



# The Open Public Health Journal

Content list available at: <https://openpublichealthjournal.com>



## RESEARCH ARTICLE

### Public Knowledge and Attitudes Towards Antibiotics Use and Resistance in Baghdad, Iraq: A Survey Conducted in Outpatient Department of University Teaching Hospital

Berq J. Hadi Al-Yasseri<sup>1,\*</sup> and Nibras A. Hussain<sup>1</sup>

<sup>1</sup>College of Medicine, Al-Nahrain University, Baghdad, Iraq

#### Abstract:

#### Introduction:

Improper antibiotics utilization permits the emergence of resistant organisms. The World Health Organization has highlighted the role of people in preventing and controlling antibiotics resistance.

#### Objectives:

To investigate public knowledge and attitude towards antibiotics use and resistance in Baghdad, Iraq; and to identify deficiencies in these areas that need to be addressed.

#### Methods:

This was a cross-sectional study with an analytic element involving 500 participants attending outpatient department of university teaching hospital in Baghdad during the period of February through May, 2017. A questionnaire-form paper was used for data collection, including questions about sociodemographic characteristics; sources of information about antibiotics; knowledge about antibiotics indications, resistance, and side effects; and attitudes towards antibiotics self-medication.

#### Results:

People who knew antibiotics have no role in managing viral infection, coughs/colds, and pain/inflammation represented 42.4%, 20.0%, and 44.6% of study sample; respectively. Low proportions of participants realized the necessity to complete antibiotics course, 38.2%. Concerning attitude; those who were against keeping leftover antibiotics in home, taking antibiotics for cold/flu, and taking them for fever without consulting doctor were 37.2%, 42.2% and 46.4%; respectively. Higher education showed significant association with good knowledge ( $p < 0.001$ ) and appropriate attitude ( $p < 0.001$ ). The presence of family member with medical profession exhibited significant association with higher knowledge ( $p = 0.011$ ). Better knowledge was a predictor of better attitude ( $p < 0.001$ ).

#### Conclusion:

Public awareness about antibiotic resistance remains largely unrecognized in Baghdad. Many participants did not have sufficient knowledge about indications for antibiotics use and consequences of their over/misuse. Inappropriate attitude towards antibiotic self-medication was also identified largely in this study.

**Keywords :** Antibiotics Misuse , Public Knowledge , Attitudes, Bacterial Resistance , Self-Medication , Survey .

#### Article History

Received: September 10, 2019

Revised: November 14, 2019

Accepted: December 11, 2019

## 1. INTRODUCTION

Antibiotics are type of antimicrobial agents, used for the management of bacterial infections. These drugs are not effective against viruses (e.g. those of common cold and flu),

and no single antibiotic can cure all forms of infections [1 - 4]. Improper utilization of antibiotics permits the emergence of resistant bacteria [2, 4], and overuse/misuse of them may lead also to the development of side effects and increasing cost of healthcare services [5 - 7].

\* Address correspondence to this author at the Al-Nahrain University/ College of Medicine, Baghdad, Iraq; E-mail: [dr\\_berq@yahoo.com](mailto:dr_berq@yahoo.com)

The decline in the rate of development of novel antibiotics

to face the threat of resistance has generated public health challenge to policy makers, healthcare providers, and the beneficiaries around the world [7, 8]. In Europe, for example, approximately 25,000 patients die each year from infections due to multidrug-resistant organisms. These infections lead also to more health expenses and loss of productivity of at least € 1.5 billion per year [9]. In the United States, at least 2 million people become infected each year with antibiotic-resistant bacteria and nearly 23,000 of them die as a direct result of associated infections. The estimated direct annual healthcare cost of antibiotic resistance for US health system is more than \$20 billion, with additional indirect cost to society of \$35 billion due to lost productivity [10]. This trend is expected to continue until rational use of antibiotics is applied effectively, unnecessary usage is avoided, and solution is found to resistance dilemma [7, 8].

The World Health Organization (WHO) has highlighted the role that can be played by general people to prevent and control the spread of resistance, and several key elements were identified: i) using antibiotics only when prescribed by a certified health professional; ii) never demanding antibiotics if health worker finds there is no need for them; iii) steady follow-up to advice of health worker when using antibiotics; and iv) avoiding share or use of leftover antibiotics [11]. Nevertheless, a large amount of evidence worldwide has showed widespread defects in population knowledge and attitude about antibiotics which affect their usage [12 - 18].

Despite the availability of considerable reports on population awareness and perception about antibiotics utilization and resistance from different countries [19], there is a shortage in information about this issue from Iraq. This study has been conducted to explore this field among individuals attending outpatient department in university teaching hospital in the capital, Baghdad. It aims to investigate public knowledge and attitude towards antibiotics use and resistance; and to identify deficiencies in these areas that need to be addressed.

## 2. METHODS

This was a cross-sectional study with an analytic element, performed in Kadhimiya Teaching Hospital, Baghdad-Iraq; during the period of February through May, 2017. This hospital is one of the largest public hospitals in Iraq and its catchment area involves wide region of capital Baghdad. The study involved persons of either sex attending outpatient clinics of hospital during time of data collection. Face to face interview was implemented with participants, using paper-based questionnaire. Convenience method of sampling was adopted and sample size of 500 individuals was selected. This sample gives more than 95% confidence level and less than 5% margin of error. To be included, the person should be  $\geq 18$  years, know the meaning of term 'antibiotic', and accepted to participate. Seriously ill individuals for whom it would be difficult to reply, confused or cognitively impaired ones were not included. Those who were doctors, pharmacists or medical students were excluded to prevent potential bias.

### 2.1. Study Instrument

The study tool was developed by reviewing similar

questionnaires in previous literatures. It was prepared primarily in English and translated later to Arabic language, using forward-backward translation method. The questionnaire involved three sections: *First section* (respondent information) contained questions inquiring about socio-demographic characteristics (gender, age, education, marital status, and occupation); and other related details like the presence of person with medical profession in family and main source from which the respondent draws its information about antibiotics. Education was categorized as none (incomplete primary education), primary (completed primary education), secondary (completed general or vocational education), or tertiary (completed university, or higher education). *Second section* (knowledge part) contained 14 statements assessing the knowledge about antibiotics in three fields: role of antibiotics - 5 items, resistance - 5 items, dangers/side effects - 4 items. Choices for response included (yes/ no/ do not know). One mark was scored for right answer, while no mark was given to wrong answer and those who did not know. The total knowledge score for each participant was calculated by summing the number of correct responses to all statements. *Third section* (attitude part) contained 6 statements assessing attitude of respondents towards self-medication with antibiotics. Choices for response included (agree/ disagree/ not sure). One mark was scored for appropriate response, while no mark was given to inappropriate one and those who were not sure. Total participant's attitude score was the sum of appropriate responses from all statements.

The study instrument was pre-tested on a sample of 30 individuals to know the time needed to fill it; figure out any difficult, sensitive, unclear, or unneeded questions; and make it more suitable and acceptable for individuals in our community. Minor changes were made on the original version after this pilot process. Those individuals who participated in the pilot project were not involved within the final sample.

### 2.2. Ethical Consideration

Ethics approval was obtained from Ethics Review Board in Al.Nahrain College of Medicine. Informed oral consent was obtained from all participants as it is found to be more accepted by them in the preliminary pilot test. The ethical committee agreed to this method after making sure that proper privacy procedures will be followed, and the study subject does not contain socially prohibited issues or untouchable topics in Iraqi society. At each working day, the researchers selected random sample of participants and interviewed them individually to ensure that data collectors were fully committed in obtaining oral consent. A full explanation of the reason and nature of the study was explained to participants. They were clearly assured that their participation is voluntary and any data obtained would be treated confidentially and for the purpose of research only.

### 2.3. Statistical Analysis

The SPSS software program, version 20, was used for all computerized statistical analyses. The results were expressed as mean  $\pm$  SD (standard deviation), or as frequency and percentage. Associations between personal baseline variables (independent) and mean participants' knowledge/ attitude

scores (dependent) were calculated by using *t*- test or analysis of variance (ANOVA) test. Multiple linear regression model was further applied for those variables that exhibited significant association with knowledge and/or attitude in univariate analysis. Spearman correlation test was used to estimate the relation between knowledge and attitude. Correlation between related statements was examined using Chi-square test. Two-tailed tests were used, and a *P* - value  $\leq 0.05$  was considered to be statistically significant.

### 3. RESULTS

The mean age of study sample was  $35.1 \pm 11.9$  years and there was slightly higher proportion of men (53.6%). More than half of participants possessed at least secondary education certificate. At study time, 277 (55.4%) had certain work whether governmental, private or other kind; 74 (14.8%) were students; and the remaining 149 (29.8%) were without work (i.e. housewives, jobless and retired). Those who were married represented (61.0%), while the remaining was singles (30.0%), widowed (6.6%), or divorced (2.4%).

Less than half of participants depended on professional persons as their main source for information about antibiotics.

These persons were physicians and pharmacists for (30.2%) and (17.0%) of participants, respectively. The remainders depended on the information obtained through self-experience with illnesses (21.8%), media/internet (21.4%), and family/friends (9.6%). The presence of family member with medical profession was reported by 50.6%. Table 1 outlines baseline characteristics of the study sample.

Table 2 reveals knowledge statements about antibiotics used in the current survey along with the percentage of respondents with correct answers. Some statements showed high proportion of incorrect response with less than half of participants reached to true answer. In subsection concerning antibiotics role; the number of these statements were three (treat viral infection, work on most coughs and colds, and relieve pain/ inflammation). With regard to resistance, two statements were identified (human could resist antibiotics, and the necessity to complete full antibiotics course even if symptoms improve). Another two statements were found in the subsection of antibiotics dangers/ side effects (some antibiotics are harmful to teeth of children, and antibiotics do not kill good bacteria on skin and in gut). In this table, additionally, the percentages of right response for comparable statements in former studies were mentioned for comparison.

**Table 1. Baseline characteristics of study sample.**

Character	Frequency (%)
Total number	500 (100)
Age group	
18 - 25 yr.	139 (27.8)
26 – 35 yr.	145 (29.0)
36 – 45 yr.	120 (24.0)
$\geq 46$ yr.	96 (19.2)
Men gender	268 (53.6%)
Education level	
- None	21 (4.2)
- Primary	180 (36.0)
- Secondary	161 (32.2)
- Tertiary	138 (27.6)
Those who obtained information about antibiotics from professional sources	236 (47.2)
Those with a member in their family of medical profession	253 (50.6)

**Table 2. The proportion of correct answers for knowledge statements in current study, compared to that of comparable statements from other studies.**

Statement (Correct answer)	Current study Iraq (%) N=500	Awad <i>et al</i> [16] Kuwait (%) N=680	Shehadeh <i>et al</i> [17] Jordan (%) N= 1141	Lim <i>et al</i> [18] Malaysia (%) N= 401	Carter <i>et al</i> [19] USA (%) N= 215	Andre' <i>et al</i> [20] Sweden (%) N= 747
<b>Antibiotic Role</b>						
1. Kill bacteria ( <i>Yes</i> )	91.6	66.5	---	78.3	90.0	77.2
2. Treat viral infections ( <i>No</i> )	42.4	29.8	---	17.0	65.0	73.2
3. Work on most coughs/ colds ( <i>No</i> )	20.0	25.2	---	18.0	64.0	---
4. Relieve pain/ swelling ( <i>No</i> ).	44.6	---	---	30.9	---	---
5. Different antibiotics are used for different diseases ( <i>Yes</i> )	69.6	74.5	---	---	---	---

(Table 2) *contd....*

Statement (Correct answer)	Current study Iraq (%) N=500	Awad <i>et al</i> [16] Kuwait (%) N=680	Shehadeh <i>et al</i> [17] Jordan (%) N= 1141	Lim <i>et al</i> [18] Malaysia (%) N= 401	Carter <i>et al</i> [19] USA (%) N= 215	Andre' <i>et al</i> [20] Sweden (%) N= 747
<b>Resistance</b>						
6. Bacteria could resist antibiotics ( <i>Yes</i> )	73.4	---	---	---	---	80.7
7. Human body could resist antibiotics ( <i>No</i> )	18.6	7.5	---	---	4.0	15.3
8. Antibiotics resistant infection is not easily cured ( <i>Yes</i> )	66.2	---	---	---	---	---
9. Long & frequent antibiotics use make bacteria more resistant ( <i>Yes</i> )	68.8	49.0	36.0	67.8	93.0	---
10. Full antibiotic course can be stopped if symptoms improve ( <i>No</i> )	38.2	---	61.5	38.1	82	94.5
<b>Dangers / side effects</b>						
11. Antibiotics may cause fatal allergic reaction ( <i>Yes</i> )	60.6	---	68.6	---	---	---
12. If allergic skin reaction developed, same antibiotic should not be used again ( <i>Yes</i> )	79.6	77.8	---	---	---	---
13. Some antibiotics are harmful to teeth of children ( <i>Yes</i> )	36.8	---	67.3	---	---	---
14. Antibiotics do not kill good bacteria on skin and in gut ( <i>No</i> )	29.0	51.1	---	39.7	81.0	---

Statements concerning attitude, the proportion of those with appropriate response, and the findings in comparable previous studies are illustrated in Table 3. In the present study, statements that demonstrated inappropriate response in more than half of participants were: the opinion from keeping leftover antibiotics in home, taking antibiotics for cold/ flu without consulting doctor, and taking antibiotics when having fever without consulting doctor.

The relationship between participants' knowledge/attitude scores and their baseline characteristics is clarified in Table 4. Mean values of knowledge and attitude scores among all participants were 7.39±1.99 out of 14 and 3.52±1.42 out of 6,

respectively. After the application of multiple linear regression model, only education maintained showing high significant association with knowledge and attitude ( $p<0.001$ ); while the presence of family member with medical profession exhibited significant association with knowledge exclusively ( $p=0.011$ ). The knowledge and attitude scores steadily increase with rise in education level and post hoc analysis revealed that those with tertiary education have significantly higher scores than others. In the same context, those with a member of medical profession in their families have significantly better knowledge than others. Better knowledge score was a predictor of better attitude score ( $r=0.261$ ,  $p<0.001$ ).

**Table 3. Proportion of appropriate responses for attitude statements in current study, compared to that of comparable statements from other studies.**

Statement (Appropriate response)	Current study Iraq (%) N=500	Awad <i>et al</i> [16] Kuwait (%) N=680	Huang <i>et al</i> [21] China (%) N=852	Lim <i>et al</i> [18] Malaysia (%) N= 401	Chinnasami <i>et al</i> [22] India (%) N= 491	Andre' <i>et al</i> [20] Sweden (%) N= 747
1. There is misuse/abuse of antibiotics in country ( <i>Agree</i> )	85.4	---	80.5	---	---	---
2. It is good to be able to buy antibiotics from pharmacy without a prescription ( <i>Disagree</i> )	54.4	66.6	---	---	69.2	89.1
3. There is need to establish public campaign on rational use of antibiotics ( <i>Agree</i> )	83.8	---	74.1	---	---	---
4. It is good to keep leftover antibiotics in home for future need ( <i>Disagree</i> )	37.2	55.7	---	83.0	64.1	92.4
5. It is appropriate to take antibiotics for cough /colds without consulting doctor ( <i>Disagree</i> )	42.2	42.9	---	38.2	13.0	---
6. It is appropriate to use antibiotics for fever without consulting doctor ( <i>Disagree</i> )	49.4	---	---	---	20.3	---

**Table 4. Relationship between participants' knowledge/attitude scores about antibiotics and baseline characteristics.**

Character	Knowledge Score Mean (SD)	P-value	Attitude Score Mean (SD)	P-value
Age group				
18 - 25 yr.	7.27 (2.02)	0.760	3.53 (1.50)	0.261
26 – 35 yr.	7.37 (1.80)		3.36 (1.43)	
36 – 45 yr.	7.48 (1.95)		3.55 (1.37)	
≥ 46 yr.	7.51 (2.27)		3.73 (1.36)	
Gender				
- Men	7.37 (2.07)	0.801	3.52 (1.46)	0.978
- Women	7.42 (1.90)		3.53 (1.39)	
Education level				
- None	6.86 (1.93)	<0.001	3.43 (1.32)	<0.001
- Primary	6.92 (1.85)		3.06 (1.34)	
- Secondary	7.23 (1.96)		3.50 (1.30)	
- Tertiary	8.28 (1.93)		4.17 (1.49)	
Source for information about antibiotics				
- Professional	7.62 (2.04)	0.360	3.72 (1.38)	0.119
- Non-professional	7.19 (1.93)		3.34 (1.44)	
Presence of family member with medical profession				
- Yes	7.89 (1.94)	0.011	3.72 (1.43)	0.525
- No	6.89 (1.92)		3.33 (1.39)	
<b>Total</b>	<b>7.39 (1.99)</b>		<b>3.52 (1.42)</b>	

#### 4. DISCUSSION

Public awareness and perception about antibiotics has been studied to a limited extent in Iraq [20 - 22]. This study aims to collect more information on this subject for better understanding of situation in this country. People in Iraq can attend outpatient clinics of hospitals directly without referral from general practice, so our sample represents to a large extent various segments of community.

##### 4.1. Knowledge of Participants

The current study revealed many gaps in knowledge about antibiotics. Less than 15% of participants can be considered to have good knowledge ( $\geq 10$  correct statements), and nearly one-third of them have poor level with  $< 50\%$  correct answers. However, these results are better than those reported by Shehadeh *et al* [13] in Jordan which estimated the percentage of participants who answered correctly less than 50% on questions concerning the knowledge to be 47.3%. Additionally, in the present study, the total knowledge score mean  $7.39 \pm 1.99$  and median 7 out of the 14 are comparable to that of Lim *et al* study in Malaysia [14] which estimated the mean of their participants at  $6.07 \pm 2.52$  and median at 6 out of 12. Awad *et al*. [12] recorded the median knowledge score of respondents in Kuwait to be 7 out of the 13.

High proportion of participants answered 'Yes' to both statements concerning possibility of using antibiotics to treat bacteria and treat viruses. This indicates the presence of confusion concerning this issue among people. Shehadeh *et al*. [13] pointed that many people do not understand the differences between bacteria and viruses, and believed that antibiotics work against both which subsequently lead to unnecessary use. André *et al*. [16] suggested the use of bacteria

or virus terminology by doctors instead of microbes when explaining the prescription decision regarding antibiotics to avoid this ambiguity.

Nearly two-thirds of participants did not agree that misuse of antibiotics affects their effectiveness (defined as not completing full antibiotic course); and around one-thirds did not accept that excessive antibiotics use reduces their effectiveness (*i.e.* bacteria become more resistant to antibiotic with its frequent and prolonged use). Additionally, a considerable proportion of study sample ( $\approx 30\%$ ) did not aware that different antibiotics are used for different diseases. Furthermore, low percentage of participants knew there is no need for using antibiotics to relieve colds, coughs, pains, and swellings. These faulty beliefs will increase indiscriminate use of antibiotics and lead to emergence and spread of resistant bacterial strains [23, 24]. Arepyeva *et al*. [25] demonstrated that antibiotic use level significantly influences resistance level in some antibiotic-microorganism pairs. Steinke and Davey [26] found the evidence of a cause-effect relationship between levels of antibiotics consumption and resistance in community.

The highly significant association ( $p=0.002$ ) between the statements of "antibiotics roles in relieving pain and swelling" and "possibility of stopping full antibiotics course if symptoms improve" indicates that the knowledge gap may not be totally random. Lim *et al* [14] thought people might mistake antibiotics as equivalent to painkillers or NSAIDs, leading them to assume it is okay to stop them, as they would do with painkillers and anti-inflammatory drugs when feeling better.

A considerable proportion of study sample (nearly one-third) was unaware with seriousness of antibiotics-resistant infections (defined as the difficulty in curing antibiotics resistant infection). The implication of this issue appeared clear

in cross-tabulate analysis. Not knowing the correct answer for this statement linked significantly with not taking positive attitude to calls to establish public campaign on rational antibiotics use ( $p=0.027$ ) and to stop buying antibiotics from pharmacy without medical prescription ( $p=0.001$ ).

The majority of participants thought that the development of resistance is not merely related to bacteria; as human body could build immunity to antibiotics. Andre' *et al* [16] thought this belief is caused by the inability of people to understand clearly the biological mechanism of resistance. Brookes-Howell *et al.* [27] believed that as people think specific antibiotic no longer works because the body got used to it, they switch to another stronger. This exacerbates the problem of misuse.

Education, which appeared in the current study to determine the level of knowledge, has been reported as a factor significantly and positively associated with the knowledge about antibiotics in many literatures [12, 14, 16, 18, 28]. The association of higher knowledge level with the presence of medical person as family member run in agreement with Napolitano *et al.* finding [28] that those who have a family member working in the health-care sector were 2.2 (95% CI =1.1–4.5) times as likely to know the definition of antibiotic resistance compared to others.

#### 4.2. Attitude of Participants

The attitude of participants toward antibiotics self-medication contains also shortcomings. The total attitude score mean  $3.52 \pm 1.42$  and median 3 out of the 6 are lower than that reported before. Lim *et al.* [14] recorded the mean score of  $5.59 \pm 1.67$  and median of 6 out of 8. The median score reported by Awad *et al* [12] was 4 out of the 7. More than half of sample of the current study can be considered to have a negative attitude as their individual attitude score  $\leq 3$ .

High proportions of participants have inappropriate view regarding antibiotics utilization for managing cold, flu or fever without physician's consultation by buying them directly from pharmacies or using left-over antibiotics. These proportions are generally higher than those reported in other developing countries [12, 14, 18] which indicate the essential need for prompt actions to address this problem. However, still the vast majority of participants acknowledged there is misuse of antibiotics in Iraq and they supported establishment of public campaign. This is something encouraging for conduction of such activities, and shows that most people aware for seriousness of this issue and they do not know enough about it.

In this study, only education revealed significant association with attitude. Those with lower attitude score tended to have low level of education. Shehadeh *et al.* [13] found that level of education, gender, and age has significant association with public attitude towards self-medication. Lim *et al* [14] reported that gender, race, highest education level, employment status and healthcare-related occupation contributed significantly to the mean attitude score. These variations may be related to the difference in sociodemographic characteristics and design in each study.

The finding of presence of direct correlation between participants' knowledge and attitude scores is in agreement with that reported previously [12, 14, 17, 29]. This is a motivation for conducting awareness campaigns as correcting misinformation among population will contribute to change to better their opinions about antibiotics utilization. Nevertheless, attention should be paid in parallel for improving inappropriate people's attitude because simply improving knowledge without changing attitude was reported to increase self-medication practice [30].

#### 4.3. Strengths and Limitations

To our knowledge, this is the first study investigating public knowledge and attitude about antibiotics in Baghdad, yet the interpretation of findings should take into account some limitations. Selection bias might occur due to the convenience sampling method. As the study was conducted in a single place, the findings may not be possible to be fully generalized to the whole capital. The survey methodology prohibited the participation of individuals who could not reply, confused or cognitively impaired and those who did not know the meaning of term "antibiotic". However, reliance on face to face interview method enabled the collection of data from people who have difficulty in reading because of their low education level, old age or existence of physical health problems among them. Additionally, this method ensured that all the required points were answered.

#### CONCLUSION

This study revealed that public awareness about antibiotic resistance and factors responsible on it remain largely unrecognized in Baghdad. Many participants did not have sufficient knowledge about indications for antibiotics use and consequences of their over/ misuse. Additionally, inappropriate attitude towards antibiotic self-medication were identified among large proportion of participants.

Policy makers should use the key findings of current study in developing multi-faceted strategy to raise public awareness about antibiotics and improve their utilization. This could include: (i) Emphasizing the role of healthcare providers in disseminating the culture of proper antibiotics use; (ii) Applying monitoring and auditing policy for the process of prescription and dispensing of antibiotics; (iii) Conducting public educational programs through mass media and outreach activities about proper antibiotics utilization and risks of misuse. Further studies are needed to be implemented as a complementary to this study. These studies should be conducted at the national level, involve sample from different provinces and investigate knowledge and attitude of health care providers which were not covered here.

#### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study protocol was reviewed and approved from Ethics Review Board in Al.Nahrain College of Medicine, Iraq.

**HUMAN AND ANIMAL RIGHTS**

Not applicable.

**CONSENT FOR PUBLICATION**

Informed consent from all participants was obtained and the potential participants were clearly assured that their participation is voluntary and any data obtained would be treated confidentially and for purpose of research only.

**AVAILABILITY OF DATA AND MATERIALS**

The data supporting the findings of the article is available in the Synapse Storage at <https://www.synapse.org/#!/Synapse:syn21387796>, Synapse ID:syn21385153.

**FUNDING**

None.

**CONFLICT OF INTEREST**

The authors declare no conflicts of interest, financial or otherwise.

**ACKNOWLEDGEMENTS**

The authors want to thank the undergraduate medical students of fourth grade in Al. Nahrain College of Medicine for their efforts in data collection.

**REFERENCES**

- [1] Leekha S, Terrell CL, Edson RS. General principles of antimicrobial therapy. *Mayo Clin Proc* 2011; 86(2): 156-67. [http://dx.doi.org/10.4065/mcp.2010.0639] [PMID: 21282489]
- [2] Fair RJ, Tor Y. Antibiotics and bacterial resistance in the 21<sup>st</sup> century. *Perspect Medicin Chem* 2014; 6: 25-64.
- [3] Martínez-González NA, Coenen S, Plate A, *et al.* The impact of interventions to improve the quality of prescribing and use of antibiotics in primary care patients with respiratory tract infections: A systematic review protocol. *BMJ Open* 2017; 7(6):e016253 [http://dx.doi.org/10.1136/bmjopen-2017-016253] [PMID: 28611111]
- [4] Aminov RI. A brief history of the antibiotic era: Lessons learned and challenges for the future. *Front Microbiol* 2010; 1: 134. [http://dx.doi.org/10.3389/fmicb.2010.00134] [PMID: 21687759]
- [5] Naylor NR, Atun R, Zhu N, *et al.* Estimating the burden of antimicrobial resistance: A systematic literature review. *Antimicrob Resist Infect Control* 2018; 7: 58. [http://dx.doi.org/10.1186/s13756-018-0336-y] [PMID: 29713465]
- [6] Founou RC, Founou LL, Essack SY. Clinical and economic impact of antibiotic resistance in developing countries: A systematic review and meta-analysis. *Butaye P, ed PLoS ONE*. 2017. [http://dx.doi.org/10.1371/journal.pone.0189621]
- [7] Llor C, Bjerrum L. Antimicrobial resistance: risk associated with antibiotic overuse and initiatives to reduce the problem. *Ther Adv Drug Saf* 2014; 5(6): 229-41. [http://dx.doi.org/10.1177/2042098614554919] [PMID: 25436105]
- [8] Lee CR, Cho IH, Jeong BC, Lee SH. Strategies to minimize antibiotic resistance. *Int J Environ Res Public Health* 2013; 10(9): 4274-305. [http://dx.doi.org/10.3390/ijerph10094274] [PMID: 24036486]
- [9] ECDC/EMA. European Centre for Disease Control and European Medicines Agency The bacterial challenge: time to react 2009. Available from: [https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/0909\\_TER\\_The\\_Bacterial\\_Challenge\\_Time\\_to\\_React.pdf](https://ecdc.europa.eu/sites/portal/files/media/en/publications/Publications/0909_TER_The_Bacterial_Challenge_Time_to_React.pdf) [Accessed 4 August 2018]
- [10] CDC. Centers for Disease Control and Prevention 2013. Available from: <http://www.cdc.gov/drugresistance/pdf/ar-threats-2013-508.pdf> [Accessed 4 August 2018]
- [11] WHO. World Health Organization 2018. Available from: <http://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance> [Accessed 4 August 2018]
- [12] Awad AI, Aboud EA. Knowledge, attitude and practice towards antibiotic use among the public in Kuwait. *PLoS ONE* 2015; 10(2): e0117910. [http://dx.doi.org/10.1371/journal.pone.0117910]
- [13] Shehadeh M, Suaifan G, Darwish RM, Wazaify M, Zaru L, Alja'fari S. Knowledge, attitudes and behavior regarding antibiotics use and misuse among adults in the community of Jordan. A pilot study. *Saudi Pharm J* 2012; 20(2): 125-33. [http://dx.doi.org/10.1016/j.jsps.2011.11.005] [PMID: 23960783]
- [14] Lim KK, Teh CC. A cross study of public knowledge and attitude towards antibiotics in Putrajaya, Malaysia. *South Med Rev* 2012; 5(2): 26-33. [PMID: 23532680]
- [15] Carter RR, Sun J, Jump RLP. A survey and analysis of the American public's perceptions and knowledge about antibiotic resistance. *Open Forum Infect Dis* 2016; 3(3):ofw112 [http://dx.doi.org/10.1093/ofid/ofw112] [PMID: 27382598]
- [16] André M, Vernby A, Berg J, Lundborg CS. A survey of public knowledge and awareness related to antibiotic use and resistance in Sweden. *J Antimicrob Chemother* 2010; 65(6): 1292-6. [http://dx.doi.org/10.1093/jac/dkq104]
- [17] Huang Y, Gu J, Zhang M, *et al.* Knowledge, attitude and practice of antibiotics: A questionnaire study among 2500 Chinese students. *BMC Med Educ* 2013; 13: 163. [http://dx.doi.org/10.1186/1472-6920-13-163] [PMID: 24321449]
- [18] Chinnasami B, Sadasivam K, Ramraj B, Pasupathy S. Knowledge, attitude and practice of parents towards antibiotic usage and its resistance. *Int J Contemp Pediatr* 2016; 3(1): 256-61. [http://dx.doi.org/10.18203/2349-3291.ijcp20160171]
- [19] Gualano MR, Gili R, Scafoli G, Bert F, Siliquini R. General population's knowledge and attitudes about antibiotics: A systematic review and meta-analysis. *Pharmacoepidemiol Drug Saf* 2015; 24(1): 2-10. [http://dx.doi.org/10.1002/pds.3716]
- [20] Darwish DA, Abdelmalek S, Abu Dayyih W, Hamadi S. Awareness of antibiotic use and antimicrobial resistance in the Iraqi community in Jordan. *J Infect Dev Ctries* 2014; 8(5): 616-23. [http://dx.doi.org/10.3855/jidc.4086] [PMID: 24820466]
- [21] Jasim AL. Parental self medication of antibiotics for children in Baghdad city. *Int J Pharm Pharm Sci* 2014; 6(10): 485-9.
- [22] Al Mosawi M, Albakaa A, Alameen H, Al-Essa H, Alkhirsan ZM, Fakhereldein H, *et al.* Antibiotic resistance awareness between public antibiotics dispensing and prescribing patterns in Najaf Iraq Unpublished article from a study done as part of I-Act action on antibiotic resistance in Iraq project, Najaf, Iraq 2014. Available from: [https://www.researchgate.net/publication/259564613\\_Antibiotic\\_resistance\\_awareness\\_between\\_public\\_antibiotics\\_dispensing\\_and\\_prescribing\\_patterns\\_in\\_Najaf\\_Iraq](https://www.researchgate.net/publication/259564613_Antibiotic_resistance_awareness_between_public_antibiotics_dispensing_and_prescribing_patterns_in_Najaf_Iraq) [Accessed 4 August, 2018].
- [23] CDC. Centers for Disease Control and Prevention, US Department of Health and Human Services 2013. Available from: <http://www.cdc.gov/drugresistance/pdf/ar-threats-2013-508.pdf> [Accessed 4 August, 2018]
- [24] Ventola CL. The antibiotic resistance crisis: part 1: causes and threats. *P&T* 2015; 40(4): 277-83. [PMID: 25859123]
- [25] Arepyeva MA, Kolbin AS, Sidorenko SV, Lawson R, Kurylev AA, Balykina YE, *et al.* A mathematical model for predicting the development of bacterial resistance based on the relationship between the level of antimicrobial resistance and the volume of antibiotic consumption. *J Glob Antimicrob Resist* 2017; 8: 148-56. [http://dx.doi.org/10.1016/j.jgar.2016.11.010]
- [26] Steinke D, Davey P. Association between antibiotic resistance and community prescribing: A critical review of bias and confounding in published studies. *Clin Infect Dis* 2001; 33(Suppl. 3): S193-205. [http://dx.doi.org/10.1086/321848] [PMID: 11524719]
- [27] Brookes-Howell L, Elwyn G, Hood K, *et al.* 'The body gets used to them': patients' interpretations of antibiotic resistance and the implications for containment strategies. *J Gen Intern Med* 2012; 27(7): 766-72. [http://dx.doi.org/10.1007/s11606-011-1916-1] [PMID: 22065334]
- [28] Napolitano F, Izzo MT, Di Giuseppe G, Angelillo IF. Public knowledge, attitudes, and experience regarding the use of antibiotics in Italy. 2013. [http://dx.doi.org/10.1371/journal.pone.0084177]
- [29] Kim SS, Moon S, Kim EJ. Public knowledge and attitudes regarding antibiotic use in South Korea. *J Korean Acad Nurs* 2011; 41(6): 742-9.

[<http://dx.doi.org/10.4040/jkan.2011.41.6.742>]  
[30] McNulty CA, Boyle P, Nichols T, Clappison P, Davey P. Don't wear

me out--the public's knowledge of and attitudes to antibiotic use. *J Antimicrob Chemother* 2007; 59(4): 727-38.  
[<http://dx.doi.org/10.1093/jac/dkl558>] [PMID: 17307770]

---

© 2019 Al-Yasseri and Hussain.

This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International Public License (CC-BY 4.0), a copy of which is available at: <https://creativecommons.org/licenses/by/4.0/legalcode>. This license permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.