among final-year medical students in Europe. *Int J Antimicrob Agents*. 2019;54:375-379.
16. Dyar OJ, Nathwani D, Monnet DL, et al. Do medical students feel prepared to prescribe antibiotics responsibly? Results from a cross-sectional survey in 29 European countries. *J Antimicrob Chemother*. 2018;73:2236-2242.
17. Dyar OJ, Lund M, Lindsjö C, Stålsby Lundborg C, Pulcini C. Preparedness to prescribe antibiotics responsibly: a comparison between final year medical students in France and Sweden. *Eur J Clin Microbiol Infect Dis*. 2019;38:711-717.
18. Ministerio de Salud Pública del Ecuador. Manual del Modelo de Atencion Integral del Sistema Nacional de Salud Familiar Comunitario e Intercultural (MAIS-FCI). Published 2012. Accessed June 28, 2019. http://instituciones.msp.gob.ec/somos-salud/images/documentos/guia/Manual_MAIS-MSP12.12.12.pdf
19. Ohl CA, Luther VP. Health care provider education as a tool to enhance antibiotic stewardship practices. *Infect Dis Clin North Am*. 2014;28:177-193.
20. Kjærsgaard M, Leth RA, Udupi A, Ank N. Antibiotic stewardship based on education: minor impact on knowledge, perception and attitude. *Infect Dis (Auckl)*. 2019;51:753-763.
21. Tavakol M, Dennick R. Making sense of Cronbach's alpha. *Int J Med Educ*. 2011;2:53-55.
22. Forster MR. Key concepts in model selection: performance and generalizability. *J Math Psychol*. 2000;44:205-231.
23. Al-Homaidan HT, Barrimah IE. Physicians' knowledge, expectations, and practice regarding antibiotic use in primary health care. *Int J Health Sci (Qassim)*. 2018;12:18-24.
24. Liu C, Liu C, Wang D, Zhang X. Intrinsic and external determinants of antibiotic prescribing: a multi-level path analysis of primary care prescriptions in Hubei, China. *Antimicrob Resist Infect Control*. 2019;8:132.
25. Quet F, Vlieghe E, Leyer C, et al. Antibiotic prescription behaviours in Lao People's Democratic Republic: a knowledge, attitude and practice survey. *Bull World Health Organ*. 2015;93:219-227.
26. Teixeira Rodrigues A, Roque F, Falcão A, Figueiras A, Herdeiro MT. Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies. *Int J Antimicrob Agents*. 2013;41:203-212.
27. Pradier C, Rotily M, Cavailler P, et al. Factors related to the prescription of antibiotics for young children with viral pharyngitis by general practitioners and paediatricians in Southeastern France. *Eur J Clin Microbiol Infect Dis*. 1999;18:510-514.
28. De Sutter AI, De Meyere MJ, De Maeseneer JM, Peersman WP. Antibiotic prescribing in acute infections of the nose or sinuses: a matter of personal habit? *Fam Pract*. 2001;18:209-213.
29. Wong AK. Culture in medical education: comparing a Thai and a Canadian residency programme. *Med Educ*. 2011;45:1209-1219.
30. Jha V, Mclean M, Gibbs TJ, Sandars J. Medical professionalism across cultures: a challenge for medicine and medical education. *Med Teach*. 2015;37:74-80.
31. Vazquez-Lago JM, Lopez-Vazquez P, Lopez-Duran A, Taracido-Trunk M, Figueiras A. Attitudes of primary care physicians to the prescribing of antibiotics and antimicrobial resistance: a qualitative study from Spain. *Fam Pract*. 2012;29:352-360.
32. Yimenu DK, Emam A, Elemineh E, Atalay W. Assessment of antibiotic prescribing patterns at outpatient pharmacy using world health organization prescribing indicators. *J Prim Care Community Heal*. 2019;10:2150132719886942. doi:10.1177/2150132719886942
33. Akter SFU, Heller RD, Smith AJ, Milly AF. Impact of a training intervention on use of antimicrobials in teaching hospitals. *J Infect Dev Ctries*. 2009;3:447-451.
34. Roque F, Herdeiro MT, Soares S, Teixeira Rodrigues A, Breitenfeld L, Figueiras A. Educational interventions to improve prescription and dispensing of antibiotics: a systematic review. *BMC Public Health*. 2014;14:1276.
35. Heaton A, Webb DJ, Maxwell SRJ. Undergraduate preparation for prescribing: the views of 2413 UK medical students and recent graduates. *Br J Clin Pharmacol*. 2008;66:128-134.
36. Passi V, Johnson S, Peile E, Wright S, Hafferty F, Johnson N. Doctor role modelling in medical education: BEME Guide No. 27. *Med Teach*. 2013;35:e1422-e1436.
37. Arrol B, Goodyear-Smith F, Thomas D, Kerse N. Delayed antibiotic prescriptions: what are the experiences and attitudes. *J Fam Pract*. 2002;51:954-959.
38. Chaw PS, Höpner J, Mikolajczyk R. The knowledge, attitude and practice of health practitioners towards antibiotic prescribing and resistance in developing countries—a systematic review. *J Clin Pharm Ther*. 2018;43:606-613.
39. Solà I, Carrasco JM, Díaz del Campo P, et al. Attitudes and Perceptions about Clinical Guidelines: A Qualitative Study with Spanish Physicians. *PLoS One*. 2014;9:e86065.
40. Gordon RA. Social desirability bias: a demonstration and technique for its reduction. *Teach Psychol*. 1987;14:40-42.