Knowledge, attitude and practice regarding antibiotics resistance among general practitioners in polyclinics in Yerevan, Armenia

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LIST OF ABBREVIATIONS

EARS-Net	European Antimicrobial Resistance Surveillance Network
EAAD	European Antibiotic Awareness Day
ECDC	European Centre of Disease Prevention
GP	General Practitioner
OTC	Over-the-counter
WHO	World Health Organization

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Abstract

Background: Antibiotic resistance is a global problem and an important public health issue. Resistance to antibiotics can develop in case of inappropriate use of antibacterial drugs, self-medication of general population, antibiotics misuse by providers, which includes inappropriate choice of antibacterial drugs as well as incorrect dose, spectrum and period of treatment. Poor prescribing practices and insufficient knowledge about antibiotics prescribing among physicians may increase bacterial resistance. Antibiotics prescribing practice may be influenced by the socioeconomic class of a patient, competition among physicians, cost of diagnostic tests, pressure by patients, physician's qualification, education and experience. Also, influence of pharmaceutical company representatives through incentives to physicians can have a negative impact on antibiotics prescription practices. The objectives of the study were: measuring the knowledge, attitude and practice scores on antibiotics resistance; exploring the association between antibiotics prescribing practice score among GPs and their knowledge and attitude scores after adjusting for other factors; and identifying barriers for rational antibiotics prescription by GPs.
Methods: A cross-sectional study design was used. Data collection was conducted through a self-administered survey among GPs in private and public polyclinics in Yerevan. The survey questionnaire included sections on demographic characteristics of GPs, professional experience, knowledge of GPs about antibiotics and antibiotics resistance, attitude of GPs towards antibiotics resistance, GPs' prescribing practices, and barriers to rational prescribing of antibiotics. Descriptive, simple and multivariable linear regression analyses were performed using SPSS 22 software.
Results: Overall, 291 GPs participated in the study. The mean age of GPs was 55.1 (SD = 9.9). Knowledge, attitude and practice mean percent scores were 58.3%, 67.5%, 63.0%, respectively. In the univariate analyses attitude and knowledge % scores, age of GPs, years of experience after graduation were found to be significantly associated with the practice % score. After adjusting for attitude and knowledge % scores, type of polyclinic, years of experience, professional education after graduation and number of patients served per day, practice % score was significantly associated with attitude % score ($\beta = 0.58$; 95% CI: 0.41, 0.75; $p < 0.001$) and years of experience of GPs ($\beta = -0.19$; 95% CI: -0.37, -0.03; $p = 0.022$). The main barriers reported by GPs were: lack of rapid diagnostic tests, high costs of laboratory tests, high costs of some antibiotics and lack of guidelines.
Conclusion: The study revealed a low knowledge, attitude and practice mean % scores, suggesting a need for improvements in these areas. Also, difference in prescribing practice between different age groups of GPs was found in the study, which suggests the need to focus on older generation of primary health care physicians when planning training programs. Availability of rapid and inexpensive diagnostic tests, enforcement of prescriptions and regulation of antibiotic's prices could help to overcome antibiotics resistance. This study provides a groundwork for the future research among primary health care physicians in marzes and other specialists to determine their prescribing practices.

1. Introduction

Antibiotic resistance is a global problem and an important public health issue. Discovery of the first antibiotic by Fleming triggered the creation of diverse antibiotics for various goals and needs. Antibacterial drugs helped to prolong life span by altering the outcome of bacterial infections. The beneficial effect of antibiotics demonstrated decrease of mortality from bacterial infections contributing to longer life expectancy.[1] Antibacterial drugs have had a key role in saving people's life and contributed significantly in the advancement in the fields of medicine. Antibiotics have an essential role in prevention of infections during such surgeries as transplantations, joint replacement and heart surgery.[2]

In 1945, Alexander Fleming raised the issue of antibiotics overuse, telling, that "public will demand (the drug and) … than will begin an era…. of abuses."[3,4] Scientists first noted the formation of resistance to penicillin when low or high dose, or inappropriate period of treatment was used, and the relationship between inappropriate usage of antimicrobial medicines and spread of resistant bacteria was demonstarted.[5,6,7] According to the World Health Organization (WHO) data, resistance of bacteria to antibiotics is registered in high as well as low income counties. "The most commonly reported resistant bacteria were Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus, and Streptococcus pneumoniae, followed by Salmonella spp."[8]

Elevated antibiotic's use was registered in many countries, such as Russia, China, India, Brazil and South Africa in 2000-2010; especially high use of Carbapenems and Polymixins was reported.[9] Around 140,000 infections per year occur due to the bacteria from Enterobacteriaceae family in the U.S., from which more than 9,000 are caused by Carbapenem-resistant Enterobacteriaceae.[3] Data shows that 600 deaths per year result from two species of carbapenem-resistant Enterobacteriaceae in the U.S., such as carbapenem-resistant Klebsiella and carbapenem- resistant E.coli, and 11,285 deaths per year result from

methicillin-resistant Staphylococcus aureus.[3]

According to the data of the Eurobarometer, antibacterial drugs were used by around 40% of Europeans for treatment of different diseases in 2016; in Malta[10] and Spain[10] antibiotics were used more often compared to Sweden[10] and Netherlands.[10] Data showed that women and low educated people used antimicrobial drugs more frequently in comparison with others. Furthermore, in Bulgaria (31%) and Greece (28%) antibacterial drugs were used for treatment of influenza, while the rates were very low in Sweden (1%) and the Netherlands (4%). Antibiotics were used to treat bronchitis by around 27% of Italians and Slovakians, whereas this number was significantly lower in Denmark (3%) and Sweden (5%).[10] The European Antimicrobial Resistance Surveillance Network (EARS-Net) reported the microbial resistance to be higher in the southern European countries compared to the northern ones. In 2016, decrease of Meticillin resistant Staphylococcus aureus and increase of Vancomycin resistant Enterococcus faecium was reported.[11] The multidrug resistance to antibiotics induces the creation of new and stronger antimicrobial drugs, which requires a lot of resources and time (around 10 years). [12] Development of new antibiotics is considered as economically unprofitable, because they are usually used for short period of time and they are not usually prescribed for long-term use as treatment for chronic conditions.[13]

Improper use of antibiotics involves self-medication of general population and antibiotics misuse by providers, including incorrect spectrum and dose of antibiotics, wrong period of treatment, inappropriate choice of medications. In settings where there are scarce resources, antibiotics prescribing practice may be influenced by social conditions, such as the socioeconomic class of a patient, his/her demand for antibacterial drugs, competition among physicians, especially physicians from private facilities could influence prescribing practice, and patients may directly get antibiotics from pharmacies without prescribtion.[14] High cost of laboratory diagnostic procedures, such as urine and blood sensitivity tests, not always

affordable for poor people, may change physicians' prescribing practice.[15] Physicians can be directly and indirectly pressured by patients to prescribe antibiotics.[16]

There are many studies showing poor prescribing practices by physicians.[14,15,17,18] Insufficient knowledge about antibiotics prescribing among physicians, as well as population lack of awareness about antibiotics use, may lead to bacterial resistance.[19,20,21]

Self-medication is elevated in those countries, where antibiotics are sold without prescription of physicians or over-the-counter (OTC).[22] In Russia[23], Greece[24], and Malta[25], self-medication without consultation with physicians, has been reported. Studies in Spain and the U.S. reported about use of previous prescriptions of antibiotics or leftover drugs.[19,26,27,28,29]

According to some studies, patient's wrong knowledge about antibiotics can result from inappropriate prescribing by physicians.[30,31] People reported self-medication for the following conditions: sore throat, eye pain, bronchitis and toothache.[10]

Antibiotics are widely used in agricultural settings contributing to antibiotics resistance development. In the U.S. around 80% of all realized antibacterial drugs serve as growth promoters as well as for prevention of infectious diseases among animals.[13,32] Humans become infected by pathogenic resistant bacteria from contaminated meat or milk products, which can cause different gastrointestinal infections, among which are campylobacteriosis and salmonellosis, or indirectly through the contact with water and soil, by which resistant microorganisms enter into human body.[33,34] Additionally, more than 80% of antibacterial drugs are excreted by animals and dispersed to groundwater and soil.[13,34] Thus, the use of antibiotics promotes alteration in the environmental ecology, which brings to elevation of resistant microorganisms' level in the environment.[35]

Education of population by increasing awareness about self-medication, especially with "leftover" medication may decrease the formation of antibiotics resistance.[36] Education should include information about the limited number of pills dispensed in pharmacies and

throw away (discard) of leftover antibiotics.[28] Learning about self-medication among medical students is also very important, because they are potential doctors and "prescribers" and need to be informed.[37] A study shows that medical university graduates have a gap in knowledge about antibiotics prescription for diverse infectious diseases and drug resistance.[38] In 2008, the European Centre for Disease Prevention and Control (ECDC) together with the European Commission and the World Health Organization's Regional Office for Europe (WHO/Europe) established the European Antibiotic Awareness Day (EAAD) on November 18 to be celebrated every year and launched a program, aiming to increase awareness of global antibacterial resistance via spread of information using social media, and will help to fight against resistance. Mobilization of laboratories in different countries would help to understand how resistance is spreading and where the highest risk is.[39] The influence of EAAD on population was demonstrated in several studies.[40,41] However, knowledge about antibiotics and consequences of their inappropriate use should be improved by regular educational campaigns using different media.

Antibacterial drugs are considered as most commonly utilized medicines and in order to gain optimal benefit they should be used rationally, which is a big problem in many countries.[42,43] According to the WHO, rational use of drugs is when "patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community".[44] Rational prescription of antibiotics is related to the type of health care facility, use of guidelines, availability of medicines, physician's trainings, their educational background and years of experience.[45] When bacteria become resistant to first line antibacterial drugs, then more expensive once should be used, which may cause an increase of the duration of treatment, hence, the economic burden on society and families could increase.[46,7] According to the WHO, around 40% of patients are prescribed antibiotics in accordance with WHO

guidelines.[47] In order to guarantee rational antibiotic prescription, physicians should follow the guidelines.[48] Unfortunately, physicians use large spectrum of antibiotics very often in order to manage both gram positive as well as gram negative bacterial infections.[18] Patient's socioeconomic status, age, co-morbidity, as well as physician's qualification, education, experience, and source of new information may influence their prescribing practice.[49,14,15] Insufficient knowledge of physicians, influence of pharmaceutical company representatives through incentives or gifts to physicians, uncertainty in diagnosis, and patient's expectation can have negative impact on antibiotics prescription practices.[50,51,52] The first contact with health care services happens in polyclinics for the majority of people, where the service is more affordable. Therefore, the greatest part of antibiotics prescription is carried out in primary health care facilities. Chung A. et al. showed an association between of resistance and antibiotics prescribing at primary care level.[53] Consequently, interventions on misuse of antibiotics for health care providers working at primary care facilities are necessary.[54,55]

1.1 Situation in Armenia

Increasing antibacterial resistance is a public health challenge in Armenia.[56] Among 43 European countries, Armenia joined the campaign and participated in the EAAD in cooperation with the WHO/Europe in 2012.[39] Data about antibiotics misuse in Armenia is scarce. Two studies were conducted in Yerevan regarding antibiotics resistance.[20,57] The first study was conducted among Yerevan residents to look at the prevalence of self-treatment with antibacterial drugs, and the impact of socioeconomic factors on it in Yerevan in 2005.[20] It was shown that self-medication with antibiotics could bring to antibiotics resistance and that pharmacies were the only available source of purchasing self-prescribed drugs. It was reported that the prevalence of self-medication during one year was 12%, whereas intended self-medication in general was more than 50%. The second study conducted in 2016

measured knowledge, attitude and practice of antibiotics use among adult population in Yerevan. The results showed that 57% of people used antibiotics improperly.[57] More than 50% of people thought that antibiotics helped in case of cold, and around 40% were sure that antibiotics helped against viruses. The study showed that self-medication and misuse of antibiotics was connected with purchasing them directly from pharmacies without prescription. Moreover, the study showed that doctors might give wrong advice regarding antibiotic's use. Additionally, high socio-economic status was associated with antibiotics misuse. Both studies demonstrated that legislative changes are necessary to prohibit selling antibiotics without prescription to reduce self-medication in Armenia and educational programs of population are needed to improve the situation with antibiotics use.

Hovahnnisyan et al. showed that resistance of Neisseria gonorrheae was registered in some regions of Armenia.[58] In some pediatric hospitals of Armenia, resistant strains of Escherichia coli, Staphylococcus, Shigella and Salmonella were registered.[59]

Insufficient data about knowledge of antibiotics resistance, attitude towards this issue and poor prescribing practices among general practitioners in Armenia justify the need for this research.

1.2 The goal of the study

The first objective of the study was measuring the knowledge, attitude and practice scores among GPs on antibiotics resistance.

The second objective was exploring the association between antibiotics prescribing practice score among GPs and their knowledge and attitude scores after adjusting for other factors.

The third objective was identifying barriers for rational antibiotics prescription by GPs.

The smart use of antibiotics was described in a conceptual framework, which consists of

three phases (Appendix 1). Phase 1 includes PRECEDE-PROCEED[60] and theory of planned behavior[61] models, which aim to change prescribing practices among physicians; phase 2 and 3 include the diffusion of innovation theory[62] and the program sustainability framework.[63] According to the framework, patient's health may be affected by prescribing practices of health providers as well as by self- medication. Predisposing, reinforcing and enabling factors can affect prescribing practice of providers. Predisposing factors include knowledge, attitude and subjective norms. Peer pressure, promotion of medications, patient's expectations towards antibiotics are included into the reinforcing factors. Enabling factors are those facilitating antibiotics' prescription, such as physician's skills for correct diagnosis and use of guidelines.[64]

2. Methods and Materials

2.1 Study design and settings

We used a cross-sectional study design. A self-administered survey was performed among GPs in private and public polyclinics in Yerevan. This design was used because it requires less time and resources compared to others. All GPs, working in Yerevan polyclinics and speaking Armenian, were eligible for the study. The data collection was performed within February and March 2020 in Yerevan.

2.2 Sample size

There was no existing data regarding antibiotics prescribing practice of physicians in Armenia. An estimated standard deviation, equal to 11.1, was taken from a previous study regarding knowledge, attitude and practice regarding antibiotics use among healthcare providers.[65] The sample size calculation was done using the formula for one group:

$$\mathbf{n} = \frac{Z^2\ 1-\alpha/2 \times \sigma^2}{d^2}$$

Where,

n = the required sample size

$\mathbf{Z}_{1-\alpha/2} = 1.96$

σ = estimated standard deviation

$\mathbf{d}^2$ = desired precision

$$\mathbf{n} = \frac{(1.96)^2 \times (11.1)^2}{(1.5)^2}$$

n = 209

The student investigator used a precision level of 1.5 percent score in the practice mean percent score among physicians, with 95% confidence interval and 80% power for the study. Since the study utilized a cluster sampling, with a cluster size of 20, a design effect of 1.3 was used to reduce the sampling error.[66] Taking into consideration the response rate from similar studies regarding knowledge, attitude and practice about antibiotics among physicians,[67,65,68] we utilized a response rate of 80%. The final sample size was equal to 340.

$$\mathbf{n} = \frac{209 \times 1.3}{0.8} = 340$$

2.3 Sampling strategy

Multistage cluster sampling technique was used to select the study participants. The list of primary health care facilities and the number of population served by each of them was obtained from the Yerevan Municipality website and through the National e-Health operator. From the list of 26 public and 12 private polyclinics, 17 largest polyclinics in Yerevan, each serving a population of at least 30,000, were selected. Due to refusal to participate in the survey of one of the 17 selected polyclinics, the next largest polyclinic by population served

was approached. In each participating polyclinic, the student investigator approached 20 GPs.

2.4 Data collection and logistic considerations

The data collection started after receiving permission from the Yerevan Municipality and selected public and private polyclinics. In order to have a high response rate, a self-administered survey tool was used. Even though the social desirability bias might be an issue with this method, it was considered more cost-effective, as it did not require to hire interviewers. The questionnaires were distributed to the physicians and collected back in closed envelopes.

The student investigator approached all GPs available in selected polyclinics at the time of the survey and invited them to take part in the survey. Due to unavailability of all 20 physicians at the same time, the student investigator approached those who were available, introduced the study and obtained their verbal consent to participate. Then she waited until others became available. Since many GPs were not able to allocate time for the survey (were busy with patients) on the day of survey, the questionnaires were left with them and collected back during the next day.

2.5 Study instrument

A structured questionnaire based on similar cross-sectional study instruments was developed.[65,68,69,67,73,70] The final survey instrument contained the following sections: 1) demographic characteristics of GPs, 2) professional experience, 3) attitude of GPs towards antibiotics resistance, 4) knowledge of GPs about antibiotics and antibiotics resistance, 5) GPs prescribing practice, and 6) barriers to rational prescribing of antibiotics (Appendix 3). The questionnaire included mainly Likert scale answer options. The survey instrument was

translated into Armenian and pretested among three GPs before the start of the fieldwork.

2.6 Measurement and sources of data

The dependent variable was the practice score of GPs. The attitude and knowledge scores of GPs were the secondary outcome variables.

GPs' age, gender, the average number of patients they served per day, their years of professional experience, professional education after graduation, and trainings regarding antibiotics resistance during the last three years, were included as independent variables.

Knowledge score was calculated based on the following scoring approach: giving one point for correct answers, and zero point for the incorrect answers, "do not know" or missing values. Responses to the six knowledge statements were summed to result in the knowledge score, which ranged from 0-6. The mean knowledge percent score was calculated. The attitude score was calculated by giving from the maximum of four points to the most desired response to the minimum of zero point to the most non-desired answer, based on the Likert response scale. The 14 items included in this domain resulted in a score ranging from 0 to 56. The mean attitude percent score was calculated. The practice score was calculated by giving 1 point if a participant reported correct practice and 0 if a participant reported incorrect practice or in case of missing value. The range for prescribing practice score was from 0 to 9. The mean practice percent score was calculated.

In addition, 12 questions were included to identify main barriers for rational antibiotics prescribing by physicians, among which one question was open ended (Appendix 3).

2.7 Data analysis

Single data entry was performed by the student investigator using SPSS 22.0 statistical

software in parallel with data collection. Range check and 10% random check was performed to clean the data.

Descriptive analysis was done to describe the participants' characteristics, using means and standard deviations for continuous variables and percentages for categorical ones. Percentages of reported correct prescribing practice, desired attitudes and accurate answers to knowledge questions were calculated. Pearson correlation coefficients were calculated to find the direction and strength of linear association between knowledge, attitude and practice scores. Univariate linear regression analysis was performed to find any significant crude associations between dependent and independent variables. Multivariable linear regression analysis was done to find associations between dependent and independent variables. The student investigator explored the distribution of residuals for the final models to check if the distributions were random and normal using normal probability plots of residuals and scatterplots of residuals versus predicted values. Multicollinearity was checked between independent variables by Variance Inflation Factor.

2.8 Ethical consideration

The Institutional Review Board of the American University of Armenia approved the proposal. Oral consent was obtained from GPs participated in the study.

3. Results

In order to reach the required sample size, 18 public and private polyclinics in Yerevan were approached; one polyclinic refused to participate. Hence, 17 polyclinics (12 public and 5 private) were included in the study. Out of 318 approached GPs, 27 refused to participate. The resulting response rate was 91.5%.

3.1 Descriptive statistics

Socio-demographic characteristics

Table 1 represents the descriptive statistics of GPs working in polyclinics of Yerevan. Mean age of the GPs in the whole sample was 55.1 (SD = 9.9), with the range from 27 to 79 years. A large proportion of GPs (98.3%) were females. The mean duration of GPs' professional experience was 28.2 (SD = 11.5). About 85% of GPs noted that they underwent postgraduate professional education with at least 6 months duration. More than 19% of participants did not participate in trainings regarding antibiotics and antibiotics resistance during the last 3 years. Average number of patients served per day by GPs was 14.1 (SD = 5.1). Majority of participants (87.3%) desired to participate in educational program on antibiotics. Knowledge mean percent score of GPs regarding antibiotics and antibiotics resistance was 58.3% (SD = 20.1). Attitude and practice average percent scores among GPs with respect to antibiotics resistance, antibiotics use and prescribing were 67.5% (SD = 10.9) and 63.0% (SD = 16.9), respectively.

3.2 Correlation between knowledge, attitude and practice scores

Pearson correlation analysis was performed to find the strength of the linear associations between practice, knowledge and attitude scores (Table 2). The correlation analysis showed that the strength of association between attitude and practice scores was high ($r = 0.375$) and highly significant ($p < 0.001$). The strength of association between attitude and knowledge scores was also rather high ($r = 0.287$) and highly significant ($p < 0.001$). The strength of association between the knowledge and practice scores was relatively lower ($r = 0.145$), but still significant ($p = 0.013$).

3.3 Knowledge regarding antibiotics and antibiotics resistance among GPs in polyclinics

Table 3 illustrates the percent of GPs' correct answers to knowledge questions about antibiotics and antibiotics resistance. The vast majority of GPs knew that there is no need to prescribe antibiotics for non-febrile diarrhea. Low proportion of physicians (25.4%) knew that methicillin resistant Staphylococcus aureus is resistant to betta-lactam antibiotics. More than 75% of GPs knew about ineffectiveness of antibacterial drugs for upper respiratory tract viral infections. More than half (56.0%) of participants knew that amoxicillin is safe to prescribe pregnant women and less than half (39.9%) of the GPs mentioned metronidazole as the best preparation against anaerobes. About 60% of GPs knew that antibiotics were effective in patients with cystitis caused by Escherichia coli.

3.4 Attitude regarding antibiotics resistance among GPs in polyclinics

Table 4 shows the percentages of desired attitudes of GPs to factors related to antibiotics resistance. More than half of GPs believed that improper hand disinfection by physicians could not cause spread of drug resistant bacteria. Moreover, only 35.4% of participants thought that a physician would change his/her antibiotic prescribing pattern even if patients were satisfied with the treatment. In addition, 69.3% mentioned that antibiotic guidelines were rather obstacles than a help for prescribing antibiotics and more than half of GPs noted that development of local guidelines on preventing antibiotics resistance would not be such helpful as the international ones. Besides, 60.5% of GPs considered that dispensing antibiotics without a prescription could not drive antibiotic resistance.

3.5 Prescribing practice regarding antibiotics resistance among GPs in polyclinics

Table 5 shows the percentages of correct prescribing practices among GPs employed in Yerevan polyclinics. Only about 30% of participants did not follow the recommendations

made by pharmaceutical companies while prescribing antibiotics. Wide spectrum antibiotics were prescribed by 82.1% of GPs when results of bacteriological analysis were absent. Moreover, 32% of GPs considered shortening the recommended duration of treatment if patient's condition got better. The same antibiotic was prescribed by 58.4% of GPs in case of recurrence of the same disease and 12% of GPs prescribed antibiotic if patient insisted on that.

3.6 Simple linear regression

Simple linear regression was conducted to find associations between the main outcome (practice % score) and independent variables (Table 6). Attitude % score, knowledge % score, age of GPs, years of experience after graduation from the university were significantly ($p < 0.05$) associated with the practice % score in the univariate analyses.

Simple linear regression between the secondary outcome of attitude % score and independent variables was done (Table 7). Knowledge % score, age of participants, type of polyclinic, years of experience after graduation and the number of patients served per day by GPs were significantly associated with the attitude % score in the univariate analyses.

Simple linear regression between the secondary outcome of the knowledge % score and independent variables was performed (Table 8). Age of participants, years of experience after graduation and the number of patients served per day were significantly associated with the knowledge % score in the univariate analyses.

3.7 Multivariable linear regression

Multivariable linear regression was done to find out the relationship between the main outcome variable (practice % score) and significant independent variables in the univariate analysis, also those variables with $p < 0.25$ in the univariate analysis (Table 9). Variables

were checked for multicollinearity. The variance inflation factor, which was equal to 4.6, revealed correlation between two independent variables: age and years of professional experience of GPs. A decision to use one of these highly correlated two variables (years of experience) was made.

After adjusting for knowledge % score, type of polyclinic, years of experience, professional education after graduation and number of patients served per day, only the attitude % score of GPs was significantly associated with the practice % score. Figures 1 and 2 demonstrate the distribution of residuals in this model indicating its normality and random pattern. The multivariable linear regression showed that, when holding all the other variables in the model constant, one unit increase in the attitude % score was associated with 0.58 unit increase in the practice % score (95% CI: 0.41, 0.75; $p < 0.001$).

Multivariable linear regression between the secondary outcome variable (attitude % score) and available independent variables was done. After adjusting for other independent variables, the knowledge % score, the number of patients served per day and the years of experience of GPs were significantly associated with the attitude % score (Table 10). Figures 3 and 4 illustrate the normal distribution and random pattern of residuals in this model. The multivariable regression showed that, when holding all the other variables in the model constant, one unit increase in the knowledge % score was associated with 0.11 unit increase in the attitude % score (95% CI: 0.05, 0.18; $p < 0.001$); one unit increase in the number of patients served per day was associated with 0.25 unit increase in the attitude % score (95% CI: 0.01, 0.49; $p = 0.042$). Also, one-year increase in GP's years of experience was associated with a 0.27 unit decrease in the attitude % score (95% CI: -0.38, -0.17; $p < 0.001$).

Multivariable linear regression with the secondary outcome variable (knowledge % score) and independent variables was done. After adjusting for other independent variables, the number of patients served per day and the years of experience of GPs were significantly

associated with the knowledge % score (Table 11). Figures 5 and 6 demonstrate the normality and random pattern of distribution of residuals in this model. The multivariable linear regression showed that, when holding all the other variables in the model constant, one unit increase in the number of patients served per day was associated with 0.61 unit increase in the knowledge % score (95% CI: 0.14, 1.07; p = 0.011). Also, one-year increase in the years of experience was associated with a 0.32 unit decrease in the knowledge % score (95% CI: -0.52, -0.12; p = 0.002).

3.8 Barriers to rational antibiotics prescribing among GPs in polyclinics

The barriers to rational antibiotics prescribing among GPs employed in Yerevan polyclinics are presented in Table 12. The main barriers reported by GPs were the lack of rapid diagnostic tests, followed by the high costs of laboratory tests, high costs of some antibiotics and lack of guidelines. Only a small proportion of participants reported "difficulty to make an accurate diagnosis", not enough free/ affordable training courses on optimal antibiotic therapy, fear of missing the bacterial infection, lack of time to search for information, pressure from patients, lack of motivation to provide quality services because of inadequate remuneration and pressure from pharmaceutical companies to be significant barriers.

4. Discussion

4.1 Findings on some important items which measure knowledge, attitude and practice

Our study demonstrated low average knowledge percent score among GPs (58.3) regarding antibiotics and antibiotic resistance. For comparison, a similar study conducted among physicians in India reported considerably higher average knowledge percent score regarding antibiotics and antibiotic resistance (77.3).[65] The knowledge concerning the resistance of methicillin resistant Staphylococcus aureus to betta- lactam antibiotics was the lowest in our study, which was consistent with the literature.[71,72]

The majority of participants demonstrated good levels of knowledge while answering some questions. Most respondents in this study knew about ineffectiveness of antibacterial drugs for upper respiratory viral infections, unlike the participants of studies performed in different countries that demonstrated a knowledge gap in this respect.[73,72,71] For the question about acute diarrhea, the majority of GPs in our study agreed that there was no need to prescribe antibiotics for diarrhea similar to what was found in other studies (Appendix 2).[74,72,71]

The current study showed a low mean attitude percent score (67.5) regarding antibiotics resistance among GPs. The similar study conducted in India reported higher average attitude percent score (87.3).[65] Several problematic attitude areas were identified. More than half of the GPs in our study mentioned that in primary care, microbiological results were not useful when treating infectious diseases. Unlike this, the study conducted by Faizullah et al. (2017) in Pakistan reported that majority of its participants agreed about the importance of microbiological sensitivity tests in treating infectious diseases.[82] In our study, 70% of participants believed that antibiotic-therapy guidelines were obstacles rather than help for prescribing antibiotics, unlike the study which was performed in Lao, where only 22% of participants had a similar response.[75] Unlike the study conducted by Liu et al. (2019), greater part of GPs in our study believed that dispensing antibiotics without a prescription cannot drive antibiotic resistance.[68]

In some areas, the majority of participants demonstrated desirable attitude. For instance, less than half of the participants in our study mentioned that physicians should not change their antibiotic prescribing pattern if patients were satisfied with the treatment, which is consistent with other studies.[68,75] Our study had almost similar results regarding the use of local guidelines over international once with the study in Lao, which highlighted that the local microbial resistance should be taken into account.[75] Majority of GPs mentioned that self-medication and inappropriate consumption of antibiotics will bring the development of

resistance. This finding was similar to the studies conducted by Thriemer et al. (2013) and Wafaa et al. (2019).[71,74]

Our study demonstrated relatively low mean percent score (63.0) for prescribing practice regarding antibiotics resistance. The study conducted in India reported almost similar average practice percent score (67.6).[65] More than two-thirds of participants showed incorrect prescribing practice in our study, relaying on recommendations made by pharmaceutical companies while prescribing antibiotics. The majority of GPs demonstrated correct prescribing practices in some areas, for example, delaying antibiotics prescription in case of viral infections, discussing antibacterial resistance with patients while prescribing antibiotics, not prescribing antibiotics based on patient's desire (Appendix 2).[68,76,69]

Most participants considered lack of rapid diagnostic tests and high cost of some antibiotics as significant barriers to rational antibiotics prescribing. The next highly rated barrier in our study was lack of clear guidelines. Most GPs did not consider "difficulty to make an accurate diagnosis", fear to miss bacterial infection, time deficiency to search for information, and pressure from patients as significant barriers.[70]

4.2 Interrelation between knowledge, attitude and practice regarding antibiotics resistance

According to the conceptual framework of antibiotics smart use, patients' health may be affected by prescribing practices of health providers and self- medication.[64] Knowledge and attitudes are included into the predisposing factors influencing prescribing practice. The antibiotics smart use framework did not completely fit with the survey data, which was demonstrated by the weak positive correlation between the practice and knowledge % scores ($r = 0.145$; $p = 0.013$). On the other hand, the strong correlation between practice and attitude % scores ($r = 0.375$; $p < 0.001$), ($\beta = 0.58$; $p < 0.001$) was present in our study, which showed that in this respect our findings were in line with the conceptual framework. In contrast with

our study, Liu et al. (2019) demonstrated that attitude did not predict prescribing practice (β = -0.039; p > 0.05).[72] Our study reported a weak but significant positive correlation between knowledge and attitude (r = 0.287; p < 0.001), (β = 0.11; p = 0.000), which corresponded to the conceptual framework. This result was consistent with the study conducted by Wafaa et al. (2019) (r = 0.313; p = 0.001).[74] In contrast to our study, Wester et al. (2002) found insignificant association between attitude and knowledge.[77]

Although knowledge about antibiotics and antibiotics resistance influence the responses of the GPs to the various questions, this study showed that knowledge was not associated with prescribing practice, which was identical to the results of the study performed by Liu et al. (2019).[72] The possible explanation might be the influence of pharmaceutical companies or representatives, offering a gifts or samples of medication, which affected prescribing practice of GPs. The other reason might be the patient pressure, which will "force" GPs to made a wrong prescription. Unlike our study, Gonzalez-Gonzalez et al. (2015) found that antibiotics use was closely associated with the knowledge and attitudes of GPs.[78]

4.3 Independent predictors of knowledge, attitude and practice regarding antibiotics resistance

Our study showed significant positive association of knowledge with the number of patients per day (β = 0.61; p = 0.011) and significant negative association of knowledge with the years of GP's experience (β = -0.32; p = 0.002), which might be explained by insufficient education on antibacterial resistance at the time when older generation studied at medical university in comparison with younger graduates.[79] Also, this study demonstrated significant positive association between attitude towards antibiotics resistance and the number of patients per day (β = 0.25; p = 0.042), and negative association with the years of GPs' experience (β = -0.27; p < 0.001). Unlike this study, similar studies in other countries

reported either improved attitude with more experience[77] or no relationship between the two concepts.[72]

Antibiotics prescribing practice of GPs in our study was positively associated with attitude of GPs ($\beta = 0.58$; $p < 0.001$), in contrast with the study conducted by Liu et al. (2019) showed that attitudes, knowledge and years of experience were not significantly associated with prescribing practices among GPs.[72]

The results of our study showed that most part of GPs received trainings on antibiotics resistance. However, the knowledge among GPs remained poor in our study. The influence of trainings on healthcare providers was examined by Das et al. (2016) and they found that trainings did not decrease unnecessary use of antibiotics.[80] Similarly, our study showed insignificant association of GPs' training with attitude towards antibiotics resistance, which is identical to a study done by Wester et al. (2002).[77] Furthermore, results of our study demonstrated that training, being a basis of knowledge, was not associated with the knowledge % score, consistent with other studies.[74,81] The fact that trainings were not associated with knowledge might be connected with the role of internet and availability of different online educational programs regarding antibiotics use and prevention of antibacterial resistance.[74] The results of our study demonstrated that trainings regarding antibiotics resistance were not associated with prescribing practice.

4.4 Strengths and limitations

One of the strengths of this study was the large sample size. Another strengths of the study was high response rate among GPs in polyclinics in Yerevan. The cross-sectional study design and the self- administered knowledge, attitude and practice questionnaire made the study cost-effective, as it required less time and resources, did not require to hire interviewers and gave a possibility to collect information from a larger number of participants. The

questionnaire was developed based on validated questionnaires, which made our study robust. To meet the cluster size requirement, only the largest polyclinics, each serving a population of at least 30,000, were selected, leaving out small polyclinics, which could affect the generalizability of the findings. Another limitation could have been the contamination of the study, since the questionnaires were left with physicians and collected back during the next day, creating a possibility for GPs to discuss the answers with peers. However, apparent similarities between GPs' responses were not detected. Another limitation was the response scale used for some questions in prescribing practice section of the questionnaire, which measured the degree of agreement rather than the actual practice. The study has a limited generalizability for Armenia, because it was done only among GPs in Yerevan, and polyclinics in marzes were not included in the study.

5. Recommendations

The identified difference in prescribing practice between different age groups suggests the need to focus on older generation of primary health care physicians when planning training programs. Improving courses on antibiotics resistance in medical universities would be beneficial in terms of resistance reduction. Availability of rapid and inexpensive diagnostic tests, enforcement of prescriptions and regulations of antibiotics' prices could help to overcome antibiotics resistance. We would recommend conducting similar studies among primary health care physicians in marzes and other doctors (specialists) in order to determine their prescribing practices.

REFERENCE LIST

1. Piddock LJ V. The crisis of no new antibiotics-what is the way forward? *Lancet Infect Dis*. 2012;12(3):249-253. doi:10.1016/S1473-3099(11)70316-4

2. Wright GD. Something old, something new: revisiting natural products in antibiotic drug discovery. *Can J Microbiol*. 2014;60(3):147-154. doi:10.1139/cjm-2014-0063

3. Lee Ventola C. *The Antibiotic Resistance Crisis Part 1: Causes and Threats*. Vol 40.; 2015.

4. Spellberg B, Gilbert DN. The future of antibiotics and resistance: a tribute to a career of leadership by John Bartlett. *Clin Infect Dis*. 2014;59 Suppl 2:S71-5. doi:10.1093/cid/ciu392

5. Zaman S Bin, Hussain MA, Nye R, Mehta V, Mamun KT, Hossain N. A Review on Antibiotic Resistance: Alarm Bells are Ringing. *Cureus*. 2017;9(6):e1403. doi:10.7759/cureus.1403

6. The antibiotic alarm. *Nature*. 2013;495(7440):141. doi:10.1038/495141a

7. Antibiotic resistance. World Health Organization website. https://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance. Accessed February 9, 2019.

8. WHO. High levels of antibiotic resistance found worldwide, new data shows. *WHO*. 2018. https://www.who.int/mediacentre/news/releases/2018/antibiotic-resistance-found/en/. Accessed February 9, 2019.

9. Van Boeckel TP, Gandra S, Ashok A, et al. Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. *Lancet Infect Dis*. 2014;14(8):742-750. doi:10.1016/S1473-3099(14)70780-7

10. Special Eurobarometer 445. Antimicrobial resistance.

https://ec.europa.eu/health/amr/sites/amr/files/eb445_amr_generalreport_en.pdf. Accessed February 9, 2019

11. Antibiotic Resistance in the European Union. https://www.ecdc.europa.eu/en/publications-data/summary-latest-data-antibiotic-resistance-european-union. European Union official website. Accessed February 9, 2019.

12. Conly J, Johnston B. Where are all the new antibiotics? The new antibiotic paradox. *Can J Infect Dis Med Microbiol = J Can des Mal Infect la Microbiol medicale*. 2005;16(3):159-160. http://www.ncbi.nlm.nih.gov/pubmed/18159536. Accessed February 9, 2019.

13. Bartlett JG, Gilbert DN, Spellberg B. Seven ways to preserve the miracle of antibiotics. *Clin Infect Dis*. 2013;56(10):1445-1450. doi:10.1093/cid/cit070

14. Basu S, Garg S. Antibiotic prescribing behavior among physicians: Ethical challenges in resource-poor settings. *J Med Ethics Hist Med*. 2018;11.

15. 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(6):684-690. doi:10.1093/fampra/cmq059

16. Antibiotics - Prescribing dilemma: Do our GPs say one thing while doing another? https://www.researchgate.net/publication/229547862_Antibiotics_-_Prescribing_dilemma_Do_our_GPs_say_one_thing_while_doing_another. Accessed October 29, 2019.

17. Llor C, Bjerrum L. Antimicrobial resistance: risk associated with antibiotic overuse and initiatives to reduce the problem. *Ther Adv drug Saf*. 2014;5(6):229-241. doi:10.1177/2042098614554919

18. Chem ED, Anong DN, Akoachere JFKT. Prescribing patterns and associated factors of antibiotic prescription in primary health care facilities of Kumbo East and Kumbo West Health Districts, North West Cameroon. *PLoS One*. 2018;13(3). doi:10.1371/journal.pone.0193353

19. Grigoryan L, Burgerhof JGM, Haaijer-Ruskamp FM, et al. Is self-medication with antibiotics in Europe driven by prescribed use? *J Antimicrob Chemother*. 2006;59(1):152-156. doi:10.1093/jac/dkl457

20. Martirosyan L, Liana. Survey on self-medication with antibiotics in Yerevan. October 2014. http://dspace.aua.am/xmlui/handle/123456789/648. Accessed February 9, 2019.

21. Dryden M, Johnson AP, Ashiru-Oredope D, Sharland M. Using antibiotics responsibly: right drug, right time, right dose, right duration. *J Antimicrob Chemother*. 2011;66(11):2441-2443. doi:10.1093/jac/dkr370

22. Ilhan MN, Durukan E, Ilhan SÃ, Aksakal FN, Ã–zkan S, Bumin MA. Self-medication with antibiotics: questionnaire survey among primary care center attendants. *Pharmacoepidemiol Drug Saf*. 2009;18(12):1150-1157. doi:10.1002/pds.1829

23. Bartlett JG. The inventory of antibiotics in russian home medicine cabinets. *Infect Dis Clin Pract*. 2004;12(3):203. doi:10.1097/01.idc.0000129853.80250.2c

24. Mitsi G, Jelastopulu E, Basiaris H, Skoutelis A, Gogos C. Patterns of antibiotic use among adults and parents in the community: a questionnaire-based survey in a Greek urban population. *Int J Antimicrob Agents*. 2005;25(5):439-443.

doi:10.1016/j.ijantimicag.2005.02.009

25. Borg MA, Scicluna EA. Over-the-counter acquisition of antibiotics in the Maltese general population. *Int J Antimicrob Agents*. 2002;20(4):253-257. doi:10.1016/s0924-8579(02)00194-2

26. Scuri S, Petrelli F, Tanzi E, Nguyễn TTC, Grappasonni I. European university students of pharmacy: Survey on the use of pharmaceutical drugs. Acta Biomed. 2019;90(1):83-91. doi:10.23750/abm.v90i1.7572

27. Zoorob R, Grigoryan L, Nash S, Trautner BW. Nonprescription antimicrobial use in a primary care population in the United States. Antimicrob Agents Chemother. 2016;60(9):5527-5532. doi:10.1128/AAC.00528-16

28. Grigoryan L, Haaijer-Ruskamp FM, Burgerhof JGM, et al. Self-medication with antimicrobial drugs in Europe. *Emerg Infect Dis*. 2006;12(3):452-459. doi:10.3201/eid1205.050992

29. Larson E, Lin SX, Gomez-Duarte C. Antibiotic use in Hispanic households, New York city. *Emerg Infect Dis*. 2003;9(9):1096-1102. doi:10.3201/eid0909.020371

30. Belongia EA, Schwartz B. Strategies for promoting judicious use of antibiotics by doctors and patients. *Br Med J*. 1998;317(7159):668-671. doi:10.1136/bmj.317.7159.668

31. Hong JS, Philbrick JT, Schorling JB. Treatment of upper respiratory infections: do patients really want antibiotics? *Am J Med*. 1999;107(5):511-515. doi:10.1016/s0002-9343(99)00270-3

32. Spellberg B, Gilbert DN. The future of antibiotics and resistance: A tribute to a career

of leadership by John Bartlett. *Clin Infect Dis*. 2014;59:S71-S75. doi:10.1093/cid/ciu392

33. Landers TF, Cohen B, Wittum TE, Larson EL. A review of antibiotic use in food animals: Perspective, policy, and potential. *Public Health Rep*. 2012;127(1):4-22. doi:10.1177/003335491212700103

34. Biggest Threats and Data. Antibiotic/Antimicrobial Resistance. CDC. Accessed October 29, 2019.

35. Ding C, He J. Effect of antibiotics in the environment on microbial populations. Appl Microbiol Biotechnol. 2010;87(3):925-941. doi:10.1007/s00253-010-2649-5

36. Rather IA, Kim B-C, Bajpai VK, Park Y-H. Self-medication and antibiotic resistance: Crisis, current challenges, and prevention. *Saudi J Biol Sci*. 2017;24(4):808-812. doi:10.1016/j.sjbs.2017.01.004

37. Ghaieth MF, Elhag SRM, Hussien ME, Konozy EHE. Antibiotics self-medication among medical and nonmedical students at two prominent Universities in Benghazi City, Libya. *J Pharm Bioallied Sci*. 2015;7(2):109-115. doi:10.4103/0975-7406.154432

38. Kållberg C, Kand M, Diaz Högberg L, Larsson J. *Medical Students' Views on the Current and Future Antibiotic Resistance Situation*. https://www.reactgroup.org/wp-content/uploads/2016/10/Medical-students'-views-on-the-current-and-future-antibiotic-resistance-situation.en_.319.pdf. Accessed February 9, 2019.

39. Earnshaw S, Mancarella G, Mendez A, et al. European Antibiotic Awareness Day: a five-year perspective of Europe-wide actions to promote prudent use of antibiotics. *Eurosurveillance*. 2014;19(41):20928. doi:10.2807/1560-7917.ES2014.19.41.20928

40. Mazińska B, Strużycka I, Hryniewicz W. Surveys of public knowledge and attitudes with regard to antibiotics in Poland: Did the European Antibiotic Awareness Day campaigns change attitudes? Gupta V, ed. *PLoS One*. 2017;12(2):e0172146. doi:10.1371/journal.pone.0172146

41. Cizman M, Srovin TP, Beović B, Vrdelja M, Bajec T, Blagus R. European Antibiotic Awareness Day (EAAD): Any impact on antibiotic consumption and public awareness in Slovenia? *J Antimicrob Chemother*. 2018;73(9):2567-2572. doi:10.1093/jac/dky206

42. Hadi U, Offra Duerink D, Lestari ES, et al. Survey of antibiotic use of individuals visiting public healthcare facilities in Indonesia. *Canada Int J Infect Dis*. 2008;12:622-629. doi:10.1016/j.ijid.2008.01.002

43. Andrajati R, Tilaqza A, Supardi S. Factors related to rational antibiotic prescriptions in community health centers in Depok City, Indonesia. *J Infect Public Health*. 2017;10(1):41-48. doi:10.1016/j.jiph.2016.01.012

44. WHO. Rational use of medicines.World Health Organization website. https://www.who.int/medicines/areas/rational_use/en/. *WHO*. 2015. Accessed February 9, 2019

45. Factors related to rational antibiotic prescriptions in community health centers in Depok City, Indonesia | Elsevier Enhanced Reader. Accessed April 26, 2020.

46. Gandra S, Barter DM, Laxminarayan R. Economic burden of antibiotic resistance: how much do we really know? *Clin Microbiol Infect*. 2014;20(10):973-980. doi:10.1111/1469-0691.12798

47. Holloway K. The world medicines situation 2011. Rational use of medicines. https://www.who.int/medicines/areas/policy/world_medicines_situation/WMS_ch14_

wRational.pdf. Accessed April 22, 2020.

48. Dhillon H, McNulty C. How can we improve antibiotic prescribing in primary care? *Prescriber*. 2012;23(22):9-10. doi:10.1002/psb.985

49. Steinman MA, Landefeld CS, Gonzales R. Predictors of Broad-Spectrum Antibiotic Prescribing for Acute Respiratory Tract Infections in Adult Primary Care. *J Am Med Assoc*. 2003;289(6):719-725. doi:10.1001/jama.289.6.719

50. Erah PO, Olumide G, Okhamafe AO. Prescribing practices in two health care facilities in Warri, Southern Nigeria: A comparative study. *Trop J Pharm Res*. 2003;2(1). doi:10.4314/tjpr.v2i1.14583

51. Davari M, Khorasani E, Tigabu BM. Factors Influencing Prescribing Decisions of Physicians A Review. Ethiop J Health Sci. 2018;28(6):795-804. doi:10.4314 ejhs.v28i6.15

52. Chandy SJ, Mathai E, Thomas K, Faruqui AR, Holloway K, Lundborg CS. Antibiotic use and resistance: perceptions and ethical challenges among doctors, pharmacists and the public in Vellore, South India. *Indian J Med Ethics*. 2013;10(1):20-27. doi:10.20529/ijme.2013.005

53. Chung A, Perera R, Brueggemann AB, et al. Effect of antibiotic prescribing on antibiotic resistance in individual children in primary care: prospective cohort study. *BMJ*. 2007;335(7617):429. doi:10.1136/bmj.39274.647465.BE

54. van der Velden AW, Bell J, Sessa A, Duerden M, Altiner A. Sore throat: effective communication delivers improved diagnosis, enhanced self-care and more rational use of antibiotics. *Int J Clin Pract Suppl*. 2013;(180):10-16. doi:10.1111/ijcp.12336

55. Interventions and Strategies to Improve the Use of Antimicrobials in Developing Countries: A Review Drug Management Program.; 2001. https://www.who.int/drug-resistance/Interventions_and_strategies_to_improve_the_use_of_antim.pdf. Accessed 26 April, 2020

56. Մեկնարկեց հակաբիոտիկների ճիշտ օգտագործման համաշխարհային շաբաթը - Լուրեր Հայաստանից - Թերթ.am. https://www.tert.am/medicine/am/news/2015/11/16/nax/2331 Accesed March 30, 2020.

57. Navasardyan N, Harutyunyan T, Abrahamyan L. Antibiotic Use: A Cross-Sectional Survey of Knowledge, Attitude and Practice among Yerevan Adult Population. Master of Public Health Integrating Experience Project. Professional Publication Framework https://sph.aua.am/files/2016/06/Nare-Navasardyan_Thesis-project.pdf. Accessed February 12, 2019.

58. Hovhannisyan G, von Schoen-Angerer T, Babayan K, Fenichiu O, Gaboulaud V. Antimicrobial Susceptibility of Neisseria gonorrheae Strains in Three Regions of Armenia. *Sex Transm Dis*. 2007;34(9):686-688. doi:10.1097/01.olq.0000258433.36526.b5

59. A doctor works to spread awareness and stop antibiotic resistance in Armenia. http://www.euro.who.int/en/health-topics/disease-prevention/antimicrobial-resistance/education,-awareness-and-behaviour-change/personal-stories/a-doctor-works-to-spread-awareness-and-stop-antibiotic-resistance-in-armenia. Accessed February 10, 2019.

60. Green LW, Kreuter MW. *Health Promotion Planning: An Educational and*

Environmental Approach. Maytield Publishing, Mountain View, California, 2nd edn. Patient Education and Counseling 19(3): 298-298. <http://hdl.handle.net/2027.42/30012>; doi: http://dx.doi.org/10.1016/0738-3991(92)90152-9

61. Ajzen I. *The Theory of Planned Behavior*. Vol 50.; Department of Psychology, University of Massachusetts, Amherst, MA 01003-0034, 1991.

62. Diffusion of Innovations, 5th Edition: Everett M. Rogers: 8601300412962: Amazon.com: Books. https://www.amazon.com/Diffusion-Innovations-5th-Everett-Rogers/dp/0743222091. Accessed December 21, 2019.

63. Shediac-Rizkallah MC, Bone LR. Planning far the sustainability of community-based health programs: Conceptual frameworks and future directions for research, practice and policy. *Health Educ Res*. 1998;13(1):87-108. doi:10.1093/her/13.1.87

64. Antibiotics Smart Use: a workable model for promoting the rational use of medicines in Thailand. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3524958/#R30. Accessed December 21, 2019.

65. Nair M, Tripathi S, Mazumdar S, et al. Knowledge, attitudes, and practices related to antibiotic use in Paschim Bardhaman District: A survey of healthcare providers in West Bengal, India. *PLoS One*. 2019;14(5). doi:10.1371/journal.pone.0217818

66. Gevorgyan T. Physicians' Prescription Practices and Knowledge about Brand-Name versus Generic Drugs in Yerevan, Armenia: An Analytical Cross-Sectional Study. College of Health Sciences American University of Armenia Yerevan, 2011

67. García C, Llamocca LP, García K, et al. Knowledge, attitudes and practice survey about antimicrobial resistance and prescribing among physicians in a hospital setting

in Lima, Peru. *BMC Clin Pharmacol*. 2011;11(1):18. doi:10.1186/1472-6904-11-18

68. Liu C, Liu C, Wang D, Zhang X. Knowledge, attitudes and intentions to prescribe antibiotics: A structural equation modeling study of primary care institutions in Hubei, China. *Int J Environ Res Public Health*. 2019;16(13). doi:10.3390/ijerph16132385

69. Salm F, Schneider S, Schmücker K, et al. Antibiotic prescribing behavior among general practitioners – a questionnaire-based study in Germany. *BMC Infect Dis*. 2018;18(1):208. doi:10.1186/s12879-018-3120-y

70. Zhuo A, Labbate M, Norris JM, et al. Opportunities and challenges to improving antibiotic prescribing practices through a One Health approach: Results of a comparative survey of doctors, dentists and veterinarians in Australia. *BMJ Open*. 2018;8(3). doi:10.1136/bmjopen-2017-020439

71. Thriemer K, Katuala Y, Batoko B, et al. Antibiotic Prescribing in DR Congo: A Knowledge, Attitude and Practice Survey among Medical Doctors and Students. Meng X, ed. *PLoS One*. 2013;8(2):e55495. doi:10.1371/journal.pone.0055495

72. 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(1):132. doi:10.1186/s13756-019-0592-5

73. Liu C, Liu C, Wang D, Deng Z, Tang Y, Zhang X. Determinants of antibiotic prescribing behaviors of primary care physicians in Hubei of China: a structural equation model based on the theory of planned behavior. *Antimicrob Resist Infect Control*. 2019;8(1):23. doi:10.1186/s13756-019-0478-6

74. Abdel Wahed WY, Ahmed EI, Hassan SK, Ibrahim EG, Eid HM. Physicians' knowledge, attitudes, and practice concerning antimicrobial resistance & prescribing: a

survey in Fayoum Governorate, Egypt. *J Public Heal*. 2019. doi:10.1007/s10389-019-01027-x

75. Leyer C, Buisson Y, Newton PN, et al. Antibiotic prescription behaviours in Lao People's Democratic Republic: a knowledge, attitude and practice survey. *Bull World Health Organ*. 2015;93(4):219-227. doi:10.2471/BLT.14.142844

76. Hardy-Holbrook R, Aristidi S, Vandana Chandnani dipPH, Daisy DeWindt M, Kathryn Dinh M. Antibiotic resistance and prescribing in Australia: current attitudes and practice of GPs. doi:10.1071/HI13019

77. Wester CW, Durairaj L, Evans AT, Schwartz DN, Husain S, Martinez E. Antibiotic resistance: A survey of physician perceptions. *Arch Intern Med*. 2002;162(19):2210-2216. doi:10.1001/archinte.162.19.2210

78. 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(10). doi:10.1371/journal.pone.0141820

79. Farley E, Stewart A, Davies MA, Govind M, van den Bergh D, Boyles TH. Antibiotic use and resistance: knowledge, attitudes and perceptions among primary care prescribers in South Africa. *South African Med J*. 2018;108(9):763-771. doi:10.7196/SAMJ.2018.v108i9.12933

80. Das J, Chowdhury A, Hussam R, Banerjee A V. The impact of training informal health care providers in India: A randomized controlled trial. *Science (80-)*. 2016;354(6308). doi:10.1126/science.aaf7384

81. Pulcini C, Williams F, Molinari N, Davey P, Nathwani D. Junior doctors' knowledge and perceptions of antibiotic resistance and prescribing: A survey in France and

Scotland. *Clin Microbiol Infect*. 2011;17(1):80-87. doi:10.1111/j.1469-0691.2010.03179.x

82. Faizullah M, Ihtesham Umar M, Anwar M, Sarfraz M. A cross-sectional study on knowledge, attitude and practices of medical doctors towards antibiotic prescribing patterns and resistance in Khyber Pakhtun Khawah, Pakistan. *J Appl Pharm Sci*. 2017;7(12):38-046. doi:10.7324/JAPS.2017.71205

TABLES

Table 1. Descriptive statistics on the main variables of interest among GPs working in Yerevan

Variable	N=291 % (n)
Gender	
Male	1.7 (5)
Female	98.3 (286)
Working in public polyclinics	86.9 (253)
Received any 6-month postgraduate education	84.5 (245)
Received any training on antibiotics resistance during three years prior to survey	80.1 (233)
Desire to receive training on antibiotics	87.3 (254)
	Mean (SD)
Age in years	55.1 (9.9)
Years of professional experience	28.2 (11.5)
Average number of patients served per day	14.1 (5.1)
Knowledge percent score	58.3 (20.1)
Attitude percent score	67.5 (10.9)
Practice percent score	63.0 (16.9)

Table 2. Correlation between practice, attitude and knowledge % scores

	Practice score	Knowledge score	Attitude score
Practice % score	1		
Knowledge % score	0.145*	1	
Attitude % score	0.375**	0.287**	1

* p = 0.013
** p < 0.001

Table 3. Correct answers to knowledge questions among GPs in Yerevan polyclinics, 2020

	Questions	N	%
1.	Antibiotics should not be prescribed for non-febrile diarrhea	262	90.0
2.	Methicillin resistant Staphylococcus aureus is resistant to betta-lactam antibiotics	74	25.4
3.	Antibiotics are ineffective for upper respiratory tract viral infections	221	75.9
4.	Amoxicillin is safe to prescribe to pregnant women	163	56.0
5.	Metronidazole has the best activity against anaerobes	116	39.9
6.	Antibiotics are effective in patients with cystitis caused by Escherichia coli	182	62.5

Table 4. Desired attitudes on antibiotics resistance among GPs in Yerevan polyclinics, 2020

Questions *(provided in same wording as in the instrument)*		N	%
1.	Inappropriate use of antibiotics drives antibiotics resistance	280	96.2
2.	Broad-spectrum antibiotics do not increase antibiotic resistance when equally effective narrower-spectrum antibiotics are available	109	37.5
3.	Lack of hand disinfection by healthcare workers causes spread of antibiotics resistance	138	47.4
4.	In primary care, microbiological results are not useful when treating infectious diseases	165	56.7
5.	Widespread use of antibiotics contributes to generation of antibiotic resistance	269	92.4
6.	Antibiotic prescribing practice influences the antibiotic resistance development	250	86.2
7.	Physicians should not change their antibiotic prescribing pattern if patients are satisfied with the treatment	103	35.4
8.	Too low antibiotic dosages do not contribute to the development of antibiotic resistance	198	68.0
9.	Self-medication contributes to the development of antibiotic resistance	259	89.0
10.	Interrupted antibiotic treatment does not contribute to the development of antibiotic resistance	181	62.4
11.	Antibiotic guidelines are rather obstacles than a help for prescribing antibiotics	201	69.3
12.	Development of local guidelines on preventing antibiotics resistance would be more useful than using international ones	143	49.1
13.	Dispensing antibiotics without a prescription cannot drive antibiotic resistance	176	60.5
14.	Prescribing antibiotics when the patient does not need them does not cause harm to the patient	266	91.4

Table 5. Correct prescribing practices among GPs in Yerevan polyclinics, 2020

	Practice	N	%
1.	Selection of antibiotics based on infection cause rather than medication expiration date or availability	251	86.3
2.	Delaying antibiotics prescription in case of viral infections	262	90.0
3.	Discussing antibacterial resistance with patients while prescribing antibiotics	193	66.3
4.	Not taking into account the recommendations made by pharmaceutical companies while prescribing antibiotics	96	33.0
5.	Not prescribing wide spectrum antibiotics when results of bacteriological analysis are absent	52	17.9
6.	Not prescribing antibiotics to patients with acute viral infections for preventing secondary bacterial infections	220	75.6
7.	Not considering shorter-than-recommended duration of treatment with antibiotics if the patient's condition gets better	198	68.0
8.	Not prescribing the same antibiotic in case of recurrence of the same disease in a patient previously successfully treated with that antibiotic	121	41.6
9.	Not prescribing antibiotics based of patient's desire	256	88.0

Table 6. Simple linear regression between practice % score and independent variables

Variable	Regression coefficient	95% (CI)	p-value
Attitude % score	0.58	(0.41; 0.75)	$p < 0.001$
Knowledge % score	0.12	(0.03; 0.22)	0.013
Age	-0.25	(-0.45; -0.04)	0.019
Gender			
Male	1.0 (ref)		
Female	-7.53	(-22.61; 7.53)	0.326
Type of polyclinics			
Public	1.0 (ref)		
Private/both	4.59	(-1.20; 10.39)	0.120
Years of experience after graduation	-0.20	(-0.36; -0.03)	0.025
Professional education after graduation			
No	1.0 (ref)		
Yes	3.48	(-1.94; 8.89)	0.208
Participation in trainings last 3 years			
No trainings	1.0 (ref)		
One and more	-0.16	(-5.07; 4.75)	0.949
Number of patients served per day	0.25	(-0.14; 0.63)	0.208

Table 7. Simple linear regression between attitude % score and independent variables

Variable	Regression coefficient	95% (CI)	p-value
Knowledge % score	0.16	(0.09; 0.22)	p < 0.001
Age	-0.36	(-0.48; -0.23)	p < 0.001
Gender			
Male	1.0 (ref)		
Female	-2.51	(-12.24; 7.21)	0.612
Type of polyclinics			
Public	1.0 (ref)		
Private/both	3.69	(-0.04; 7.42)	0.052
Years of experience after graduation	-0.32	(-0.43; -0.21)	0.000
Professional education after graduation			
No	1.0 (ref)		
Yes	-0.22	(-3.31; 3.75)	0.903
Participation in trainings last 3 years			
No trainings	1.0 (ref)		
One and more	-0.09	(-3.26; 3.08)	0.955
Number of patients served per day	0.38	(0.13; 0.63)	0.003

Table 8. Simple linear regression between knowledge % score and independent variables

Variable	Regression coefficient	95% (CI)	p-value
Age	-0.56	(-0.79; -0.33)	p < 0.001
Gender			
Male	1.0 (ref)		
Female	-11.8	(-29.64; 5.96)	0.192
Type of polyclinics			
Public	1.0 (ref)		
Private/both	4.07	(-2.80; 10.94)	0.245
Years of experience after graduation	-0.34	(-0.55; -0.14)	0.001
Professional education after graduation			
No	1.0 (ref)		
Yes	3.22	(-3.18; 9.62)	0.323
Participation in trainings last 3 years			
No trainings	1.0 (ref)		
One and more	-2.84	(-8.63; 2.96)	0.337
Number of patients served per day	0.58	(0.13; 1.04)	0.012

Table 9. Multivariable linear regression model with the outcome of practice % score

Variable	Regression coefficient	95% CI	p-value
Attitude % score	0.58	(0.41; 0.75)	p<0.001

Table 10. Multivariable linear regression model with the outcome of attitude % score

Variable	Regression coefficient	95% CI	p-value
Knowledge % score	0.11	(0.05; 0.18)	p<0.001
Number of patients per day	0.25	(0.01; 0.49)	0.042
Years of experience	-0.27	(-0.38; -0.17)	p<0.001

Table 11. Multivariable linear regression model with the outcome of knowledge % score

Variable	Regression coefficient	95% CI	p-value
Number of patients per day	0.61	(0.14; 1.07)	0.011
Years of experience	-0.32	(-0.52; -0.12)	0.002

Table 12. Barriers to rational antibiotics prescribing reported by GPs in Yerevan polyclinics, 2020

	Not a barrier % (N)	Somewhat a barrier % (N)	Moderate barrier % (N)	Significant barrier % (N)
Lack of rapid diagnostic tests	21.0 (61)	14.4 (42)	25.4 (74)	39.2 (114)
High cost of laboratory tests	19.6 (57)	20.6 (60)	27.8 (81)	32.0 (93)
High cost of some antibiotics	21.0 (61)	25.8 (75)	32.3 (94)	21.0 (61)
Lack of clear guidelines	27.1 (79)	26.5 (77)	23.4 (68)	23.0 (67)
Difficulty of making an accurate diagnosis	26.8 (78)	27.5 (80)	25.8 (75)	19.9 (58)
Lack of free/affordable quality courses on optimal antibiotic therapy	30.1 (87)	28.4 (82)	26.6 (77)	14.9 (43)
Fear of missing the bacterial infection	36.1 (105)	27.5 (80)	27.8 (81)	8.6 (25)
Lack of time to search for information	38.5 (112)	27.1 (79)	22.0 (64)	12.4 (36)
Pressure from patients	56.7 (165)	23.7 (69)	10.7 (31)	8.9 (26)
Lack of motivation of physicians to provide quality services because of their inadequate remuneration	70.4 (205)	10.0 (29)	9.6 (28)	10.0 (29)
Pressure from pharmaceutical companies interested in selling their antibiotics	71.8 (209)	11.3 (33)	8.6 (25)	8.2 (24)

FIGURES

Figure 1. Normality of residuals' distribution of the final model demonstrating the association between the practice % score and attitude % score and years of experience (standardized normal probability plot)

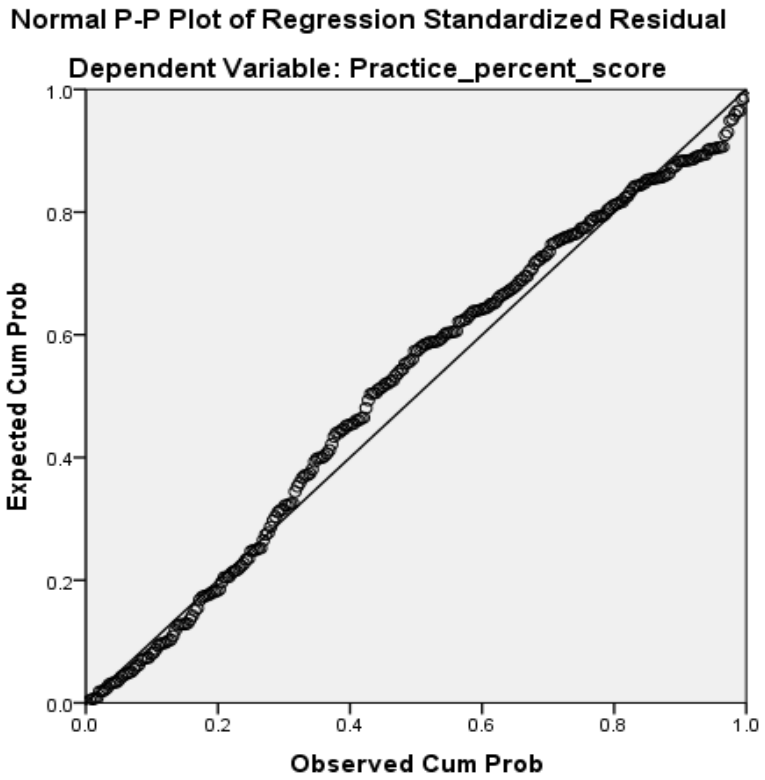


Figure 2. The distribution of residuals of the final model demonstrating the association between the practice % score and attitude % score and years of experience (residuals versus predictor scatterplot)

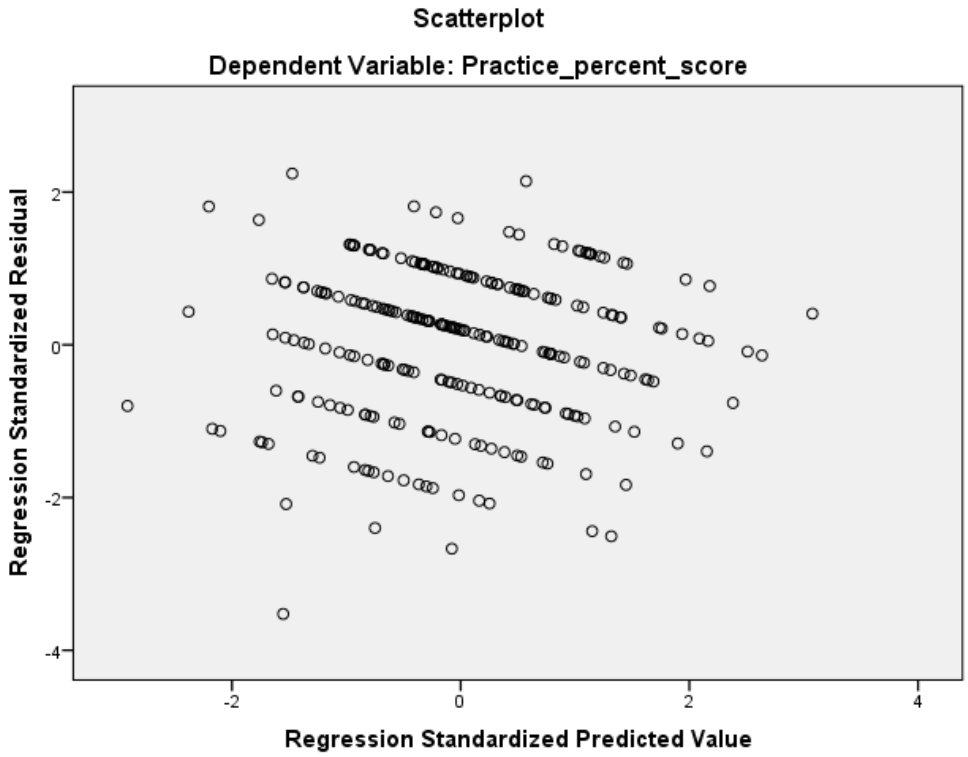


Figure 3. Normality of residuals' distribution of the final model demonstrating the association between the attitude % score and knowledge % score, number of patients per day and years of experience (standardized normal probability plot)

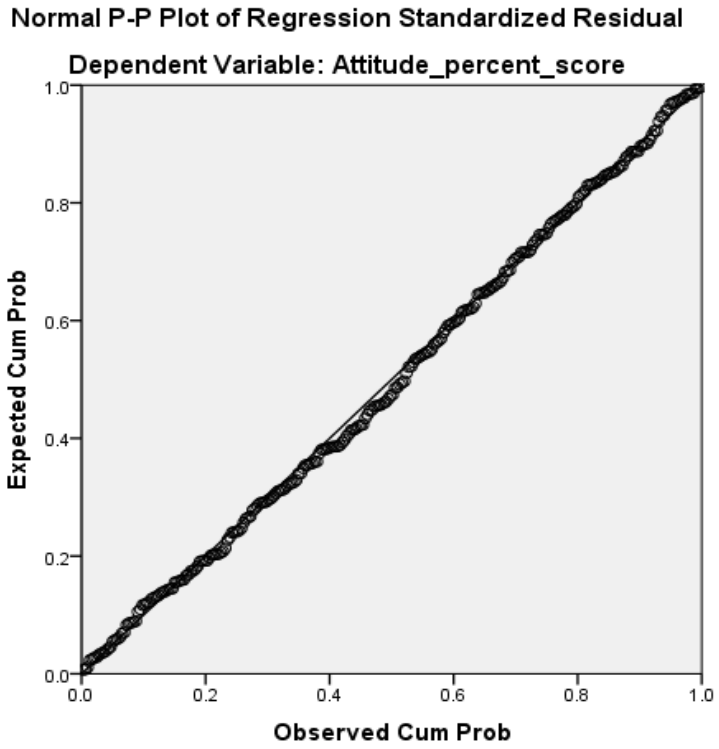


Figure 4. The distribution of residuals of the final model demonstrating the association between the attitude % score and knowledge % score, number of patients per day and years of experience (residuals versus predictor scatterplot)

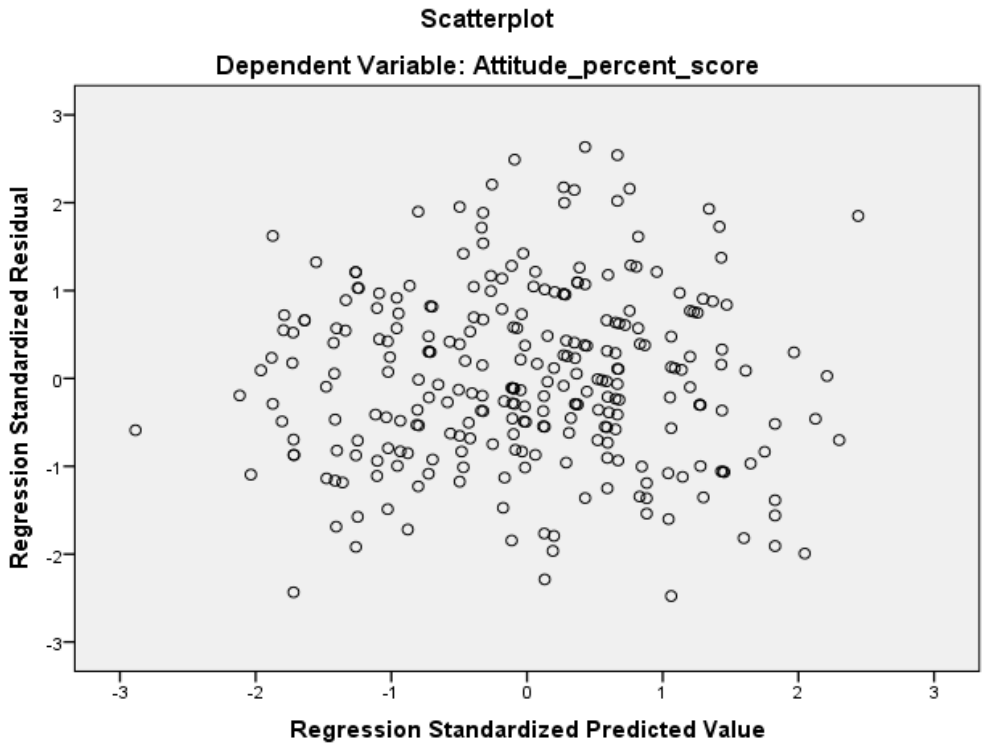


Figure 5. Normality of residuals' distribution of the final model demonstrating the association between the knowledge % score and number of patient per day and years of experience (standardized normal probability plot)

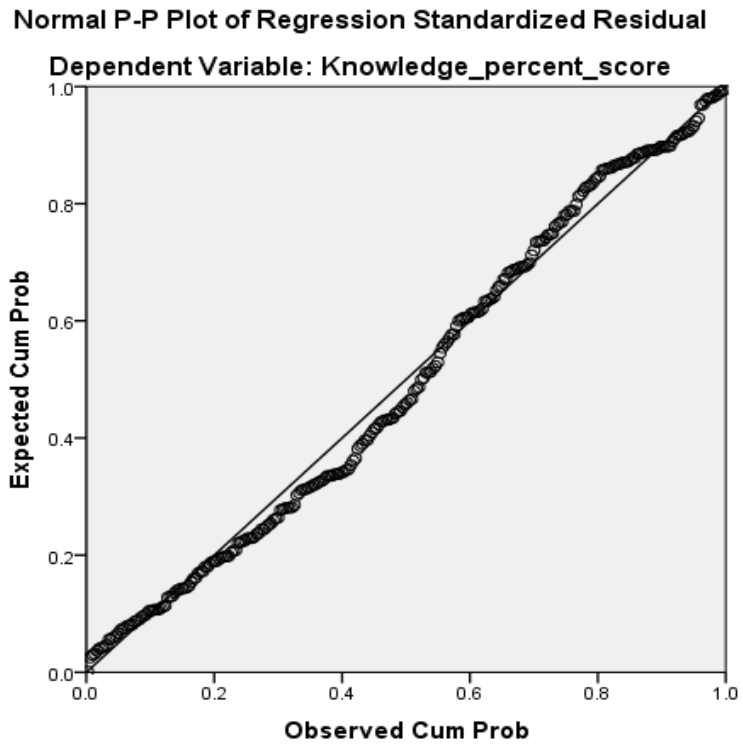
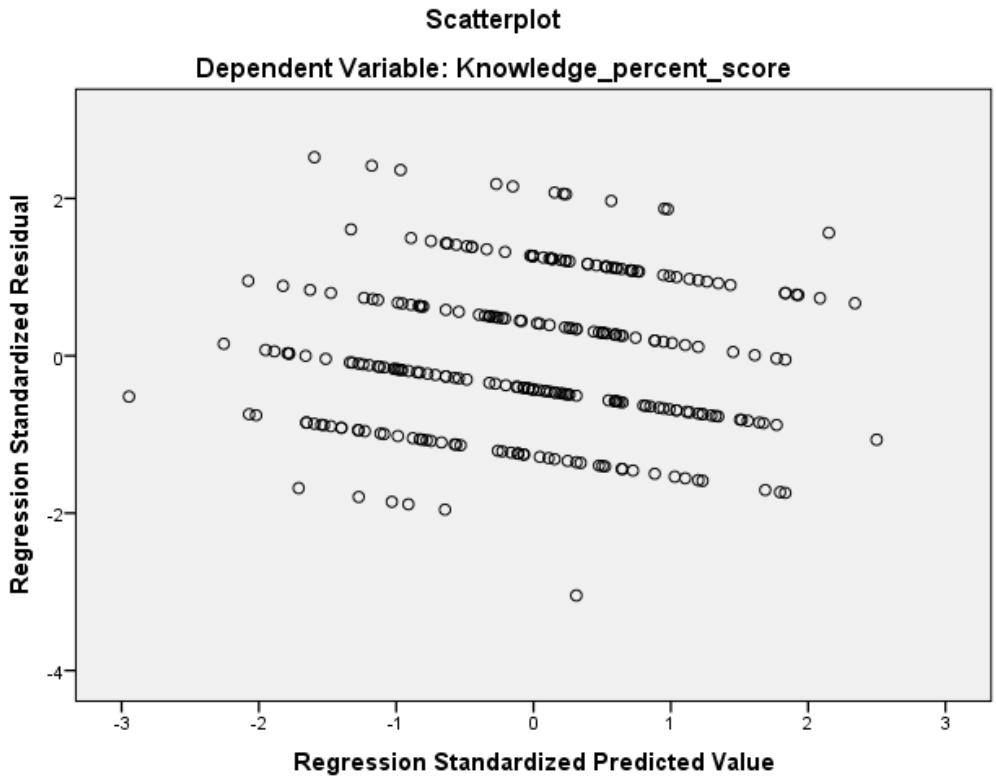
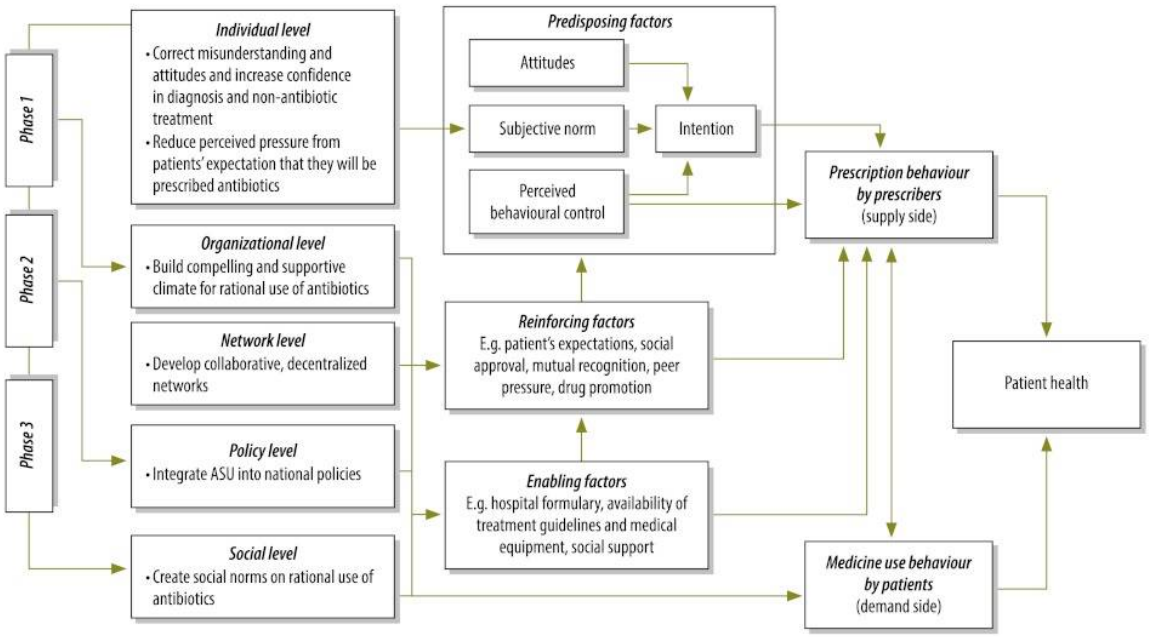


Figure 6. The distribution of residuals of the final model demonstrating the association between the knowledge % score and number of patient per day and years of experience (residuals versus predictor scatterplot)



APPENDICES

Appendix 1: Conceptual framework of the Antibiotics Smart Use Model[64]



Appendix 2:

Percentages of reported correct prescribing practices and answers to knowledge questions among GPs in Yerevan and other study sites

Percentages of correct answers to knowledge questions among GPs in Yerevan in comparison with different study sites

Questions	Results of our study (%)	Results from the studies performed in different countries (%)			
		Congo[71]	Egypt[74]	Hubei[72]	China[68]
1. Methicillin resistant Staphylococcus aureus is resistant to betta-lactam antibiotics	25.4	36.8	NA	29.06	NA
2. Metronidazole has the best activity against anaerobes	39.9	93.5	84.1	97.19	98.86
3. Amoxicillin is safe to prescribe to pregnant women	56.0	97.4	86.1	96.59	96.21
4. Antibiotics are ineffective for upper respiratory tract viral infections	75.9	35.9	NA	5.01	5.68
5. Antibiotics should not be prescribed for non-febrile diarrhea	90.0	85.9	89.7	95.19	NA

NA – not applicable as the item was not asked

Percentages of reported correct prescribing practices among GPs in Yerevan and other study sites

Practice	Results of our study (%)	Results from the studies performed in different countries (%)				
		Egypt[74]	Congo[71]	Germany[69]	China[68]	Australia[76]
1. Delaying antibiotics prescription in case of viral infections	90.0	NA	NA	29.4	NA	NA
2. Discussing antibacterial resistance with patients while prescribing antibiotics	66.3	NA	NA	49.4	89.6	NA
3. Not taking into account the recommendations made by pharmaceutical companies while prescribing antibiotics	33.0	27.2	23.1	NA	NA	NA
4. Not prescribing antibiotics based of patient's desire	88.0	NA	NA	60.0	67.0	66.0

NA – not applicable as the item was not asked

Appendix 3:

Study instrument

Knowledge, attitudes and practice survey about antibiotics use and antimicrobial resistance

1.Participant's ID_____

2.Date (dd/mm/yy)_____/_____/_____

Instructions for Completing the Questionnaire

Dear participant, first read carefully each question and the possible response options. Choose the option that best represent your response and circle the number next to the option. Some questions should be answered by words or by a number. For these questions, please, write your response on the blank line next to the question.

Please follow the instructions in Italics. These instructions will help you to complete the questionnaire. Please, note that some questions may look like others, but each one is different.

Please, try to answer ALL THE questions.

Please start answering from here.

This section includes questions regarding demographic data.

3.	Your age (completed years)	_____years
4.	Your gender	□ 1. Male □ 2. Female
5.	Your marital status	□ 1. Married □ 2. Divorced □ 3. Widowed □ 4. Single

This section includes questions regarding your professional background.

6.	In what type of healthcare facility do you practice?	□ 1. Private □ 2. Public □ 3. Both
7.	How many years have you been practicing after you graduated from the Medical University?	_____years

8.	After graduating from the Medical University, have you had any professional education for at least 6 months duration?	□ 1. Yes □ 2. No
9.	During the last three years, how many times have you received a training on antibiotics?	_____
10.	In average, how many patients do you serve per day?	_____ patients
11.	I would like to participate in educational programs on antibiotics.	□ 1. Yes □ 2. No

Please, indicate whether you agree with each of the statements below.

	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
12. Inappropriate use of antibiotics drives antibiotics resistance.	1. □	2. □	3. □	4. □	5. □
13. Use of broad-spectrum antibiotics, when equally effective narrower-spectrum antibiotics are available, can not increase antibiotic resistance.	1. □	2. □	3. □	4. □	5. □
14. Lack of hand disinfection by healthcare workers causes spread of antibiotics resistance.	1. □	2. □	3. □	4. □	5. □
15. In primary care, microbiological results are not useful when treating infectious diseases.	1. □	2. □	3. □	4. □	5. □
16. Widespread use of antibiotics contributes to generation of antibiotic resistance.	1. □	2. □	3. □	4. □	5. □
17. Antibiotic prescribing practice influences the antibiotic resistance development.	1. □	2. □	3. □	4. □	5. □
18. If patients are satisfied with the treatment, the physician does not need to change his/her antibiotic prescribing pattern.	1. □	2. □	3. □	4. □	5. □
19. Too low antibiotic dosages do not contribute to the development of antibiotic resistance.	1. □	2. □	3. □	4. □	5. □
20. Self-medication contributes to the development of antibiotic resistance.	1. □	2. □	3. □	4. □	5. □
21. Interrupted antibiotic treatment does not contribute to the development of antibiotic resistance.	1. □	2. □	3. □	4. □	5. □
22. Antibiotic guidelines are rather obstacles than a help for prescribing antibiotics.	1. □	2. □	3. □	4. □	5. □

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
23. Development of local guidelines on preventing antibiotics resistance would be more useful than using the international ones.	1. □	2. □	3. □	4. □	5. □
24. Dispensing antibiotics without a prescription cannot drive antibiotic resistance.	1. □	2. □	3. □	4. □	5. □
25. I think prescribing antibiotics when the patient does not need them does not cause harm to the patient.	1. □	2. □	3. □	4. □	5. □

Please, indicate to what degree do you agree with each of the statements below.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
26. When I decide which antibiotic to use, my selection is more affected by the expiration date or availability of the antibiotic than the cause of the infection.	1. □	2. □	3. □	4. □	5. □
27. I usually delay antibiotics prescribing in case of viral infections.	1. □	2. □	3. □	4. □	5. □
28. I discuss the subject of antibacterial resistance with my patients while prescribing an antibiotic.	1. □	2. □	3. □	4. □	5. □
29. When prescribing antibiotics, I usually take into account recommendations made by pharmaceutical companies.	1. □	2. □	3. □	4. □	5. □
30. I usually prefer to prescribe wide spectrum antibiotics when results of bacteriological analysis are absent.	1. □	2. □	3. □	4. □	5. □
31. I usually do not prescribe antibiotics to patients with acute viral infections for prevention of development of secondary bacterial infections.	1. □	2. □	3. □	4. □	5. □
32. I usually consider shorter-than-recommended duration of treatment with antibiotics if the patient's condition gets better.	1. □	2. □	3. □	4. □	5. □

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
33. If the patient was previously successfully treated with some antibiotic, in case of recurrence of the same disease I usually prescribe him/her the same antibiotic.	1. □	2. □	3. □	4. □	5. □
34. If the patient insists on being treated with antibiotics, I usually prescribe them.	1. □	2. □	3. □	4. □	5. □

Please, indicate the right answer.

35.	A 4-year-old girl has diarrhea for 4 days (3 stools/day). She has no fever at examination nor during the last few days. Which treatment would you propose?	□1. Amoxicillin □2. TMP/SMX □3. Amoxicillin-clavulanic acid □4. No antibiotic treatment, only oral rehydration □5. I don't know
36.	Methicillin resistant - *Staphylococcus aureus* is susceptible to: *(Please, choose one or more correct answers.)*	□1.Amoxicillin-clavulanic acid □2. Cefotaxime □3. Ceftriaxone □4. None of those antibiotics □5. I don't know
37.	Which of the following statements is correct? *(Please, choose one or more correct answers.)*	□1.Antibiotics are helpful in treating upper respiratory tract viral infections □2.Antibiotics reduce the duration of upper respiratory tract viral infections □3.Antibiotics can reduce the occurrence of complications of upper respiratory tract viral infections □4. None of the above □5. I don't know
38.	Which one of the following antibiotics may be safe during pregnancy?	□1. Amoxicillin □2. Ciprofloxacin □3. Gentamicin □4. None of the above □5. I don't know

39.	Which one of the following antimicrobials has the best activity against anaerobe bacteria?	□1.Ciprofloxacin □2. Metronidazole □3.Trimethoprim-sulfamethoxazole □4. None of the above □5. I don't know
40.	A 30 years old female has cystitis and complaining on pain. Microbiological analysis revealed *E.coli* . Will you prescribe antibiotics?	□1.Yes □2. No

To what extent, in your opinion, the following factors are barriers to prescribing antibiotics appropriately in your setting?

	Not a barrier	Somewhat a barrier	Moderate barrier	Significant barrier
41. Lack of rapid diagnostic tests.	1. □	2. □	3. □	4. □
42. Cost of laboratory tests.	1. □	2. □	3. □	4. □
43. Difficulty of making an accurate diagnosis.	1. □	2. □	3. □	4. □
44. Fear of missing the bacterial infection.	1. □	2. □	3. □	4. □
45. Lack of clear guidelines.	1. □	2. □	3. □	4. □
46. Lack of time to search for information.	1. □	2. □	3. □	4. □
47. Cost of some antibiotics.	1. □	2. □	3. □	4. □
48. Lack of free/affordable quality courses on optimal antibiotic therapy.	1. □	2. □	3. □	4. □
49. Pressure from patients.	1. □	2. □	3. □	4. □
50. Pressure from pharmaceutical companies interested in selling their antibiotics.	1. □	2. □	3. □	4. □
51. Lack of motivation of physicians to provide quality services because of their inadequate remuneration.	1. □	2. □	3. □	4. □
52. What other barrier could you point out?	_____			

Thank you very much for participation

Հարցաշար հակաբիոտիկների օգտագործման և հակաբիոտիկակայունության վերաբերյալ բժիշկների գիտելիքների, վերաբերմունքի և գործելակերպի մասին

1. Հարցվողի ՏՀ _____

2. Ամսաթիվ (օր/ամիս/տարի) _____ / _____/_____

Հարցաթերթիկի լրացման ցուցումներ

Հարգելի՛ մասնակից, ուշադիր կարդացեք յուրաքանչյուր հարց և պատասխանների ներկայացված տարբերակները: Ընտրեք այն տարբերակը, որն ավելի մոտ է Ձեր կարծիքին և նշում կատարեք (√) Ձեր նախընտրած տարբերակի կողքին դրված վանդակում՝ շրջանակի մեջ վերցնելով Ձեր նախընտրած տարբերակի առջև գրված թիվը: Որոշ հարցերի պետք է պատասխանել բառերով կամ թվերով: Այդ հարցերին հաջորդում են դատարկ տողեր, որպեսզի Դուք գրեք Ձեր պատասխանը: Խնդրում ենք հետևել ***<u>չեղարար</u>*** ցուցումներին: Այդ ցուցումները կօգնեն Ձեզ լրացնել հարցաշարը: Որոշ հարցեր կարող են նման լինել մյուսներին, սակայն դրանցից յուրաքանչյուրը տարբեր է: Խնդրում ենք պատասխանել ԲՈԼՈՐ ՀԱՐՑԵՐԻՆ ԱՆԽՏԻՐ:

<u>Այս բաժնում ընդգրկված հարցերը վերաբերում են Ձեր ժողովրդագրական տվյալներին:</u>

3.	Ձեր տարիքը (լրացրած տարիների թիվը)	_____ տարեկան
4.	Ձեր սեռը	□ 1. Արական □ 2. Իգական
5.	Ձեր ամուսնական կարգավիճակը	□ 1. Ամուսնացած □ 2. Ամուսնալուծված □ 3. Այրի □ 4. Չամուսնացած

Այս բաժնում ընդգրկված հարցերը վերաբերում են Ձեր մասնագիտական փորձառությանը:

6.	Նշեք, թե ո՞ր տիպի պոլիկլինիկայում եք աշխատում:	□ 1. Մասնավոր □ 2. Պետական □ 3. Երկուսում էլ
7.	Բժշկական Համալսարանն ավարտելուց հետո քանի՞ տարի եք աշխատել Ձեր մասնագիտությամբ:	_____տարի
8.	Բժշկական Համալսարանն ավարտելուց հետո ստացե՞լ եք որևէ մասնագիտական վերապատրաստում՝ առնվազն 6 ամիս տևողությամբ:	□ 1. Այո □ 2. Ոչ
9.	Վերջին երեք տարվա ընթացքում քանի՞ անգամ եք մասնակցել հակաբիոտիկների վերաբերյալ դասընթացների:	_____
10.	Միջինում օրական քանի՞ հիվանդ եք զննում:	_____ հիվանդ
11.	Ես կցանկանայի մասնակցել հակաբիոտիկաբուժման վերաբերյալ դասընթացների:	□ 1. Այո □ 2. Ոչ

Խնդրում եմ նշեք՝ որքանո՞վ եք համաձայն հետևյալ պնդումներից յուրաքանչյուրին:

	Լիովին համաձայն եմ	**Համաձայն եմ**	**Ո՛չ համաձայն եմ, ո՛չ էլ՝ ոչ**	**Համաձայն չեմ**	**Ամենևին համաձայն չեմ**
12. Հակաբիոտիկների սխալ օգտագործումը բերում է հակաբիոտիկակայունության զարգացման:	1. □	2. □	3. □	4. □	5. □
13. Նեղ սպեկտրի արդյունավետ հակաբիոտիկների առկայության դեպքում լայն սպեկտրի հակաբիո-	1. □	2. □	3. □	4. □	5. □

	Լիովին համա-ձայն եմ	Համա-ձայն եմ	Ո՛չ համա-ձայն եմ, ո՛չ էլ՝ ոչ	Համա-ձայն չեմ	Ամենևին համաձայն չեմ
տիկների նշանակումը չի հանգեցնում հակաբիոտիկակայունության աճի:					
14. Բուժաշխատողների կողմից ձեռքերի հիգիենայի կանոնների ոչ լիարժեք պահպանումը կարող է բերել հակաբիոտիկակայուն շտամերի տարածման:	1. □	2. □	3. □	4. □	5. □
15. Ամբուլատոր պայմաններում վարակների բուժման ժամանակ բակտերիաբանական հետազոտության արդյունքները կարևոր չեն:	1. □	2. □	3. □	4. □	5. □
16. Հակաբիոտիկների լայն կիրառումը նպաստում է հակաբիոտիկակա-յունության ավելացմանը:	1. □	2. □	3. □	4. □	5. □
17. Հակաբիոտիկների նշանակման գործելակերպը ազդում է հակբիոտիկակայունության զարգացման վրա:	1. □	2. □	3. □	4. □	5. □
18. Եթե հիվանդները գոհ են իրենց ստացած բուժումից, բժիշկը կարիք չունի փոխելու հակաբիոտիկների նշանակման իր գործելակերպը:	1. □	2. □	3. □	4. □	5. □
19.Հակաբիոտիկի չափազանց ցածր դեղաչափը չի հանգեցնում հակաբիոտիկակայության զարգացման:	1. □	2. □	3. □	4. □	5. □
20. Ինքնաբուժումը նպաստում է հակաբիոտիկակայության զարգացմանը:	1. □	2. □	3. □	4. □	5. □

	Լիովին համաձայն եմ	Համաձայն եմ	Ո՛չ համաձայն եմ, ո՛չ էլ՝ ոչ	Համաձայն չեմ	Ամենևին համաձայն չեմ
21. Հակաբիոտիկի կուրսը չավարտելը չի նպաստում հակաբիոտիկակայության զարգացմանը:	1. □	2. □	3. □	4. □	5. □
22. Հակաբիոտիկներ նշանակելիս ուղեցույցներից օգտվելը ավելի շատ խանգարում է, քան՝ օգնում:	1. □	2. □	3. □	4. □	5. □
23. Հակաբիոտիկակայունության կանխարգելման վերաբերյալ տեղական ուղեցույցների մշակումն ավելի օգտակար է, քան՝ միջազգային ուղեցույցների օգտագործումը:	1. □	2. □	3. □	4. □	5. □
24. Հակաբիոտիկների վաճառքն առանց դեղատոմսի չի կարող նպաստել հակաբիոտիկակայունության աճին:	1. □	2. □	3. □	4. □	5. □
25. Իմ կարծիքով՝ հակաբիոտիկի նշանակումը չի վնասում հիվանդին, եթե նույնիսկ նա դրա կարիքը չունի:	1. □	2. □	3. □	4. □	5. □

Խնդրում եմ նշեք՝ արդյոք համաձա՞յն եք հետևյալ պնդումներին, թե՞ ոչ:

	Լիովին համաձայն եմ	Համաձայն եմ	Ո՛չ համաձայն եմ, ո՛չ էլ՝ ոչ	Համաձայն չեմ	Ամենևին համաձայն չեմ
26. Հակաբիոտիկների նշանակման ժամանակ ես ավելի շատ ուշադրություն եմ դարձնում դրանց օգտագործման ժամկետին կամ մատչելիությանը, քան՝ հիվանդության հարուցիչին:	1. □	2. □	3. □	4. □	5. □

	Լիովին համա-ձայն եմ	Համա-ձայն եմ	Ո՛չ համա-ձայն եմ, ո՛չ էլ՝ ոչ	Համա-ձայն չեմ	Ամենևին համաձայն չեմ
27. Հակաբիոտիկներ նշանակելու հարցում ես սովորաբար կիրառում եմ սպասողական մոտեցում, երբ կասկածում եմ վիրուսային վարակ։	1. □	2. □	3. □	4. □	5. □
28. Հակաբիոտիկ նշանակելիս ես հիվանդի հետ քննարկում եմ հակաբիոտիկակայունության հարցերը։	1. □	2. □	3. □	4. □	5. □
29. Հակաբիոտիկ նշանակելիս ես սովորաբար հաշվի եմ առնում դեղագործական ընկերությունների խորհուրդները։	1. □	2. □	3. □	4. □	5. □
30. Երբ բակտերիաբանական հետազոտության արդյունքները բացակայում են, ես սովորաբար նախընտրում եմ նշանակել լայն սպեկտրի հակաբիոտիկներ։	1. □	2. □	3. □	4. □	5. □
31. Երկրորդային բակտերիալ վարակների կանխարգելման նպատակով ես սովորաբար չեմ նշանակում հակաբիոտիկներ սուր վիրուսային ինֆեկցիայով հիվանդներին։	1. □	2. □	3. □	4. □	5. □
32. Եթե հիվանդի վիճակն արագ լավանում է, ես սովորաբար նախընտրում եմ կրճատել հակաբիոտիկաթերապիայի սահմանված տևողությունը։	1. □	2. □	3. □	4. □	5. □
33. Եթե նախկինում հիվանդը հաջող բուժում է ստացել տվյալ հակաբիոտիկով, ապա նույն	1. □	2. □	3. □	4. □	5. □

	Լիովին համա-ձայն եմ	**Համա-ձայն եմ**	**Ո՛չ համա-ձայն եմ, ո՛չ էլ՝ ոչ**	**Համա-ձայն չեմ**	**Ամենևին համաձայն չեմ**
հիվանդության կրկնության ժամանակ ես սովորաբար նշանակում եմ նրան այդ նույն հակաբիոտիկը:					
34. Եթե հիվանդը պնդում է, որ իրեն անհրաժեշտ են հակաբիոտիկեր, ես սովորաբար նշանակում եմ դրանք:	1. □	2. □	3. □	4. □	5. □

<u>Խնդրում եմ նշեք ճիշտ պատասխանը:</u>

35.	Հիվանդը 4 տարեկան աղջիկ է և ունի փորլուծություն (օրը 3 անգամ): Նա չունի ջերմություն ո՛չ հետազոտման պահին, ո՛չ էլ վերջին օրերին: Տրված տարբերակներից ո՞ր բուժումը կընտրեք:	□1. Ամոքսիցիլին □2. Տրիմեթոպրիմ-սուլֆամեթոքսազոլ □3. Ամոքսիցիլին-կլավուլոնաթթու □4. Չեմ նշանակի հակաբիոտիկներ, միայն օրալ ռեհիդրատացիա □5. Այլ_____
36.	Ո՞ր հակաբիոտիկների նկատմամբ է զգայուն մետիցիլինակայուն *Staphylococcus aureus-ը:* *(Նշեք բոլոր ճիշտ պատասխանները)*	□1. Ամոքսիցիլին-կլավուլոնաթթու □2. Ցեֆոտաքսիմ □3. Ցեֆտրիաքսոն □4. Նշվածներից ոչ մեկը

37.	Նշեք, թե ո՞ր պնդումն է ճիշտ։ *(Նշեք բոլոր ճիշտ պատասխանները)*	□1.Հակաբիոտիկները արդյունավետ են վերին շնչառական վիրուսային ինֆեկցիաների ժամանակ։ □2.Հակաբիոտիկները կարճացնում են վերին շնչառական վիրուսային ինֆեկցիաների տևողությունը։ □3.Հակաբիոտիկները նվազեցնում են վերին շնչառական վիրուսային ինֆեկցիաների բարդությունների հավանականությունը։ □4. Նշվածներից ոչ մեկը
38.	Նշված ո՞ր հակաբիոտիկներն են անվտանգ հղիության ժամանակ։ *(Նշեք բոլոր ճիշտ պատասխանները)*	□1. Ամոքսիցիլին □2. Ցիպրոֆլոքսացին □3. Գենտամիցին □4. Նշվածներից ոչ մեկը □5. Չգիտեմ
39.	Նշված ո՞ր հակաբիոտիկներն են նշանակվում անաէրոբ ինֆեկցիաների ժամանակ։ *(Նշեք բոլոր ճիշտ պատասխանները)*	□1. Ցիպրոֆլոքսացին □2. Մետրոնիդոզոլ □3. Տրիմեթոպրիմ-սուլֆամեթոքսազոլ □4. Նշվածներից ոչ մեկը □5. Չգիտեմ
40.	Հիվանդը 30 տարեկան կին է, որն ունի ցիստիտ և գանգատվում է ցավից։ Մանրէաբանական հետազոտությունը հայտնաբերել է *E.coli*։ Կնշանակե՞ք արդյոք հակաբիոտիկներ։	□1.Այո □2. Ոչ

<u>Ձեր կարծիքով, որքանո՞վ են հետևյալ գործոնները խոչընդոտում հակաբիոտիկների ռացիոնալ նշանակումը Ձեր պոլիկլինիկայում։</u>

	Չեն խոչըն-դոտում	**Թեթևակի խոչընդո-տում են**	**Չափավոր խոչընդո-տում են**	**Զգալի խոչընդո-տում են**
41. Արագ ախտորոշման թեստերի բացակայությունը։	1. □	2. □	3. □	4. □
42. Լաբորատոր թեստերի արժեքը։	1. □	2. □	3. □	4. □
43. Ճիշտ ախտորոշման դժվարությունը։	1. □	2. □	3. □	4. □

	Չեն խոչընդոտում	Թեթևակի խոչընդոտում են	Չափավոր խոչընդոտում են	Զգալի խոչընդոտում են
44. Ինֆեկցիան բաց թողնելու վախը:	1. □	2. □	3. □	4. □
45. Մատչելի ուղեցույցների բացակայությունը:	1. □	2. □	3. □	4. □
46. Ինֆորմացիա որոնելու համար ժամանակ չունենալը:	1. □	2. □	3. □	4. □
47.Որոշ հակաբիոտիկների արժեքը:	1. □	2. □	3. □	4. □
48. Օպտիմալ հակաբիոտիկա-թերապիայի վերաբերյալ անվճար կամ մատչելի որակյալ դասընթացների բացակայությունը:	1. □	2. □	3. □	4. □
49. Հիվանդների կողմից ճնշումը:	1. □	2. □	3. □	4. □
50. Դեղագործական կազմակերպու-թյունների կողմից ճնշումը, որոնք շահագրգռված են իրենց հակաբիոտիկների վաճառքով:	1. □	2. □	3. □	4. □
51.Բժշկի աշխատանքի անբավարար վարձատրության պատճառով նրա՝ որակյալ ծառայություն մատուցելու մղում չունենալը:	1. □	2. □	3. □	4. □
52. Այլ խոչնդոտ (նշեք) ————————————————				

<u>Շնորհակալությո՛ւն մասնակցության համար:</u>

Appendix 4: Oral consent form

English version:

American University of Armenia

Institutional Review Board #1

Consent form

Knowledge, attitude and practice regarding antibiotics resistance among general practitioners in polyclinics in Yerevan

Hello, my name is Diana Muradyan. I am a final year graduate student at the Turpanjian School of Public Health at the American University of Armenia. Our department is conducting a study to better understand the knowledge, attitude and practice regarding antibiotics resistance among general practitioners in polyclinics in Yerevan.

We have randomly chosen 17 private and public polyclinics located in Yerevan. From these polyclinics 340 general practitioners, who speak Armenian fluently, will participate in this study. Your polyclinic also has been chosen and You are one of 20 general practitioners from this polyclinic whom we invite to participate in the study. Your participation only involves self-completion of a questionnaire that should take no longer than 15 minutes. The questionnaire consists of questions about knowledge, attitude and practice regarding antibiotics resistance. The information received from you is entirely confidential and will be used only for study purposes. Your name, contact information and other identifiable information will not be recorded on the questionnaire and will not appear in any presentation of the project. Nobody except research team will have access to the data you will provide. Your responses to the questions will contribute to this project and your answers will be put together with the answers of other participants.

Your participation in this study is voluntary. There is no penalty if you decline to take part in this project. You may refuse to answer any question you feel uncomfortable with. There are

no known risks to You if you participate in the study. You will not gain any financial compensation or other personal benefits by participating in this study, but Your honest answers will help us to conduct this study, the results of which will be important in the effective implementation of preventive measures against antibiotic's resistance in Yerevan. If you have any questions regarding this study you can contact the Principal Investigator Varduhi Petrosyan by this phone number: (37460) 612592. If you feel you have not been treated fairly or think you have been hurt by joining the study you should contact Human Participants Protections Administrator in the American University of Armenia Varduhi Hayrumyan by this phone number: (37460) 612561. Do you agree to participate? (YES or NO) Thank you.

Armenian version:

Հայաստանի Ամերիկյան Համալսարան

Գիտահետազոտական Էթիկայի թիվ 1 Հանձնաժողով

Իրազեկ Համաձայնության ձև

Հակաբիոտիկակայունության վերաբերյալ Երևան քաղաքի ընդհանուր պրակտիկայի բժիշկների գիտելիքների, վերաբերմունքի և գործելակերպի մասին

Բարև Ձեզ: Իմ անունը Դիանա Մուրադյան է: Ես Հայաստանի Ամերիկյան համալսարանի Թրփանճեան Հանրային առողջապահության ֆակուլտետի մագիստրատուրայի ավարտական կուրսի ուսանող եմ: Հանրային առողջապահության ֆակուլտետը կատարում է հետազոտություն, որի նպատակն է պարզել հակաբիոտիկակայունության վերաբերյալ Երևան քաղաքի ընդհանուր պրակտիկայի բժիշկների գիտելիքները, մոտեցումները և գործելակերպը:

Երևան քաղաքի պետական և մասնավոր պոլիկլինիկաների ցանկից մենք պատահականության սկզբունքով ընտրել ենք 17 պոլիկլինիկա: Ընտրված պոլիկլինիկաներից 340 ընդհանուր պրակտիկայի բժիշկներ, ովքեր ազատ տիրապետում են հայերեն լեզվին, կմասնակցեն այս ուսումնասիրությանը: Պոլիկլինիկան, որտեղ որ Դուք եք աշխատում, նույնպես ընտրվել է և Դուք այս պոլիկլինիկայի 20 բժիշկներից մեկն եք, ում մենք հրավիրում ենք մասնակցելու այս ուսումնասիրությանը: Հետազոտության համար անհրաժեշտ է, որ Դուք ինքնուրույն լրացնեք այս հարցաթերթիկը, ինչը Ձեզնից կպահանջի առավելագույնը 15 րոպե: Հարցաշարը կազմված է հակաբիոտիկակայունության վերաբերյալ գիտելիքների, վերբերմունքի և գործելակերպի մասին հարցերից: Ձեր տրամադրած տեղեկությունները գաղտնի կպահվեն և կօգտագործվեն միայն հետազոտության շրջանակներում: Ձեր անունը, հասցեն, հեռախոսահամարը և ինքնությունը

բացահայտող որևէ տվյալ չի գրանցվի հարցաթերթիկում և չի ներկայացվի ոչ մի զեկույցում: Հետազոտության խմբի անդամներից բացի ոչ մեկին հասանելի չեն լինի Ձեր տված պատասխանները: Ձեր տված անհատական պատասխանները և մեր մյուս մասնակիցների պատասխանները կհավաքվեն մեկ տեղում և կօգնեն այս հետազոտության իրականացմանը:

Ձեր մասնակցությունն այս ուսումնասիրությանը կամավոր է: Ձեր իրավունքն է՝ համաձայնել կամ հրաժարվել մասնակցել՝ առանց որևէ բացասական հետևանքների Ձեզ համար: Հարցաթերթիկը լրացնելիս Դուք կարող եք հրաժարվել պատասխանել այն հարցերին, որոնք Ձեզ դուր չեն գա: Ուսումնասիրությանը Ձեր մասնակցությունը որևէ ռիսկ չի ենթադրում: Չի ենթադրում նաև որևէ ֆինանսական փոխհատուցում կամ ուղղակի շահ Ձեզ համար, սակայն Ձեր անկեղծ պատասխանները կօգնեն մեզ իրականացնել այս ուսումնասիրությունը, որի արդյունքները շատ արդյունավետ կարող են լինել հակաբիոտիկակայունության կանխարգելմանն ուղղված արդյունավետ միջոցների մշակման համար Երևանում:

Այս հետազոտության վերաբերյալ հարցեր ունենալու դեպքում կարող եք զանգահարել հետազոտության համակարգողին՝ Վարդուհի Պետրոսյանին հետևյալ հեռախոսահամարով՝ (37460) 612592: Եթե Դուք կարծում եք, որ հետազոտության ընթացքում Ձեզ լավ չեն վերաբերվել և/կամ հետազոտությունը Ձեզ վնաս է հասցրել, կարող եք կապվել Հայաստանի Ամերիկյան Համալսարանի Էթիկայի հանձնաժողովի համակարգող Վարդուհի Հայրումյանի հետ հետևյալ հեռախոսահամարով՝ (37460) 612561: Դուք համաձա՞յն եք մասնակցել այս հետազոտությանը: (Այո, Ոչ):

Շնորհակալություն: