Power System Technology
ISSN:1000-3673

Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

Antibiotics Use among Saudi Population: A Cross-sectional Study

Waad Ali Alghamdi[1] and Ahlam Ali Majrshi[2]

[1] Corresponding Author, Respiratory Therapist, Alalialgamdiwa@Mngha.Med.Sa, Ministry Of National Guard-Health Affairs, Riyadh, Saudi Arabia

[2] Respiratory Therapist, Majrshiah@Mngha.Med.Sa, Ministry Of National Guard-Health Affairs, Riyadh, Saudi Arabia

Abstract

Purpose: Antibiotic resistance has become a worldwide issue, posing a significant threat to public health. The evidence has shown that the public plays a key role in the increase of antibiotic resistance. This study was designed to assess the awareness, attitude, and practice regarding antibiotic use among Saudis.

Methods: This cross-sectional study was carried out in May 2023 in Saudi Arabia by using an online questionnaire that was adapted from a previous study. The data were analyzed using descriptive analysis, and chi-square test.

Result: A total of 572 participants were included in this study. Most of them were female and in the age group from above18 to 25-year-old. The result showed that the participants are highly aware with moderate attitude, and practice. Most of them were aware of the use of antibiotics. However, more than half thought that bacteria are germs that could cause the common cold and flu. There was a significant association between age and antibiotic use including awareness ($p = .019$), attitude ($p = .001$), and practice ($p = .001$). Whereas female participants had better practice than male participants ($p < .001$).

Value: This study showed that the participants had somewhat a good awareness with moderate attitude, and practice. Therefore, education initiatives and campaigns should be carried out for the population to change their behavior, and accordingly reduce antibiotic inappropriate usage and decrease misconceptions regarding the consequences of improper use of antibiotics.

Key words: Antibiotic resistance; Saudi Arabia; awareness; attitude; practice; antibiotic use.

Introduction:

In recent decades, antibiotic resistance has become a worldwide issue, posing a significant threat to public health (Olesen, 2018). Increased antibiotic resistance can decrease the therapeutic effectiveness of these drugs, prolonging severe illness episodes and leading to higher costs and mortality rates (Zanichelli, 2018).

The inappropriate use of antibiotics is the primary cause of antibiotic resistance, which typically occurs due to lack of prudent use of antibiotics and obtaining medication without a

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

prescription. Another significant cause of antibiotic resistance is patients' belief in the remarkable effectiveness of antibiotics and their universal efficacy against many diseases which results in overuse (Alqarni, 2019). Thus, controlling antibiotic use requires multifaceted strategies involving educated and engaged healthcare practitioners and the general population.

Numerous studies on the public awareness, attitude, and use of antibiotics have been conducted in several countries. In Saudi Arabia, it was found that the third most prescribed medicine is antibiotics. In addition, most community pharmacists would give antibiotics without a prescription (Alnasser, 2021). According to a study conducted in Al-Kharj, Saudi Arabia, almost half of the participants believe that antibiotics may be used to treat viral (Alqarni, 2019). Another study conducted in Mecca, Saudi Arabia, found that 87% of the participants use antibiotics that are not prescribed to them, and 79.2% get their antibiotics from numerous sources. (Yezli, 2018)

According to Gillani, 2020, 60% of his participants in Punjab Province, Pakistan, had a low level of awareness about using antibiotics. Whereas in Sudan, Elmahi, 2022, found that previous experience with similar symptoms was the most common cause for self-medicating with antibiotics. In addition to citing expensive appointments as a rationale for antibiotic self-medication

The selling of antibiotics without prescriptions has been observed in many countries. However, only a few of them have implemented regulations for the purchase of antibiotics Over the Counter (OTC) (AlOtieschan, 2021). In Saudi Arabia, the Ministry of Health started enforcing regulations regarding dispensing antibiotics in 2018 and now, it is illegal for the pharmacists to provide antibiotic without medical prescription (AlOtieschan, 2021). One of the recent studies found that after the regulation enforcement, only 12.9% of the pharmacists reported that dispensing antibiotics without medical prescription is a common practice (Alrasheedy, 2020).

The evidence has shown that the public plays a key role in the increase of antibiotic resistance. The World Health Organization (WHO) has recognized three key areas for public engagement: enhancing access to healthcare facilities, reducing unnecessary use of antimicrobial drugs, completing the course of treatment, and avoiding providing medication to other people or saving part of the course for future needs (Alqarni, 2019). The WHO has also advised several countries to initiate educational interventions for the public to improve their understanding of antibiotic use and reduce antibiotic resistance.

Thus, improving the population's awareness and changing their practice towards antibiotic use will be an essential early strategy to prevent antibiotic resistance, and maintain its effectiveness. Therefore, it is important to evaluate the public’s behavior regarding antibiotic use to determine the appropriate education they may need (Alqarni, 2019). This study

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

aims to assess the behavior regarding antibiotic use among Saudi Arabian public. It focuses on achieving three objectives, which are to assess the population's level of awareness, to assess the population's attitude, and to examine the population's practice regarding antibiotic use.

Materials and methods

Study Design

A quantitative cross-sectional study, using an online survey was conducted in Saudi Arabia.

Study sample

This study targeted all Saudi population aged above 18 years old. Due to the lack of databases that could serve as a sampling frame to draw random samples from, a convenience sampling procedure was used by posting the survey in social media and inviting the public to participate.

Out of the completed the questionnaire, five hundred and seventy-two individuals met the criteria. Although the sample size was statistically satisfying, it lacks representativeness of the Saudi population and accordingly the generated results should be interpreted with cautious.

Study instrument

The questionnaire was adapted from a previous study (Khan et al, 2013). It was translated into Arabic and then subjected to a process of forward and backward translation. The accuracy and meaning of the translated versions both forward and backward were checked by two academic instructors from King Saud University and a research coordinator from King Abdullah International Medical Research Center. Their recommended modifications were considered carefully before finalizing the instrument. The instrument was then pretested for content, design, readability, and comprehension on 30 individuals, and modifications were done accordingly with a reliability test result of 0.52.

The questionnaire consisted of 29 questions divided into five sections: the first is: is the demographic characteristics, including: Age, gender, marital status, having children, occupation, private insurance, and level of education. The second section asked about awareness of antibiotic use by using a set of nine questions. Seven of these were of the True/False type and two were Likert scale-based questions. For example, indiscriminate and injudicious use of antibiotics can lead to: Emergence of bacterial resistance T/F. The true answer = 1 while the false answer = 0.

The third section used a 5-point Likert scale ranging from ‘strongly agree’ to ‘strongly disagree’ to study the attitude of the participants regarding antibiotic resistance and usage in five questions such as Whenever I take an antibiotic, I contribute to the development of antibiotic resistance. The fourth section assessed antibiotic use practices using a 5-point Likert scale ranging from ‘always’ to ‘never’ in eight questions. For example, The Doctor prescribes

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

a course of antibiotics for you. After taking 2–3 doses you start feeling better. Do you stop taking further treatment?.

Data Collection

Data were collected using an online survey by Google Forms in Arabic and English language. The questionnaire link was distributed in May 2023. Before participating in this study, informed consent was obtained from the participants. Moreover, the age and nationality were checked by adding questions, and if the participants are non-Saudi or 18-years or under, they couldn't continue the survey.

Data Analysis

Data analysis was conducted with SPSS version 25 (IBM). Descriptive statistics, including means, standard deviations, and frequencies, were used to examine both continuous and categorical variables. Associations and comparisons related to awareness, attitudes, and practices were evaluated using chi-square tests.

For true and false questions, each question was assigned a value of 1 for true and 0 for false then the scores were summed up to determine the level of awareness. The respondents were classified into three groups based on their level of awareness, (0 - 3) means Low awareness, (3 to 5) means Moderate awareness, and (5 to 7) means High awareness.

Likert scale was selected as the preferred method of measurement compared to other scaling techniques. This scale is widely recognized for effectively capturing participants' attitudes and practices by allowing them to express their level of agreement or disagreement with each statement in the survey, as shown in Table (1).

Table (1):

Degree	Response		Degree	Weighted Average
5	Strongly agree	Always	Very high	4.20–5
4	Agree	Usually	high	3.40–4.19
3	Neutral	Sometimes	Moderate	2.60–3.39
2	Disagree	Rarely	weak	1.8–2.59
1	Strongly disagree	Never	Very weak	1–1.79

*Degree could be reversed in case of negative items

Ethical Considerations:

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

The study was approved by King Saud University Research Review Board (IRB No: KSU-HE-23-446), each participant signed the agreement before answering the questionnaire, and the objectives of the study were explained.

Result

Characteristics of study participants

A total of 572 participants were included in this study. Most of them were under 26 years old, female, had tertiary education, and employed. More than half of the participants were single and 44.6% were married and only 42.5% have children. Table (2).

Table (2): Characteristics of study participants (n=572)

Variables		F*	%+
Age (years)	>18-25	229	40.0
	26 to 30	99	17.3
	31 to 40	111	19.4
	41 to 50	85	14.9
	> 50	48	8.4
	Total	572	100.0
Gender	Male	181	31.6
	Female	391	68.4
	Total	572	100.0
Marital status	Single	295	51.6
	Married	255	44.6
	Widowed	5	.9
	Divorced	17	3.0
	Total	572	100.0
Do you have children	No	329	57.5
	Yes	243	42.5
	Total	572	100.0
Occupation	Employee	452	79.0

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

	Student	2	.3
	Unemployed	118	20.6
	Total	572	100.0
Do you have private insurance	No	423	74.0
	Yes	149	26.0
	Total	572	100.0
Level of education	Primary or below	3	.5
	Secondary	16	2.8
	High school	126	22.0
	Tertiary or above	427	74.7
	Total	572	100.0

*Frequencies, +Percentages

Awareness of study participants towards antibiotics uses

Most of the participants provided correct answers; 85% - 91% of the participants answered correctly on the first six questions. Whereas only 45% of the participants knew that bacteria are not germs that cause the common cold and flu (seventh question). The average score for true and false answers was 5.7 out of 7, which means the current participants had a high level of awareness towards antibiotics uses.

In addition, two thirds of the participants agreed that antibiotic resistance is an important and serious public health issue with a significant difference, as more participants thought of it as a threat on the global level than on the local level (M=4.03, M=3.85 respectively). Whereas almost one third of the participants were uncertain on that issue. Table (3)

Table (3): the participants' awareness about antibiotics (N=572).

Items	FALSE (0) n (%)	TRUE (1) n (%)
Antibiotics are ineffective treatment	69 (12.1)	503 (87.9)
Antibiotics lead to increased adverse effects	55 (9.6)	517(90.4)
Antibiotics lead to exacerbation or prolongation of illness	84(14.7)	488(85.3)

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

Antibiotics lead to emergence of bacterial resistance	85(9.1)	487(85.1)
Antibiotics are additional cost to the patient	52(9.1)	520(90.9)
If taken too often, antibiotics are less likely to work in the future.	57(10)	515(90)
Bacteria are germs that cause the common cold and flu reversed	256(44.8)	316(55.2)
Total score	**5.7**	

Antibiotic resistance is an important and serious public health issue	**Mean (SD)**	**(1)* n (%)**	**(2)* n (%)**	**(3)* n (%)**	**(4)* n (%)**	**(5)* n (%)**	**P-Value****
Facing the world	4.03(0.91)	5(0.9)	16(2.8)	151(26.4)	186(32.5)	214(37.4)	0.00
Facing our country	3.85(095)	5(0.9)	30(5.2)	186(32.5)	175(30.6)	176(30.8)	0.00

*(5)=Strongly agree, (4)=Agree, (3)= Uncertain, (2)=Disagree, (1)=Strongly disagree.

**Chi-Square test

The attitude of study participants towards antibiotic uses

Table (4) illustrates the population's attitude toward antibiotic use. The second statement shows that a significant number of respondents (55.4%) disagreed, showing awareness that antibiotics are not effective against fevers unless there is a bacterial infection. On the other hand, more than half of the participants did not know that taking antibiotics would contribute to the development of antibiotic resistance and only one third of the participants knew that even missing a few doses can contribute to the development of antibiotic resistance. The total attitude score was 3.04, which indicated a moderate attitude.

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

Table (4): The participants' attitude toward antibiotic use (N=572)

Items	(1)* n (%)	(2)* n (%)	(3)* n (%)	(4)* n (%)	(5)* n (%)	M	SD
When I have a cold, I should take antibiotics to prevent getting a more serious illness.	76(13.3)	128(22.4)	70(16.8)	168(29.4)	130(22.7)	3.26	1.38
When I get a fever, antibiotics help me to get better more quickly	99(17.3)	218(38.1)	88(15.4)	93(16.3)	74(12.9)	2.69	1.29
Whenever I take an antibiotic, I contribute to the development of antibiotic resistance.	68(11.9)	141(24.7)	131(22.9)	124(21.7)	108(18.9)	3.11	1.30
Skipping one or two doses does not contribute to the development of antibiotic resistance**	73(12.8)	124(20.1)	201(35.1)	111(19.4)	63(11)	2.94	1.17
Antibiotics are safe drugs; hence they can be commonly used	39(6.8)	130(22.7)	134(23.4)	178(31.1)	91(15.9)	3.27	1.17
Overall Attitude						**3.05**	**0.70**

*(5)=Strongly agree, (4)=Agree, (3)= Uncertain, (2)=Disagree, (1)=Strongly disagree.

**reversed negative items.

The practice of study participants towards antibiotics uses

Table (5) illustrates the population's practice toward antibiotic use. The responses were leaning more towards the negative practices among the participants. More than half of them would stop the treatment as soon as they felt better, would keep the remaining for future use or give it to someone else, and would not necessarily complete the full course of treatment. On the other hand, more than two thirds would always consult a doctor before taking antibiotics and would always check the expiry date before using them. Finally, less than one third would not prefer to use antibiotics when having a cough or sore throat.

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

Table (5): the participants' practice regarding antibiotic use (N=572)

Items	Never* n (%)	Rarely* n (%)	Sometimes* n (%)	Usually* n (%)	Always* n (%)	M	SD
The Doctor prescribes a course of antibiotics for you. After taking 2–3 doses you, start feeling better / Do, you stop taking further treatment?	81(14.2)	71(12.4)	122(21.3)	73(12.8)	225(39.3)	3.51	1.46
Do you save the remaining antibiotics for the next time you get sick?	78(13.6)	55(9.6)	112(19.6)	54(9.4)	273(47.7)	3.68	1.48
Do you discard the remaining antibiotics?	144(25.2)	59(10.3)	102(17.8)	94(16.4)	173(30.2)	3.16	1.57
Do you give the leftover antibiotics to someone else who is sick?	25(4.4)	35(6.1)	86(15)	56(9.8)	370(64.7)	4.24	1.17
Do you complete	210(36.7)	114(19.9)	97(17)	60(10.5)	91(15.9)	2.49	1.47

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

the full course of antibiotics							
Do you consult a doctor before starting antibiotics?	13(2.3)	24(4.2)	76(13.3)	90(15.7)	369(64.5)	4.36	1.01
Do you check the expiry date of the antibiotic before using it?	25(4.4)	40(7)	57(10)	65(11.4)	385(67.3)	4.30	1.16
Do you prefer to take antibiotics when you have a cough or sore throat?	86(15)	79(13.8)	136(23.8)	129(22.6)	142(24.8)	3.28	1.37
Overall Mean						**2.96**	**0.57**

*5= Always, 4= Usually, 3= Sometimes, 2= Rarely, 1= Never.

**reversed negative items.

Association between demographic characteristics and antibiotics use

According to Table (6), antibiotic use differed significantly between age groups (awareness p =.019, attitude p =.001, and practice p =.00). Whereas female participants had significantly better practice than male participants (p =.00) as well as participants with children were significantly more aware (p =.008) and had better practice (p =.013) than those without children. Finally, both attitude and practice towards antibiotic use differed significantly among level of education (p =.000, p =.004 respectively).

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

Table (6): Association between demographic data and antibiotic use

Variables		Awareness	Attitude		Practice	
		P-value	Mean (SD)	P-value	Mean (SD)	P-value
Age (years)	>18-25	**0.019***	2.95(0.70)	**0.001***	2.86(0.63)	**0.001***
	26 to 30		3.28(0.77)		3.02(0.48)	
	31 to 40		3.19(0.72)		3.12(0.47)	
	41 to 50		2.93(0.56)		3.00(0.57)	
	> 50		2.97(0.60)		2.90(0.54)	
Gender	Male	0.128	3.03(0.67)	0.926	2.83(0.66)	**0.00***
	Female		3.06(0.71)		3.03(0.51)	
Marital status	Single	0.083	3.04(0.74)	0.640	2.90(0.63)	0.060
	Married		3.08(0.66)		3.03(0.48)	
	Widowed		2.88(0.54)		2.8(0.57)	
	Divorced		2.89(0.63)		3.05(0.62)	
Do you have children	No	**0.008***	3.05(0.76)	0.984	2.91(0.62)	**0.013***
	Yes		3.05(0.62)		3.03(0.49)	
Occupation	Employee	0.6	3.05(0.70)	0.428	2.96(0.57)	0.668
	Student		3.7(0.42)		2.63(0.18)	
	Unemployed		3.05(0.71)		2.98(0.55)	
Do you have private insurance:	No	0.775	3.07(0.72)	0.311	2.98(0.58)	0.211
	Yes		3.00(0.64)		2.91(0.54)	
Level of education	Primary or below	0.612	2.53(0.23)	**0.000***	2.79(0.71)	**0.004***
	Secondary		2.96(0.61)		2.99(0.44)	
	High school		2.83(0.58)		2.80(0.60)	

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

	Tertiary or above			3.13(0.73)		3.01(0.56)	

*A Significant association has been detected at 0.05 or less

Discussion:

The emergence and spread of antibiotic resistance are a growing worldwide issue that poses a serious threat to public health both globally and locally. Population plays a key role in the abusive or inappropriate use of antibiotics, as well as in the spread of bacterial resistance (Voidăzan, S., 2022). The aim of this study was to assess the public behavior toward antibiotic use among Saudis; their awareness, attitude, and practice. The local literature as well as the international ones reported variable findings in relation to antibiotic misuse.

Most of the current participants were aware that antibiotic resistance is an important and serious public health issue facing the world and our country. Female participants were more aware of antibiotics uses than the males to support the finding of a recent local study (Alnasser, 2021).

A recent study collected responses from Arabic countries reported unsatisfactory knowledge of proper antibiotic use (Alsayed et al, 2022) and in agreement, more than half of our participants thought bacteria are the germs that cause common cold and flu. This result is in accordance with another study conducted in Saudi Arabia (Alnasser, 2021). Similarly, a study conducted in the Gulf countries reported that half of its participants thought antibiotics have major therapeutic impact on viruses (Almohammed, 2019).

On the other hand, a study conducted in Saudi Arabia showed that Saudi population were knowledgeable on antibiotic resistance and the potential consequences of misuse (Alkhuraisi, 2023). Also, in Nepal the respondents were reasonably knowledgeable about antibiotic use (Nepal, 2019).

The public knowledge of antibiotics varied among researchers, which might be resulted from using different measurement scales or from recruiting convenience samples. Another explanation could be the interpretation; while some researchers would report more than half of the participants as a good indicator, others would interpret it as unsatisfactory level of knowledge.

In terms of attitude, our participants had a moderate attitude toward antibiotic use, whereas a recent local study showed a satisfactory level of attitudes (Alkhuraisi, 2023). More than half of the current participants believe that antibiotics could prevent a more serious illness, but less than one third of them realize that antibiotics are not safe drugs. This is in accordance with a multinational study reported that the majority of its participants from multiple Arabic countries are using antibiotics at least once a year (Alsayed et al, 2022). In contrast, a Turkish

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

study found that only a few of its participants believe antibiotics do not have any harmful effects (Azap, 2019).

However, more than half of our participants did not believe antibiotics would help them to get better more quickly from feverand a similar result was reported among pilgrims (Yezli, 2018). A study conducted in Indonesia also found that less than half of its participants considered taking antibiotics to help them recover faster from a cold and fever (Karuniawati, 2021).

Clearly, the attitude reflects the participants awareness of antibiotic usage, which indicates a need to enhance the public awareness in order to affect the attitude positively. Keeping in mind that the patient is a unique consumer, where the provider decides on behalf of them which places most of the responsibility on the provider's shoulders regarding patients' attitude.

On the other hand, our study showed a significant relationship between age and antibiotics use, whereas another Saudi study showed that age was significantly associated with attitude only (Alnasser, 2021). Also, our data revealed a strong relationship between level of education and attitude to support the findings of another local study (Alqarni, 2019). These relationships mean patients are responsible to a certain degree for their attitude toward modifications.

In terms of practice, our data showed that respondents had moderate practice in relation to antibiotic use. Earlier, a high rate of antibiotic self-medication was noticed in GCC countries (Almohammed, 2019), and according to a recent local study (Alkhuraisi, 2023) as well as one from Qatar (Aljayyousi , 2019), antibiotics were widely used without prescription. Whereas, although most of our participants would consult a doctor before taking antibiotics, they would mostly give leftover to someone else. This practice is against the WHO recommendation which implies that to stop and control the development of antibiotic resistance, patients should never share leftover of antibiotics (WHO, 2021).

In addition, according to WHO, incompletion of the full course of antibiotics will lead to increased bacterial resistance to antibiotics (WHO, 2021). In our study, only 26% of the participants said they would not stop taking antibiotics after feeling better. In support, with somehow a better practice, a local study reported that 49% of its respondents would not stop taking antibiotics if they feel better (Alqarni, 2019), as well as 55% of the participants from Qatat would complete the antibiotic course (Aljayyousi, 2019). Whereas, a much better practice was reported in Mozambique, as 71% of the participants said they would complete the full course of treatment (Mate, 2019).

Although the current sample was convenience and accordingly the findings cannot be generalized to the Saudi population, the practices appeared to be alarming and require attention.

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

Examples of local, regional, and international findings, which also were based on convenience samples, seemed much better than the current ones. That might be related to variability in the measurement or in the interpretation, and in both cases, there has to be more oriented efforts to measure the practice on the population level and deal with it properly.

Limitation

Our study had some limitations. First, the study was cross-sectional that reflected one point in time, and did not represent any changes in awareness, attitude, and practice over time. Second, the participants were chosen by convenience sampling and the results were subject to bias. Third, the accuracy of the results depended on the honesty of the respondents.

Conclusion

This study is a significant step toward developing a better understanding of the awareness, attitudes, and practices about antibiotic use among Saudi population. It showed that there is some awareness with moderate attitude, and practice. In addition, it showed that female respondents have better awareness and practice than the males. Moreover, the participants who have kids have better practice and awareness.

Therefore, education initiatives and campaigns should be carried out for the population to change their behavior to reduce antibiotic inappropriate usage and to decrease misconceptions regarding the consequences of improper use of antibiotics. Thus, help to reduce the emergence and spread of antibiotic resistance locally and globally. These campaigns should not only increase awareness but also provide appropriate and practical methods for changing their attitudes and practices to rationalize antibiotic usage. It has been noted that increasing community awareness without imparting a correct attitude could lead to an increase in antibiotic misuse.

Implications

Several implications were drawn from our findings. Our outcomes would be helpful as the baseline for decision-makers to inform their movement toward develop community education programs about antibiotic use.

First, education initiatives and campaigns should be carried out for the population to influence their behavior about appropriate antibiotic usage. These efforts should be developed to reach and educate the public while considering the culture and social environment, and the level of education in which incorrect behaviors have arisen. They also should be targeted to help the population to differentiate between bacteria and viruses.

Second, Ministry of Health regulations should be strictly applied, they prohibit dispensing antibiotics without prescriptions which will help in controlling antibiotics distribution.

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

Third, national databases should be developed to provide accurate data on the use of medications and the public health behavior. That will aid in collecting more accurate and accordingly, more oriented conclusion can be drawn.

Future research is needed to assess the awareness, attitude, and practice regarding antibiotic use among people aged under 18 and non-Saudi people who reside in Saudi Arabia. In addition, the main factors that affect the population's behavior regarding antibiotic use need to be investigated. Finally, a qualitative analysis is recommended to explore the factors shaping antibiotic use among individuals in Saudi Arabia.

References:

1. Aljayyousi GF, Abdel-Rahman ME, El- Heneidy A, Kurdi R, Faisal E (2019) Public practices on antibiotic use: A cross-sectional study among Qatar University students and their family members. PLoS ONE 14(11): e0225499. https://doi.org/10.1371/journal.pone.0225499
2. Alkhuraisi, L. S. (2023, December 24). Knowledge, attitude, and practice of antibiotic resistance among general population in Saudi Arabia: A cross-sectional study. Cureus. https://www.cureus.com/articles/209612-knowledge-attitude-and-practice-of-antibiotic-resistance-among-general-population-in-saudi-arabia-a-cross-sectional-study#!/
3. Almohammed, R. (2019, September). Public knowledge and behaviours relating to antibiotic use in Gulf Cooperation Council countries: A systematic review. Journal of Infection and Public Health. https://www.sciencedirect.com/science/article/pii/S1876034118301424?via%3Dihub
4. Alnasser, A. (2021). Public Knowledge, Attitude and Practice towards Antibiotics Use and Antimicrobial Resistance in Saudi Arabia. Retrieved April 11, 2023, from https://journals.sagepub.com/doi/full/10.4081/jphr.2021.2276
5. AlOtieschan, S. (2021). Public perception toward ministry of health regulations for antibiotic dispensing and its impact on pharmacy and family physician visits. Cureus. Retrieved May 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8194502/#REF9
6. Alqarni, S. A. (2019). Knowledge and attitude towards antibiotic use within consumers in Alkharj, Saudi Arabia. Saudi pharmaceutical journal : SPJ: the official publication of the Saudi Pharmaceutical Society. Retrieved March 31, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6323197/#b0005
7. Alrasheedy , A. A. (2020). The impact of law enforcement on dispensing antibiotics without prescription: A multi-methods study from Saudi Arabia. Expert review of anti-

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

infective therapy. Retrieved May 2023, from https://pubmed.ncbi.nlm.nih.gov/31834825/

8. Al-Saleh, S. (2019). Influencing factors of knowledge, attitude, and **practice regarding antibiotic use in children with upper respiratory tract infections in Dubai**. Wiley Online Library. Retrieved April 12, 2023, from https://onlinelibrary.wiley.com/doi/abs/10.1111/jep.13188
9. Alsayed, A.R., El Hajji, F.D., Al-Najjar, M.A., Abazid, H. and Al-Dulaimi, A., 2022. Patterns of antibiotic use, knowledge, and perceptions among different population categories: A comprehensive study based in Arabic countries. Saudi Pharmaceutical Journal, 30(3), pp.317-328.
10. Altorkmani, A. (2021). Assessing the Syrian population's knowledge, attitudes, and practices regarding antibiotic usage. Avicenna Journal of Medicine. Retrieved April 12, 2023, from https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0041-1732815
11. Alzaid, A. (2020). Available online international journal of pharmaceutical ... - IJPRAS. Saudi Parents' Knowledge, Attitudes, and Practices Regarding Antibiotic Use for Upper Respiratory Tract Infections in Children. Retrieved April 12, 2023, from https://ijpras.com/storage/models/article/NCPUlg8bWXHbOnA54C0IvZI7nb1QAoLsznHSM1ThbM3hdAnpo9wIZeBmtJjw/saudi-parents-knowledge-attitudes-and-practices-regarding-antibiotic-use-for-upper-respiratory-tra.pdf
12. Azap, A. (2019). Public knowledge and attitudes regarding antibiotic use in Ankara, Turkey. IDCM. Retrieved April 12, 2023, from https://www.idcmjournal.org/public-knowledge-and-attitudes-to-antibiotic-use.
13. Chapot, L. (2021). Knowledge, attitudes, and practices regarding antibiotic use and resistance among veterinary students in Bangladesh. MDPI. Retrieved April 12, 2023, from https://www.mdpi.com/2079-6382/10/3/332.
14. Effah, C. (2020). A population-based survey on knowledge, attitude, and awareness of the general public on antibiotic use and resistance - antimicrobial resistance & infection control. BioMed Central. Retrieved April 11, 2023, from https://aricjournal.biomedcentral.com/articles/10.1186/s13756-020-00768-9
15. Elmahi, O. (2022). Perception and practice of self-medication with antibiotics among medical students in Sudanese universities: A cross-sectional study. PLOS ONE. Retrieved April 2023, from https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0263067.

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

16. Gajdács, M. (2020). Knowledge, attitude, and practice of community pharmacists regarding antibiotic use and infectious diseases: A cross-sectional survey in Hungary (Kappha-HU). MDPI. Retrieved April 12, 2023, from https://www.mdpi.com/2079-6382/9/2/41
17. Gillani, A. (2020). Public knowledge, attitude, and practice regarding antibiotics use in Punjab, Pakistan: A cross-sectional study. Taylor & Francis. Retrieved April 11, 2023, from https://www.tandfonline.com/doi/abs/10.1080/14787210.2021.1823216
18. Higuita-Guti, L. (2020). Knowledge, attitude, and practice regarding antibiotic use and resistance among medical students in Colombia: A cross-sectional descriptive study - BMC public health. SpringerLink. Retrieved April 12, 2023, from https://link.springer.com/article/10.1186/s12889-020-09971-0
19. Jairoun, A. (2022). University students' knowledge, attitudes, and practice regarding antibiotic use and associated factors: A cross-sectional study in the United Arab Emirates. Taylor & Francis. Retrieved April 12, 2023, from https://www.tandfonline.com/doi/full/10.2147/IJGM.S200641
20. Karuniawati, H. (2021). Assessment of knowledge, attitude, and practice of antibiotic use among the population of Boyolali, Indonesia: A cross-sectional study. MDPI. Retrieved April 11, 2023, from https://www.mdpi.com/1660-4601/18/16/8258
21. Khan A K, A. (2013). Antibiotic resistance and usage-a survey on the knowledge, attitude, perceptions and practices among the medical students of a Southern Indian Teaching Hospital. Journal of clinical and diagnostic research : JCDR. Retrieved April 13, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3782911/
22. Mate, I. (2019). Knowledge, attitudes, and practices regarding antibiotic use in Maputo city, Mozambique. PLOS ONE. Retrieved April 12, 2023, from https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0221452
23. Nepal, A. (2019). Knowledge, attitudes, and practices relating to antibiotic use among community members of the Rupandehi District in Nepal - BMC public health. BioMed Central. Retrieved, 2023, from https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-019-7924-5
24. Olesen, S. W. (2018). The distribution of antibiotic use and its association with antibiotic resistance. eLife. Retrieved April 11, 2023, from https://elifesciences.org/articles/39435
25. Pogurschi, E. (2022). Knowledge, attitudes, and practices regarding antibiotic use and antibiotic resistance: A latent class analysis of a Romanian population. MDPI. Retrieved April 12, 2023, from https://www.mdpi.com/1660-4601/19/12/7263

Power System Technology
ISSN:1000-3673
Received: 16-08-2024 Revised: 05-09-2024 Accepted: 22-09-2024

26. Sakr, S. (2020). Antibiotic use and resistance: An unprecedented assessment of university student's knowledge, attitude and practices (KAP) in Lebanon - BMC Public Health. BioMed Central. Retrieved April 12, 2023, from https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-020-08676-8

27. Voidăzan, S. (2022). Knowledge, attitudes, and practices regarding the use of antibiotics. study on the general population of Mureș County, Romania. Taylor & Francis. Retrieved April 11, 2023, from https://www.tandfonline.com/doi/full/10.2147/IDR.S214574

28. WHO. (2021). Antimicrobial resistance. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance

29. Yezli, S. (2018). Knowledge, attitude, and practice (KAP) survey regarding antibiotic use among pilgrims attending the 2015 Hajj Mass Gathering. Travel Medicine and Infectious Disease. Retrieved April 12, 2023, from https://www.sciencedirect.com/science/article/pii/S1477893918302722.

30. Zanichelli, V. (2018). Patient-related determinants of antibiotic use: A systematic review. Clinical Microbiology and Infection. Retrieved April 11, 2023, from https://www.sciencedirect.com/science/article/pii/S1198743X18303987