

Clinician's Knowledge and Performance regarding Antibiotics Stewardship



Hany Hamdy Ibrahim¹, Sahar Mohamed Soliman²

¹B.Sc, in Pharmacy, Faculty of Pharmacy, Mansoura University, Egypt

E-mail address: hanyhamdy182@gmail.com

²Professor, Community Health Nursing Department, Faculty of Nursing, Mansoura University, Egypt

E-mail address: smsahar.ss212@gmail.com

ABSTRACT

Background: Antibiotic stewardship programs (ASP) improve clinical outcomes, patient safety and help combat antibiotic resistance. Increasing awareness and practice of Antimicrobial Stewardship (AMS) has gained immense importance in hospitals for preventing the irrational use of antibiotics. Clinicians should play a key role in fighting antimicrobial resistance (AMR), and medical education is a fundamental issue to combat it. Understanding the knowledge and practices of clinicians regarding antibiotic prescription and antibiotic resistance is important for controlling irrational antibiotic use. **Method.** A cross-sectional study design was utilized to accomplish this study. A convenient sample of 128 clinicians in ICUs, which included 21 clinicians in the general ICU, 24 clinicians in Neonatal ICUs (NICU) and 83 clinicians in surgical unit at Aga Central Hospital. The researchers used three tools to assess the demographic and occupational data, knowledge, and performance of clinicians. **Results.** The study revealed that 73.4% of the studied clinicians had a poor level of knowledge and 71.9% of them had an incompetent performance level regarding antibiotics stewardship. **Conclusion.** Since clinicians had a poor level of knowledge and an incompetent performance level regarding antibiotics stewardship, it is recommended to design and implement an effective educational program for clinicians regarding antibiotics stewardship.

Keywords: Antibiotics Stewardship, Infectious Diseases, Antimicrobial, Clinicians' Knowledge, and Performance.

Introduction:

Antibiotics have transformed the practice of medicine, making once lethal infections readily treatable and making other medical advances, like cancer chemotherapy and organ transplants, possible. Prompt initiation of antibiotics to treat infections reduces morbidity and saves lives, as in cases of sepsis (Rhodes A, et al., 2016). Like all medications, antibiotics have serious adverse effects, which occur in roughly 20% of hospitalized patients who receive them. Patients who are unnecessarily exposed to antibiotics are placed at risk for these adverse events with no benefit. The misuse of antibiotics has also contributed to antibiotic resistance, a serious threat to public health (CDC., 2019).

Antimicrobial Resistance (AMR) is resistance of a microorganism to an antimicrobial drug that was originally effective for treatment of infections caused by it. Resistant microorganisms (including bacteria, fungi, viruses, and parasites) are able to withstand attack by antimicrobial drugs, such as antibacterial drugs (e.g., antibiotics), so that standard treatments become ineffective and infections persist, increasing the risk of spread to others (Mendelson, M., Morris, A. M., Thursky, K., & Pulcini, C., 2020).

AMR has a global impact on public health, leading to increase morbidity, mortality, and healthcare costs (Murray, C.J.; et al., 2022; Aldeyab, M., López-Lozano, J. M., & Gould, I. M., 2020). Antibiotics, as a group of medications, have been subject to indiscriminate use, which is considered to be a primary factor in the development of AMR microorganisms, leading to complications for patients (World Health Organization, 2014; Jirjees, F. J., et al, 2020).

Clinicians are directly involved in the prescribing and use of antibiotics. They might respond to patients' inappropriate requests or might carry out inappropriate practices, which in turn increase the chances for AMR (Al-Taani, G. M., et al., 2022).

AMR leads to decreased medication efficiency, complication during treatment of patients, or an increase in management cost. Therefore, there is an urgent need to tackle antimicrobial resistance in developing countries specifically in Africa because it is being ignored and yet vastly associated with high morbidity and mortality (Cox, J. A., et al., 2017)

Evidence suggests that strategic actions such as antimicrobial stewardship must be enforced (Akande-Sholabi, W., & Ajamu, A. T., 2021). So, awareness of initiatives addressing antimicrobial resistance is very important and should be directed toward clinicians (Al-Taani, G. M., et al., 2022).

Aim of the Study

To assess clinician's knowledge and performance regarding antibiotics stewardship.

Method

Design

A cross-sectional study design was utilized to accomplish this study.

Setting

This study was carried out at 2 ICUs: the general ICU and Neonatal ICUs (NICU) and the surgical unit at Aga Central Hospital.

Participants

All clinicians of both genders were invited to participate in the study with different years of experience in the previously mentioned setting.

Sampling technique and sample size

Convenience sample technique was used. The required sample size included in this study was all clinicians in ICUs; 21 clinicians in the general ICU, 24 clinicians in Neonatal ICUs (NICU) and 83 clinicians in surgical unit at Aga Central Hospital. The total number was 128 clinicians.

Procedure

Data Collection:

The researchers designed and used three tools based on the related literature (Teixeira, et al., (2015); Abbo et al., (2013); and Nair et al., 2019).

Tool (I): Demographic and occupational data self-administered structured questionnaire:

The researchers used this questionnaire to assess the demographic and occupational characteristics of clinicians such as age, gender, qualification, years of experience in ICU, and attendance of workshops or training programs about antibiotics stewardship.

Tool II: Clinicians' knowledge assessment self-administrated structured questionnaire:

The researchers used this questionnaire to assess clinicians' knowledge levels regarding antibiotic use. It was composed of four categories;

(overview of antibiotics, antibiotics resistance, hospital acquired infections, prevention of antibiotics resistance, and antibiotics stewardship). All of these categories were composed of 52 questions. One mark was awarded for each correct answer. The total score of knowledge ranged from 0 to 52. According to the researcher's cut of point, the knowledge level was categorized into three levels as follows:

- Poor= scores less than 60% of total scores (less than 31.2 marks) .
- Fair= scores 60% to less than 75% of total scores (31.2 - less than 39marks).
- Good= scores more than 75% of total scores (39 marks and more).

Tool III: Clinicians' performance observational checklist:

The researchers used this observational checklist to observe clinicians' performance regarding antibiotics use. It was including the hospital leadership commitment, education, antibiotic dispensing, and sensitivity. Each of the above-mentioned domains included sub performance that were scored as the following: "yes= 1 or no= 0". The total score of the clinician's performance ranged from 0 to 16. According to the researcher's cut of point, the performance level was categorized into three levels as.

- Improper = scores less than 75% of total scores. (From 0 to less than 12 mark)
- Proper = scores 75% and more of total scores. (From 12 mark and more)

Data analysis:

The researchers used the most currently reliable and valid statistical methods for statistical analysis. Then coded, entered, and analyzed collected data using Statistical Package for Social Sciences (SPSS) software version 23 (Armonk, NY: IBM Corp). Descriptive statistics are used to analyze the response to individual items and the respondents' characteristics. Continuous variables were presented as mean \pm SD (standard deviation) and percentages for categorical variables.

Procedure

Ethical consideration. The researchers obtained an ethical approval from the Research Ethics Committee of Faculty of Nursing, Mansoura University, The permission from the responsible authorities of study (Aga Central Hospital) to conduct the study after an explanation. Then

Clinician's Knowledge and Performance regarding

obtained oral informed consent from the study participants after being informed about the purpose of the study. The participants assured that their identities and response to the questionnaire would be confidential; answering was voluntary and they have the right to withdraw at any time from the study without any explanation.

Designing the tools of data collection: The researchers designing three tools (I, II, and III) after reviewing the related literature. The jury that involves five experts of community health nursing and clinician was test the content and face validity of the study tools, and the required modification was carried out. A Pilot study on 10 % participants (13) who are not included in the study to test the validity of the questionnaire. Reliability of the observation checklist as a quantitative data collection tool - Accordingly, any required modifications was done.

Results

Table (1) represents the demographic and occupational characteristics of the clinicians.

Table 1 Clinicians' demographic and occupational characteristics (N=128)

Item	N(128)	%
Age		
20 < 30	43	33.6
30 < 40	59	46.1
40 and more	26	20.3
Mean (SD)	34(7.5)	
Gender		
Male	66	51.6
Female	62	48.4
Qualifications		
Bachelor's degree	67	52.3
Diploma	20	15.6
Egyptian fellowship	8	6.3
Master degree	33	25.8
Job title		
Resident physician	69	53.9
Attending physician	40	31.3
Associate chief physician and above	19	14.8
Years of work experience in ICU		
0 < 5	82	64.1
5 < 10	29	22.7
10 and more	17	13.3
Mean (SD)	4(4.09)	
Attendance of workshops about antibiotics stewardship	32	25

Regarding age, it was noticed that 46.1% of them were 30<40 years with a mean age 34(7.5) years. 51.6%of them are males and 52.3% had a bachelor's degree. Study found that 53.9% of participants were resident physician, 64.1% had less than 5 years of experience in ICU and 25% of them were attended workshops about antibiotics stewardship.

Table (2) clarifies that 87.5% and 88.3% of the clinicians had a poor level of knowledge regarding antibiotic stewardship, types of antibiotic stewardship interventions with a mean of **2(0.7)** and **1 (0.7)**, respectively. While 43% of them had a fair level of knowledge regarding prevention of antibiotic resistance with a mean of **1.6(0.8)**, respectively. According to **figure 1** to the total score level of knowledge, **73.4%** of them showed a poor score level of knowledge with a mean of **28.7(5.3)**.

Table 3 elicits that 75.8%, and 84.4% of the clinicians had an improper performance regarding to hospital leadership commitment, and education with a mean of **1.7(1.9)**, and **1.1(1.1)**.

Table 2 Clinicians' score level of knowledge regarding antibiotics stewardship (N=128)

Item	Poor		Fair		Good		Mean (SD)
	N	%	N	%	N	%	
General description of antibiotics (6 items)	6	4.7	2	1.6	120	93.8	5.6(0.8)
Types of antibiotics (9 items)	99	77.3	16	12.5	13	10.2	4.5(1.3)
Antibiotic treatment according to type of infection (2 items)	86	67.2			42	32.8	1.1(0.7)
Antibiotic resistance (4 items)	23	18.0			105	82.0	3.1(0.8)
Mechanisms of antibiotic resistance(5items)	100	78.1	21	16.4	7	5.5	1.4(1.2)
Causes of antibiotic resistance (6 items)	108	84.4	9	7.0	11	8.6	2.8(1.1)
Hospital acquired infections (2 items)	14	10.9			114	89.1	1.9(0.3)
Prevention of Antibiotic resistance (3 items)	60	46.9	55	43.0	13	10.2	1.6(0.8)
Antibiotic stewardship(4items)	112	87.5			16	12.5	2(0.7)
Core elements of an antibiotic stewardship program(4iems)	57	44.5			71	55.5	2.3(1.5)
Types of antibiotic stewardship interventions (3 items)	113	88.3	1	.8	14	10.9	1 (0.7)
Benefits of developing antibiotic stewardship (4 items)	107	83.6			21	16.4	1.6(1.1)

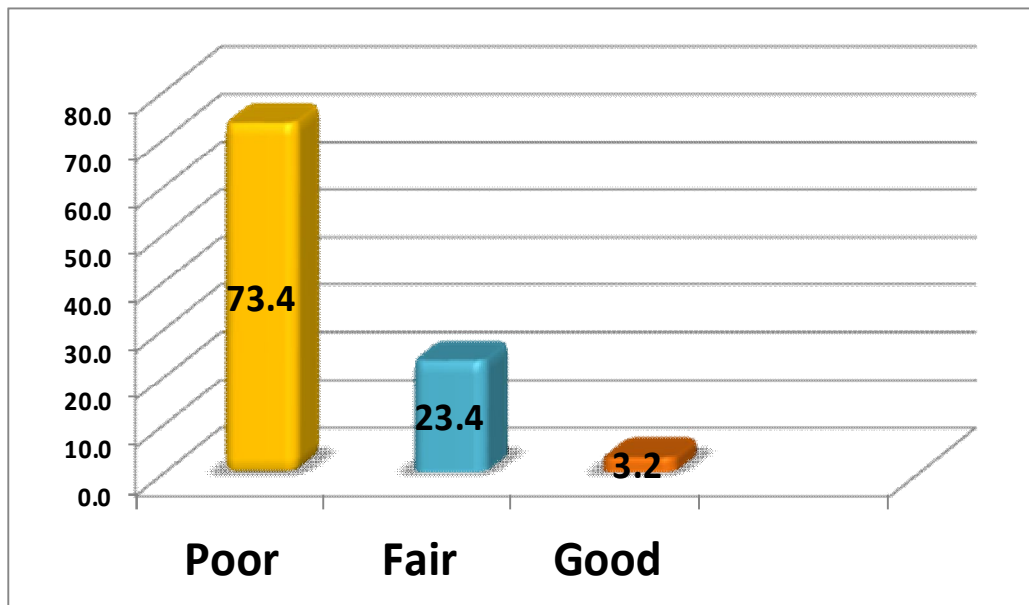


Figure (1): Clinicians' Total Score Level of Knowledge Regarding antibiotic stewardship (N=12)

Table 3 Clinicians' Total Score Level of performance regarding antibiotic stewardship (N=128)

Item	Improper		Proper		Mean (SD)
	N	%	N	%	
Hospital leadership commitment (5items)	97	75.8	31	24.2	1.7(1.9)
Education (3items)	108	84.4	20	15.6	1.1(1.1)
Antibiotic dispensing (5 items)	77	60.2	51	39.8	2.4(1.5)
Antibiotic sensitivity (3 items)	73	57.0	55	43.0	1.9(1.1)
Total score (16 item)	92	71.9	36	28.1	7.2(5)

Discussion

The World Health Organization (WHO) revealed that antimicrobial resistance (AMR) has been recognized as a top health priority and is a global threat. Numerous organizations have responded by establishing prevention and control recommendations (O'Neill, J., 2016 & WHO, 2019). Many interventions have been introduced to reduce incidence of AMR (WHO., 2015 & Boucher, H. W., Bakken, J. S., & Murray, B. E., 2016). Such interventions are considered an essential part of healthcare settings; one of such is antibiotics stewardship program (ASP).

Healthcare professionals are involved with prescribing, dispensing, administering, and using antibiotics. Promoting prudent antimicrobial use is a major quality and safety requirement to mitigate the risk of antimicrobial resistance. (Al-Taani, G. M., et al., 2022). The present study was eager to explore the clinician's knowledge and performance regarding antibiotics stewardship. Accordingly, the results of the current study can be argued as follows

The current study revealed that the mean age of the majority of studied participants was 34 (7.5) years, and more than half of them are resident physicians.

Related to attendance of workshops about antibiotics stewardship. It was also noted that more than one third of them did not attend any workshops about antibiotics stewardship. This finding is consistent with Atif, M., et al., 2021, finding who exploring medical doctors' knowledge, perception, and practices about Antibiotic stewardship program in Pakistan who found that most respondents stated that no educational program or awareness campaign about antibiotic stewardship for clinicians. Lack of hospital antibiogram is a major barrier that hinder the implementation of antibiotic stewardship program.

However, this result is inconsistent with **Tahoon, M. A., et al., 2020** result who assess the effect of educational intervention on healthcare providers' knowledge, attitude, and practice towards antimicrobial stewardship program in Menoufia, Egypt. The result showed that only 48 health care providers out of 69 attended the invitation of educational workshop with a response rate of 70.0%.

The current study indicates that, the majority of the studied clinicians had fair score level of knowledge regarding antibiotic, which is disagreed with **Abdel Wahed, W. Y., Ahmed, E. I., Hassan, S. K., Ibrahim, E. G., & Eid, H. M. 2020**, results that carried out in Fayoum and concluded that the level of knowledge of physicians was acceptable.

Also, the study indicates that, the majority of the studied clinicians had poor score level of knowledge regarding antibiotic resistance. This result is in the same line with **Adegbite, B. R., et al..., 2022**, who assess the Knowledge and perception on antimicrobial resistance and antibiotics prescribing attitude among physicians and nurses in Gabon. The author found that overall knowledge about possible causes of antimicrobial resistance spread was limited. In addition to **Sami, R., Sadegh, R., Fani, F., Atashi, V., & Solgi, H., 2022** finding, who concluded that the level of knowledge of participants physicians about antimicrobial resistance and antimicrobial stewardship is poor.

Related to hospital acquired infections the majority of the studied clinicians had good score level of knowledge. On other hand this result is not in the same line with **Di Gennaro, F., et al..., 2020** who concluded that only one-third or less of participants in Aga hospital correctly answered the questions on VRE, and MRSA.

Also, the study indicates that, most of the studied clinicians had poor score level of knowledge related to prevention of antibiotic resistance. This result was inconsistent with **Al-Taani, G. M., et al., 2022** result which revealed about half of the responses in Jordan agreed or strongly agreed that they had easy access to guideline and educational material to provide advice on prudent antibiotic resistance in patients.

Based on the results of the present study the majority of the studied clinicians had poor score level of knowledge regarding antibiotics stewardship. This finding is consistent with other two studies carried out recently in Egypt: the first is **Salem, M. R., et al., 2023** study who conducted an exploratory cross-sectional design to explore the perspectives of clinicians on antibiotics stewardship and their awareness of these perspectives. The result of this study showed lack of awareness on antibiotics stewardship programs among clinicians that inhibited the application of functional and efficient stewardship.

The second study is **Tahoon, M. A., et al., 2020** study who studied the impact of educational program on the knowledge, attitude, and practice (KAP) of clinicians towards antimicrobial stewardship before and after the educational program at the surgery department and surgical ICU. The result of this study illustrated lack of the clinician awareness about antibiotics stewardship.

As regards types of antibiotic stewardship interventions, the current study indicates that most of the studied clinicians had a poor score level of knowledge regarding intervention of stewardship. This finding is inconsistent with **Mane, A., Kamat, S., & Thanusubramanian, H., 2021**, results in although clinicians have good knowledge on antibiotic use, it was not equally reflected in their practice who found that hospitals need improved infrastructure along with mandatory and certified training for antibiotic stewardship practices. While a Namibian results in most of the participants that they were aware of systems and policies for good antibiotics stewardship practice (ASP), but it was not implemented with all its core elements, which developed by **Brinkmann, I., & Kibuule, D., 2020**.

Related to benefits of developing antibiotic stewardship, the current study indicates that, majority of the studied clinicians had a poor score level of knowledge. This finding is supported with **Kalungia, A. C., et al., 2019**, findings and showed that few clinicians demonstrated sufficient knowledge of the basic principles of antibiotic

stewardship while the basic knowledge of antibiotic stewardship was relatively low.

Based on the result of the present study, more than two thirds of the studied clinicians had an incompetent total performance level regarding hospital leadership commitment. This result is supported with **Tahoon, M. A., et al., 2020, results** in Egypt who revealed improper performance of clinicians related hospital leadership commitment before program.

However, this study's findings revealed that, most of the studied clinicians had incompetent practice in antibiotic stewardship. This finding is supported by **Hashemi, S., Nasrollah, A., & Rajabi, M., 2013 & Atif, M., et al., 2021** finding that revealed the clinician were not use guidelines of antibiotic and also it was not available in the hospitals, clinician prescription is based on their clinical experience, while, **Saleem, Z., et al., 2019** conducted study in Pakistan stated that availability of institutional antibiogram, antibiotic prescribing guidelines, educational sessions, advice from an antimicrobial stewardship team, regular audits and feedback strategies can greatly improve the rational antibiotic prescribing.

As regards antibiotic dispensing and sensitivity, more than half of the studied clinicians had an incompetent total performance level. This result supported with **Zakaa El-din, M., et al., 2019** results in Greater Cairo who recommended that the Egyptian Ministry of Health should regulate and monitor the process of dispensing antibiotics without a prescription with law enforcements. Moreover, raising awareness on the consequences of the problem of antibiotic dispensing without a prescription.

According to the retrieved field notes throughout the data collection of the present study shortage of clinician's staff, work overload, inadequate antibiotics administration policies and protocols, as well as insufficient training of the clinicians on antibiotics stewardship programs. All of these factors lead to the observed poor knowledge and incompetent performance level among the studied group.

Conclusion

Based on the findings of the present study, the researcher concluded that the majority of the studied participants had poor level of knowledge and more than two thirds of them had an incompetent performance level regarding antibiotics stewardship.

Recommendations

Based on the findings of the study the researchers recommended the following:

1. In-service training programs for newly hired clinicians and clinicians on work regarding antibiotics stewardship.
2. Availability of antibiotics stewardship guidelines in the health care settings.
3. Monitoring clinicians' performance regarding antibiotic prescription using antibiotics stewardship with regulations.

Acknowledgments

Greetings and appreciation to all clinicians who participated in the study.

Reference

- Al-Taani, G. M., Karasneh, R. A., Al-Azzam, S., Bin Shaman, M., Jirjees, F., Al-Obaidi, H., ... & Aldeyab, M. A. (2022). Knowledge, attitude, and behavior about antimicrobial use and resistance among medical, nursing and pharmacy students in Jordan: A cross sectional study. *Antibiotics*, *11*(11), 1559.
- Abbo, L. M., Cosgrove, S. E., Pottinger, P. S., Pereyra, M., Sinkowitz-Cochran, R., Srinivasan, A., ... & Hooton, T. M. (2013). Medical Students' Perceptions and Knowledge About Antimicrobial Stewardship: How Are We Educating Our Future Prescribers? *Clinical Infectious Diseases*, *57*(5), 631-638.
- Abdel Wahed, W. Y., Ahmed, E. I., Hassan, S. K., Ibrahim, E. G., & Eid, H. M. (2020). Physicians' knowledge, attitudes, and practice concerning antimicrobial resistance & prescribing: a survey in Fayoum Governorate, Egypt. *Journal of Public Health*, *28*, 429-436.
- Adegbite, B. R., Edoa, J. R., Schaumburg, F., Alabi, A. S., Adegniko, A. A., & Grobusch, M. P. (2022). Knowledge and perception on antimicrobial resistance and antibiotics prescribing attitude among physicians and nurses in Lambaréné region, Gabon: a call for setting-up an antimicrobial stewardship program. *Antimicrobial Resistance & Infection Control*, *11*(1), 1-8.
- Akande-Sholabi, W., & Ajamu, A. T. (2021). Antimicrobial stewardship: Assessment of knowledge, awareness of antimicrobial resistance and appropriate antibiotic use among healthcare students in a Nigerian University. *BMC Medical Education*, *21*, 1-8.
- Aldeyab, M., López-Lozano, J. M., & Gould, I. M. (2020). Global antibiotics use and resistance. *Global Pharmaceutical Policy*, 331-344.
- Al-Taani, G. M., Karasneh, R. A., Al-Azzam, S., Bin Shaman, M., Jirjees, F., Al-Obaidi, H., ... & Aldeyab, M. A. (2022). Knowledge, attitude, and behavior about antimicrobial use and resistance among medical, nursing and pharmacy students in Jordan: A cross sectional study. *Antibiotics*, *11*(11), 1559.
- Al-Taani, G. M., Karasneh, R. A., Al-Azzam, S., Bin Shaman, M., Jirjees, F., Al-Obaidi, H., ... & Aldeyab, M. A. (2022). Knowledge, attitude, and behavior about antimicrobial use and resistance among medical, nursing and pharmacy students in Jordan: A cross sectional study. *Antibiotics*, *11*(11), 1559.
- Atif, M., Ihsan, B., Malik, I., Ahmad, N., Saleem, Z., Sehar, A., & Babar, Z. U. D. (2021). Antibiotic stewardship program in Pakistan: A multicenter qualitative study exploring medical doctors' knowledge, perception and practices. *BMC infectious diseases*, *21*(1), 1-11.
- Brinkmann, I., & Kibuule, D. (2020). Effectiveness of antibiotic stewardship programmes in primary health care settings in developing countries. *Research in Social and Administrative Pharmacy*, *16*(9), 1309-1313.
- Boucher, H. W., Bakken, J. S., & Murray, B. E. (2016). The United Nations and the urgent need for coordinated global action in the fight against antimicrobial resistance. *Annals of internal medicine*, *165*(11), 812-813.
- Centers for Disease Control and Prevention (2019). Core Elements of Hospital Antibiotic Stewardship Programs. Retrieved from <https://www.cdc.gov/antibiotic-use/core-elements/hospital.html>.
- Cox, J. A., Vlieghe, E., Mendelson, M., Wertheim, H., Ndegwa, L., Villegas, M. V., ... & Hara, G. L. (2017). Antibiotic stewardship in low-and middle-income

- countries: the same but different?. *Clinical microbiology and infection*, 23(11), 812-818.
- Di Gennaro, F., Marotta, C., Amicone, M., Bavaro, D. F., Bernaudo, F., & Frisciale, E. M. (2020)** ;Italian young doctors' knowledge, attitudes and practices on antibiotic use and resistance: A national cross-sectional survey. *J Glob Antimicrob Resist*. 23: 167-73.
- Kalungia, A. C., Mwambula, H., Munkombwe, D., Marshall, S., Schellack, N., May, C., ... & Godman, B. (2019)**. Antimicrobial stewardship knowledge and perception among physicians and pharmacists at leading tertiary teaching hospitals in Zambia: implications for future policy and practice. *Journal of chemotherapy*, 31(7-8), 378-387.
- Mane, A., Kamat, S., & Thanusubramanian, H. (2021)**. Knowledge, Attitude and Practices of Clinicians, Nurses and Pharmacists Regarding Antimicrobial Stewardship: A Five Center Survey from India. *Journal of Clinical & Diagnostic Research*, 15(8).
- Mendelson, M., Morris, A. M., Thursky, K., & Pulcini, C. (2020)**. How to start an antimicrobial stewardship programme in a hospital. *Clinical Microbiology And Infection*, 26(4), 447-453.
- Murray, C. J., Ikuta, K. S., Sharara, F., Swetschinski, L., Aguilar, G. R., Gray, A., ... & Tasak, N. (2022)**. Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *The Lancet*, 399(10325), 629-655. [Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis - The Lancet](#)
- Nair, M., Tripathi, S., Mazumdar, S., Mahajan, R., Harshana, A., Pereira, A., ... & Burza, S. (2019)**. Knowledge, Attitudes, and Practices Related to Antibiotic Use in Paschim Bardhaman District: A survey of healthcare providers in West Bengal, India. *PloS one*, 14(5), e0217818. Larsen, C. M., Terkelsen, A. S., Carlsen, A. M. F., & Kristensen, H. K.(2019). Methods for teaching evidence-based practice: a scoping review. *BMC medical education*, 19(1), 1-33.
- O'Neill, J. (2016)**. Tackling drug-resistant infections globally: final report and recommendations.
- Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, et al. (2016)**. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock:. *Intensive care medicine*. 2017 Mar;43(3):304-77
- Saleem, Z., Hassali, M. A., Hashmi, F., Azhar, F., Hasan, H., Zaheer, S., & Rehman, I. U. (2019)**. Assessment of physicians' perception about antibiotic use and resistance and factors influencing antibiotic prescribing: a situational analysis from Pakistan. *Family Medicine & Primary Care Review*, 21(2), 149-157.
- Salem, M. R., Youssef, M. R. L., Shalaby, S. F., Mahmoud, A. T., Ismail, M., & Ibrahim, S. K. (2023)**. Perspectives on Antibiotic Stewardship Programs among Health Care Providers at Two University Hospitals in Egypt. *International Journal of Environmental Research and Public Health*, 20(5), 3777.
- Sami, R., Sadegh, R., Fani, F., Atashi, V., & Solgi, H. (2022)**. Assessing the knowledge, attitudes and practices of physicians on antibiotic use and antimicrobial resistance in Iran: a cross-sectional survey. *Journal of Pharmaceutical Policy and Practice*, 15(1), 82.
- Tahoon, M. A., Khalil, M. M., Hammad, E., Morad, W. S., awad, S. M., & Ezzat, S. (2020)**. The effect of educational intervention on healthcare providers' knowledge, attitude, & practice towards antimicrobial stewardship program at, National Liver Institute, Egypt. *Egyptian Liver Journal*, 10, 1-7.
- Teixeira, A. R., Ferreira, M., Roque, F., Falcão, A., Ramalheira, E., Figueiras, A., & Herdeiro, M. T. (2015)**. Physicians' Attitudes and Knowledge Concerning Antibiotic Prescription and Resistance: Questionnaire Development and Reliability. *BMC Infectious Diseases*, 16, 7-7.
- WHO. Ten health issues WHO will tackle this year. Geneva: World Health Organization; 2019.**
<https://www.who.int/emergencies/ten-threats-to-global-health-in-2019>.

World Health Organization (2014)

Antimicrobial Resistance: Global Report on Surveillance; Available online: <https://apps.who.int/iris/handle/10665/112642>.

World Health Organization. (2015). Global

action plan on antimicrobial resistance.

<https://doi.org/10.2471/BLT.16.181743>

Zakaa El-din, M., Samy, F., Mohamed, A.,

Hamdy, F., Yasser, S., & Ehab, M. (2019).

Egyptian community pharmacists' attitudes and practices towards antibiotic dispensing and antibiotic resistance; a cross-sectional survey in Greater Cairo. *Current Medical Research and Opinion*, 35(6), 939-946.