



Original article

Assessment of knowledge and attitude toward the new antibiotic dispensing law and its effect on antibiotic use in Saudi Arabia

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ABSTRACT

Background: Antibiotics resistance is a serious problem around the world, which has been increasing in the last century due to misuse of antibiotics. Recently, Saudi Arabia enforced the Executive Regulations of Health Practice Law that prohibits dispensing antibiotics without prescription.

Aim: (1) To assess the association between the knowledge and attitude toward the recent enforcement of the antibiotic restriction Law and the antibiotic use among Saudi population.

(2) To assess the pattern of antibiotic use before and after the enforcement of the Law.

Method: An online cross-sectional study was conducted among residents of Saudi Arabia.

Results: The study was carried out among 570 Saudi participants; the result shows no considerable difference before and after law enforcement in purchasing and use of antibiotics. During the six months before the law implementation, antibiotics were obtained by 42 (7%) through purchase from the pharmacy without a prescription, 23 (4%) through remains of previously used containers, and 7 (1%) through a relative or a friend; while during the six months after the law implementation it was 31 (5%), 22 (4%) and 7 (1%), respectively. Only 48% agreed that they always received advice from a doctor, nurse or pharmacist on how to use your antibiotics. 32% have no knowledge about antibiotic resistance or drug resistance or antibiotic-resistant bacteria. More than two third (75%) were aware of the recent enforcement of the law that prohibits dispensing antibiotics without prescription. Among the participants, 91 (16%), 285 (50%) and 194 (34%) were expressed negative, neutral and positive attitude towards the law, respectively.

Conclusion: In spite of the recent enforcement of the Law, there is still misuse of antibiotics, which indicate need for educational programs and campaigns to improve the knowledge of the population.

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1. Introduction

The fast emergence and continuous spread of antibiotic resistance has been a major health and economic threat to individuals as well as communities around the world (Abdelaziz et al., 2019). Antibiotic resistance can increase the health expenditure, length of hospital stay, morbidity and mortality. A recent study estimated

that 10 million deaths will be attributed to antibiotic resistance by 2050, and it is expected that \$100 trillion of the world's economic outcome will be lost if the policy makers don't intervene to find effective solutions to overcome this threat (Founou et al., 2017). The antibiotic resistance crisis has been attributed to the misuse of antibiotics either by physicians or pharmacists through unnecessary prescribing and dispensing or by self-medicating patients (Abdelaziz et al., 2019; CDC, 2013; Harbarth et al., 2005; Al-Azzam et al., 2007).

In Saudi Arabia, patients might seek the medical and wellness advice firstly through the community pharmacies because of their easy access, quick services, and lack of restrictions on dispensing prescription medications including antibiotics. These reasons are believed to contribute to overuse of antibiotics. One study reported that 78.7% of adults were using non-prescribed antibiotics in Riyadh city (Nafisah et al., 2017). Furthermore, a study from Jordan showed that 28% of patients are misusing antibiotics and using

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them as analgesics and 56% of them using antibiotics for prophylaxis. (Shehadehe et al., 2012).

Since data started to show an increase in antibiotics resistance around the world, the Ministry of Health (MOH) in Saudi Arabia established a policy to prohibit dispensing medications without prescriptions including antibiotics. As a result, the percentage of pharmacists who dispensed antibiotics without prescription was reduced from 97.9% in 2011 to 63% in 2015 (Al-Mohamadi et al., 2013; Zowalaty et al., 2016).

However, the practice of dispensing antibiotics without prescriptions by pharmacists in community pharmacies continued until 2018 when the MOH announced a new enforcement of the Executive Regulations of Health Practice Law that prohibits dispensing antibiotics without a prescription in order to regulate antibiotics use (Ministry of Health, 2018). The MOH warned those who were selling antibiotics without a prescription with a fine of up to SR100,000. Since this new enforcement was applied, there has been no study to examine the public's knowledge and response to it. Therefore, we aimed in this study to assess the public's knowledge, perception and attitude toward the antibiotic resistance and the enforcement of the antibiotics restriction law as well as to measure the impact of such enforcement on their use of antibiotics.

2. Methodology

2.1. Study settings

An online cross-sectional survey, using QuestionPro.com, was carried out during January 2019 targeting people who are residents of Saudi Arabia. People who were of age 16 years or older and speaks Arabic were eligible for the study. A link to the online survey was distributed through emails and social media platforms (Facebook, Twitter, WhatsApp, and Snapchat). The link initially led to an informed consent and eligibility check before directed to the survey questions.

2.2. Questionnaire

A self-designed questionnaire, in Arabic, was prepared following a comprehensive literature review on related topics. Although some questions were used from the literature (WHO, 2015; Mason et al., 2018; Alhomoud et al., 2017), some new questions were added specifically to assess the awareness and attitude of the general public towards the Law on the prohibition of dispensing antibiotics without prescription. The content validity of the questionnaire was examined by a panel of researchers in the field of Clinical Pharmacy and Biostatistics. Prior to distributing the questionnaire, it was piloted among 40 people to assess its feasibility and to revise the questions for clarity and interpretability. The questionnaire was refined and finalized based on the feedback. The final questionnaire consists of 30 items and divided into four sections: seven items were on socio-demographic characteristics of participants; three items were on knowledge about the law and the sources of antibiotic medications; ten items were on attitude towards the law; and the final ten items were on the awareness about antibiotics resistance. Internal consistency was assessed using Cronbach's Alpha: it was 0.79 for the third section and 0.74 for the final section of the questionnaire. The questionnaire is presented in the appendix.

The data that were obtained on participants' socio-demographic characteristics included gender, age, education status, employment status, monthly income, marital status, and field of study or work.

In the next section of the questionnaire, ten items were included to assess the level of knowledge about antibiotic resistance

on a dichotomous scale (yes/no). A summative score was computed after negative items were reversed, and it was transformed to a scale ranged from 0 (no knowledge) to 1 (substantially high level of knowledge) for comparative purpose. The summative score was then divided into three categories based on pre-defined arbitrary cut-off values: 0–0.5 as low, 0.5–0.8 as moderate, and 0.8–1.0 as high.

The participants were then asked whether they were aware of the Ministry of Health's law that prohibit dispensing antibiotics without a prescription. They were also requested to report the sources of antibiotics during the six months before and after the implementation of the law if they have used any during that period.

In the final section of the questionnaire, ten items were included to assess the attitude towards the new law on a 5-point Likert scale. A summative score was computed after negative items were reversed, and it was transformed to a scale ranged from 0 (highly negative attitude) to 1 (highly positive attitude) for comparative purpose. The summative score was then divided into three categories based on pre-defined arbitrary cut-off values: 0–0.5 as a negative attitude, 0.5–0.8 as a moderately positive attitude, and 0.8–1.0 as a highly positive attitude. A brief introduction to the new law had been given before allowing participants to respond to the items on the attitude towards the law.

2.3. Sample size

A minimum sample size of 385 was calculated using Raosoft online calculator (<http://www.raosoft.com/samplesize.html>) to estimate a conservative proportion of a favorable response of 50% with a confidence level of 95% and a margin of error of 5%. A comparable sample size was reported in similar studies (Awad et al., 2015; Nafisah et al., 2017).

2.4. Statistical analysis

Descriptive statistics were used to summarize the data. Data were presented as frequency and percentage or mean and standard deviation (SD). Chi-square test was used to compare categorical variables. A p-value less than 0.05 was considered as statistically significant. Data analysis was carried out using SPSS Statistics version 24.0 (IBM Corporation, Armonk, NY).

3. Result

Among the 1053 participants who started to fill the survey, 570 (54%) completed and submitted the questionnaire.

3.1. Characteristics of participants

Table 1 presents the socio-demographic characteristics of the participants. The study comprised of 570 participants with about 60% between the age of 19–44 years old. The majority of the participants are females (80%). The bachelor's degree was the highest level of education in about 67% of the participants and 65% have no medical background.

The mean summative score for the level of knowledge about antibiotic resistance was 0.70 (SD = 0.16). Among the participants, 42% (241/570) were well-aware of antibiotic resistance and its related problems, 51% (289/570) have a moderate level of knowledge, and 7% (40/570) have a low level of knowledge on antibiotic resistance. The proportion of participants with a high level of knowledge was higher among participants who aged 19–34 years (p-value = 0.004), or who study or work in the medical field (p < 0.001).

Table 1
Socio-demographic characteristics of participants.

	Count	Column %
Age		
16–18	67	11.80%
19–24	183	32.10%
25–34	152	26.70%
35–44	108	18.90%
45+	60	10.50%
Gender		
Male	112	19.60%
Female	458	80.40%
Marital Status		
Single	241	42.30%
Married	311	54.60%
Divorced/Widowed	18	3.20%
Education level		
High School	110	19.30%
Diploma	49	8.60%
Bachelor's degree	379	66.50%
Masters or Doctorate degree	32	5.60%
Employment status		
Student	228	40.00%
Unemployed	127	22.30%
Employee	194	34.00%
Retired	21	3.70%
Field of study or work		
Medical field	200	35.10%
Non-medical field	370	64.90%
Monthly income		
Below 5000 SR	139	24.40%
5000–10,000 SR	139	24.40%
10,000–15,000 SR	142	24.90%
More than 15,000 SR	150	26.30%

3.2. The new law and the sources of antibiotic medications

The study found that about a quarter of the participants (145/570) agreed that they have not heard about the new law. We also found that the use of antibiotics without a prescription decreased from 11% to 9% after the law implementation (Fig. 1). Specifically, during the six months before the law implementation, antibiotics were obtained by 42 (7%) participants through purchasing from the pharmacy without a prescription, 23 (4%) through remains of previously used containers, and 7 (1%) through a relative or a friend. On the other hand, during the six months after the law implementation, the obtaining of antibiotics was 31 (5%), 22 (4%) and 7 (1%), respectively. Among those who have heard about the new law, the proportion of participants purchased from a pharmacy without prescription was 5.4% (n = 23), while among those who have not heard about the law, it was 5.5% (n = 8; p = 0.961).

3.3. Attitude towards the new law

The mean summative score for the attitude towards the new law enforcement was 0.79 (SD = 0.17). In particular, 29% (164/570) of participants expressed a highly positive attitude, 58% (332/570) expressed a moderately positive attitude, and the remaining 13% expressed a negative attitude towards the law.

The study found an association between the attitude towards the law and the use of antibiotics without a prescription, a significantly higher proportion of participants (n = 17; 23.0%) with a negative attitude towards the law were purchasing antibiotics

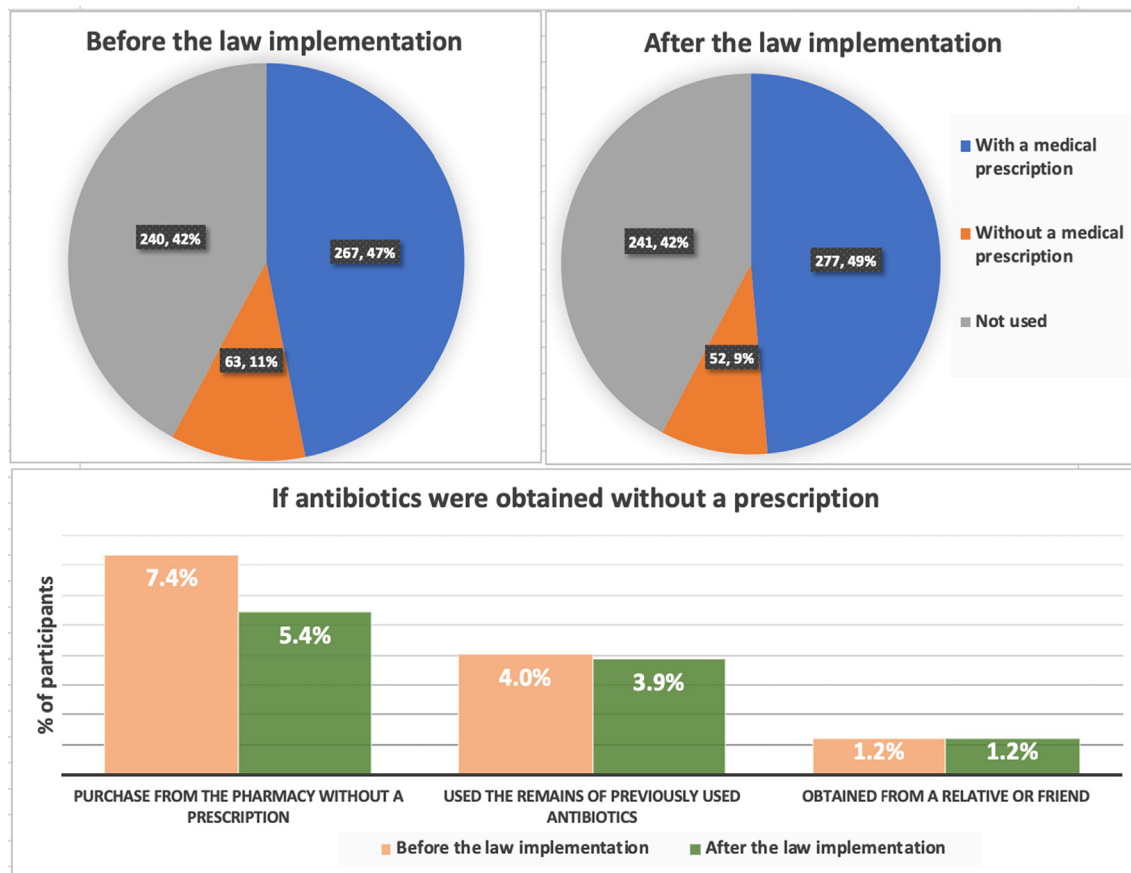


Fig. 1. Source of antibiotics before and after the law implementation.

from a pharmacy without a prescription compared to the participants with a moderately positive attitude ($n = 12$; 3.6%) or with a highly positive attitude ($n = 2$; 1.2%; $p < 0.001$).

As shown in Table 2, the highest proportion of participants with the negative attitude was among those with an education level of diploma or lower ($p = 0.024$), unemployed or retired ($p < 0.012$), those with no medical background ($p < 0.001$), and those with low level of knowledge about antibiotic resistance ($p < 0.001$).

3.4. Knowledge about antibiotic resistance and use of antibiotics without prescription

The study showed that the proportion of participants who obtained antibiotics without a prescription was higher among those with a low level of knowledge about antibiotic resistance compared to those with a high level of knowledge (18% vs. 5%; $p = 0.022$; Fig. 2).

Table 2
Factors that influence the attitude towards the Executive Regulations of Health Practice Law.

Variables	Highly positive n (%)	Moderately positive n (%)	Negative n (%)	p-value
Age				
16–18	16 (23.9%)	40 (59.7%)	11 (16.4%)	0.091
19–24	65 (35.5%)	100 (54.6%)	18 (9.8%)	
25–34	46 (30.3%)	85 (55.9%)	21 (13.8%)	
35–44	25 (23.1%)	64 (59.3%)	19 (17.6%)	
45+	12 (20%)	43 (71.7%)	5 (8.3%)	
Gender				
Male	35 (31.3%)	66 (58.9%)	11 (9.8%)	0.501
Female	129 (28.2%)	266 (58.1%)	63 (13.8%)	
Marital Status				
Single	80 (33.2%)	136 (56.4%)	25 (10.4%)	0.200
Married	81 (26%)	184 (59.2%)	46 (14.8%)	
Divorced/Widowed	3 (16.7%)	12 (66.7%)	3 (16.7%)	
Education level				
High School or lower	23 (20.9%)	64 (58.2%)	23 (20.9%)	0.024*
Diploma	11 (22.4%)	29 (59.2%)	9 (18.4%)	
Bachelor's degree	117 (30.9%)	222 (58.6%)	40 (10.6%)	
Masters or Doctorate degree	13 (40.6%)	17 (53.1%)	2 (6.3%)	
Employment status				
Student	79 (34.6%)	124 (54.4%)	25 (11%)	0.012*
Unemployed	21 (16.5%)	86 (67.7%)	20 (15.7%)	
Employee	61 (31.4%)	107 (55.2%)	26 (13.4%)	
Retired	3 (14.3%)	15 (71.4%)	3 (14.3%)	
Field of study or work				
Medical field	82 (41%)	102 (51%)	16 (8%)	<0.001*
Not medical field	82 (22.2%)	230 (62.2%)	58 (15.7%)	
Monthly income				
Below 5000 SR	40 (28.8%)	76 (54.7%)	23 (16.5%)	0.343
500,010,000 SR	36 (25.9%)	80 (57.6%)	23 (16.5%)	
1,000,015,000 SR	44 (31%)	86 (60.6%)	12 (8.5%)	
More than 15,000 SR	44 (29.3%)	90 (60%)	16 (10.7%)	
Knowledge about antibiotic resistance				
High	94 (39%)	131 (54.4%)	16 (6.6%)	<0.001*
Moderate	64 (22.1%)	177 (61.2%)	48 (16.6%)	
Low	6 (15%)	24 (60%)	10 (25%)	

Factors that influence the attitude towards the Executive Regulations of Health Practice Law.

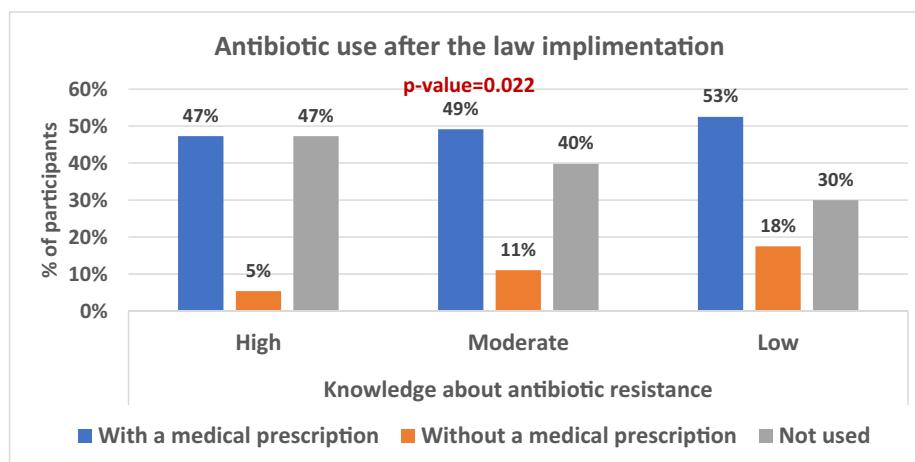


Fig. 2. Use of antibiotics without prescription stratified by the level of knowledge about antibiotic resistance.

4. Discussion

To the best of our knowledge, this is the first study in the Kingdom of Saudi Arabia that evaluates the public's knowledge and attitude toward the recent enforcement of the Executive Regulations of Health Practice Law and their association with antibiotics use.

The knowledge of law does not appear to have a significant effect on the use of antibiotics without a prescription, which was shown by the absence of a significant difference between the people who know versus who do not know about the law ($p = 0.961$). On the other hand, an association between the attitude towards the law and antibiotics use was found, which was shown by a higher antibiotic use without a prescription in people with negative attitude towards the law ($p < 0.001$).

Also, our study has found that the level of knowledge about antibiotic resistance is significantly associated with lower use of antibiotics without prescriptions ($p = 0.022$). Previous study argued that people do not necessarily know what is meant by antibiotic resistance but they tend to know that antibiotic resistance is a result of inappropriate or unnecessary antibiotic use, and that it makes the antibiotics less effective (Waaseth et al., 2019). Moreover, we found that participants with high knowledge about antibiotics resistance have expressed positive attitude towards the law compared with people with low knowledge about antibiotic resistance ($p < 0.001$). A previous study has shown that even people who use antibiotics without a prescription agree that the dispensing of antibiotics should be regulated (Zowalaty et al., 2016). Our study could explain that finding by suggesting a contributing factor, which is the knowledge of antibiotics resistance. This suggestion is supported by the results of a previous study in Sweden. In that study, 80.7% of the participants were aware of the concept of antibiotic resistance. Consequently, the results have shown that only 10.9% agreed to the idea of purchasing antibiotics without prescriptions (Andre et al., 2010).

Education level, and medical background in particular, may play an important role in the knowledge about antibiotics resistance. A study that was conducted in Southern India has shown that people with medical background are well aware of antibiotics resistance (Khan et al., 2013). In our study, the results also support this as people with medical background has shown to have higher level of knowledge about antibiotics resistance ($p < 0.001$).

Our study did not find a significant difference in antibiotic use without prescriptions before and after the implementation of the law. A previous study in Greece has found a similar result; reporting a high prevalence in dispensing fluoroquinolones (53%) even with the implementation of a law restricting the dispense of fluoroquinolones in Greece in 2003 (Plachouras et al., 2010). However, dispensing antibiotics without prescriptions in Saudi Arabia has been shown to be decreasing over the years since the establish-

ment of the Health Practice Law in 2005 (Al-Mohamadi et al., 2013; Zowalaty et al., 2016; Algadeer et al., 2018) although the Executive Regulations of the Health Practice Law was only implemented in 2017. Our study may provide a new insight towards explaining this downtrend of antibiotic use without prescription by showing the effect of knowledge about antibiotic resistance, which was represented by its association with more positive attitude towards the Law as well as lower use of antibiotics without prescriptions. This suggests that implementing the Law and improving the knowledge and awareness of antibiotic use need to be applied together in order to have the desired effect of increasing the appropriate utilization of antibiotics.

5. Limitations

Our study has several limitations. First, this is a cross-sectional survey study, which means that our data is based on the subjective information that has been provided by the participants, and it can be susceptible to recall errors or to providing inaccurate information and thus the association that has been demonstrated in our study may not imply a causal relationship. Second, the questionnaire of the study was only available in an online format and was distributed through the social media channels, which can limit the extent to which this survey can reach to only those who are active on social media and know how to use this kind of surveys. Finally, we did not include a question about the geographic area of the participants in the demographic section of the survey, which can limit our ability to evaluate the association between the different geographic areas of Saudi Arabia and the knowledge, attitude, and practice of antibiotic use in those areas.

6. Recommendations

(1) We recommend developing educational programs and campaigns to the population about antibiotic resistance and the real cause after the prohibition law. (2) Increase surveillance of antibiotics dispensing. (3) Increase accessibility for primary health care & provide health insurance to the population to decrease self-medication with antibiotics.

7. Conclusion

This study revealed that public knowledge about the recent enforcement of the antibiotics dispensing law was not associated in a decrease in antibiotics use without prescription. However, having positive attitude toward the law contributed to significantly less use of antibiotics without prescription. Further research should be directed to measure the economic impact of the law enforcement on both community and hospital pharmacies.

Appendix

1. Age

- 16-18
- 19-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65+

2. Gender

- Male
- Female

3. Social Status

- Single
- Married
- Divorced
- Widowed

4. Education Level

- No schooling completed
- Primary School
- Intermediate School
- High School
- Diploma
- Bachelor's degree
- Master's or Doctorate degree
- Others.....

5. Job

- Student
- Unemployed
- Employee
- Retired

6. Field of study or work

- Medical field
- Not medical field

7. Family Monthly income

- Below 5000 SR
- 6000-10000 SR
- 11000-15000 SR
- More than 15000 SR

Aware of the new Law Enforcement

- 8. Have you heard about mandatory law of the Ministry of Health's prohibiting the prescription of over-the-counter antibiotics, which was applied six months ago?**
- Yes, I heard about it
 - No, I did not hear about it
- 9. I got the antibiotic during the 6 months before the law implementation through (Multiple selection allowed)**
- Medical Prescription
 - Purchase from the pharmacy without a prescription
 - Remains of previously used containers
 - A relative or friend
 - I can't remember
 - I did not use any
- 10. I got the antibiotic during the 6 months after law implementation through (Multiple selection allowed)**
- Medical Prescription
 - Purchase from the pharmacy without a prescription
 - Remains of previously used containers
 - A relative or friend
 - I can't remember
 - I did not use any

Knowledge of Antibiotics Resistance:

Please indicate whether you think the following statements are ‘true’ or ‘false’

- 11. Have you heard about “antibiotic resistance, drug resistance, or antibiotic-resistant bacteria”**
 - Yes
 - No
- 12. All of the antibiotics should be taken as directed once you’ve begun the treatment**
 - True
 - False
- 13. Antibiotic resistance occurs when your body becomes resistant to antibiotics and they no longer work as well**
 - True
 - False
- 14. Many infections are becoming increasingly resistant to treatment by antibiotics**
 - True
 - False
- 15. If bacteria are resistant to antibiotics, it can be very difficult or impossible to treat the infections they cause.**
 - True
 - False
- 16. Antibiotic resistance is an issue that could affect me or my family.**
 - True
 - False
- 17. Antibiotic resistance is an issue in other countries but not here.**
 - True
 - False
- 18. Antibiotic resistance is only a problem for people who take antibiotics regularly.**
 - True
 - False
- 19. Bacteria which are resistant to antibiotics can be spread from person to person.**
 - True
 - False
- 20. Antibiotic-resistant infections could make medical procedures like surgery, organ transplants and cancer treatment much more dangerous**
 - True
 - False

Attitude towards the new law on law

21. How do you agree with the following statements regarding the enforcement of the law that prohibits dispensing antibiotics without prescription?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The law enforcement is for patient benefit					
The law enforcement can save money for patient					
The law enforcement Limits the resistance of bacteria					
The law enforcement leads to the consumption of patient time to visit the doctor					
The law enforcement causes delayed treatment.					
The law enforcement may cause accumulation and remaining the antibiotics in warehouse and pharmacies without using.					
The law enforcement goal is to increase the price of antibiotics					
The law enforcement leads to consumption of patient money to visit a doctor.					
The law enforcement has no effect on anything					
I agree with the law of preventing the dispensing antibiotics without a prescription					

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