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A Systematic Review of Misuse of Antibiotics in Jordan

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Abstract

Background: Antibiotic misuse has become a major global public health issue and this weapon against bacteria is becoming increasingly threatened by the misuse of antibiotics. In Jordan specifically, the availability of antibiotics over the counter, the ease of purchasing antibiotics without prescription, and their misuse could lead to a major health problem.

Objectives: This systematic review aims to explore the published literature on antibiotic misuse in Jordan, and to explore the factors contributing to this issue and its effects and propose strategies for reducing antibiotic misuse in Jordan.

Methods: Published articles on antibiotic misuse in Jordan from January 2013 to January 2023 were searched via several databases including PubMed, Insight Medical Publishing, ResearchGate, and Semantic Scholar. We included 28 articles discussing the prevalence of antibiotic misuse, knowledge, awareness, and factors contributing to the issue, its impact, and mitigating intervention strategies .

Results: The literature indicated a high prevalence of antibiotic misuse among the Jordanian population, especially among children with upper respiratory tract infections. There are numerous reasons for the high prevalence, and several contributing factors were reported, including, but not limited to, cultural factors, financial circumstances, and the level of education.

Conclusion: This review highlights antibiotic misuse as a major health problem at the community level and in the Jordanian healthcare system. effective strategies are needed to address this major health challenge.

Keywords: Antibiotic misuse, Jordan, antibiotics, antibiotic prescriptions, antibiotic resistance.

INTRODUCTION

Antibiotics have had a significant impact on medicine, saving many lives from life-threatening bacterial infections [1]. However, the last decades have witnessed the emergence of antibiotic resistance and the global spread of antibiotic-resistant bacteria, resulting in increasing mortality and morbidity and prolonged hospital stay, especially among children [2, 3]. One of the main reasons for this is that antibiotics, in many countries, are sold to patients without a medical prescription, including in Jordan [2, 4].

In recent years, the consumption of antimicrobial drugs has increased substantially [5, 6]. This is true in many countries where antibiotics are either legally

obtained without a prescription or existing regulations are not enforced. For example, several studies have shown that the misuse of antibiotics and self-medication, mainly for the common cold or upper respiratory tract infections (RTI), is a common practice in many countries [7–11]. In Jordan, antibiotics and other drugs are available over the counter and can be purchased without prescription or consulting a medical specialist, and there is no legislation or restriction on their use [4, 12].

This article is focused on reviewing the prevalence of, and factors associated with, antibiotic misuse in Jordan. To the best of our knowledge, this is the first review article to evaluate the literature on antibiotic misuse in Jordan, alongside the impact of this issue on the health system, and the intervention strategies used in mitigation. We also hope the findings will help formulate strategies to increase awareness, improve attitudes, and create rules and regulations for proper antibiotic usage. In addition, it may aid in the implementation of regulations and interventions to combat antimicrobial overprescription.

METHODS

We searched PubMed and other databases for all studies on antibiotic misuse in Jordan from January 2013 to January 2023. The heading terms used in searching were 'Antimicrobial misuse in Jordan', (Behaviour or attitudes or knowledge or aware*) and (antibiotic or antibacterial) and use* AND Jordan)) AND ('2013/1/1' [Date - Publication]: '2023/1/1'[Date - Publication]). All relevant published articles were included and discussed in this review. One article was not listed in PubMed; [13] but was found in Insight Medical Publishing and ResearchGate, and another one, [14], was listed in Semantic Scholar. The decision was made to add these two articles due to the valuable insight they provide on the issue of antibiotic misuse in Jordan.

RESULTS

We retrieved 28 articles published in Jordan concerned with the prevalence of antibiotic misuse, knowledge, attitudes, and practices regarding antibiotic use, factors contributing to this problem in the Jordanian population, its impacts, and intervention strategies used in the reduction of this problem.

In a retrospective study in Jordan in 2014, the authors analyzed the percentage of antibiotic prescriptions as well as each type of antibiotic used in the outpatient pediatric emergency clinic. The findings indicated a high level of antibiotic use, mainly for upper RTI. Antibiotics were administered in around 83% of patients, of which 60% of all given antibiotics were broad-spectrum antibiotics, with the most prevalent class being macrolides [15]. This study showed how frequently antibiotics were used to treat childhood upper RTI commonly caused by viral infections.

In another cross-sectional retrospective analysis study, antimicrobials constituted about 77.5% of all prescriptions written for ambulatory patients; most frequently, antibiotics were administered for RTI [16]. In addition to this, another cross-sectional study conducted in a major university hospital in Jordan involved a total of 250 children (80 admitted to the NICU and 170 admitted to hospitals). Some 598 antibiotic prescriptions were issued for these patients (244 in NICUs and 354 in pediatric wards). These results showed that off-label antibiotic prescribing to pediatric patients is very common [17]. Both studies suggested that such findings indicate the need for more concentrated efforts and legislation supporting proper drug use, as well as to provide safe and effective antibiotic use in paediatric patients, such that clinical pharmacists and pediatricians must work together effectively.

A prevalence study in a tertiary hospital in Jordan explored patterns of antimicrobial use among 144 inpatients, finding that the highest prescription rate of antibiotics was in the internal medicine wards (49%), followed by surgery wards and the intensive care unit. These results can help establish antimicrobial stewardship programs that may improve patient outcomes and reduce antimicrobial resistance [6]. In another retrospective cross-sectional study conducted on hospitalized patients prescribed IV antibiotics, a total of 110 antibiotic prescriptions were dispensed for 80 patients, with imipenem/cilastatin being the most prescribed antibiotic (41.25%), followed by cephalosporines (27.5%). Nearly half of the patients (47.5%) were prescribed IV antibiotics despite their eligibility for oral conversion. This study revealed a deficiency in the implementation of guidelines important to decreasing antibiotic resistance and improving clinical outcomes. The study suggested that clinical pharmacists need to be more involved in antibiotic prescriptions to improve effectiveness and decrease potential antimicrobial resistance in hospital settings [18].

A retrospective secondary analysis was performed for oral antibiotics prescribed in the family medicine clinics in a teaching university hospital in Jordan in 2017 [19]. The study showed that antibiotics accounted for 27.3% of all prescriptions in the clinics. Penicillin was the most prescribed antibiotic and RTI was the most frequent reason for giving antibiotics. Only 28.8% of all given antibiotics were deemed necessary and medically indicated. It was reported that antibiotics were frequently administered incorrectly and at high rates. The study concluded that measures need to be implemented and steps taken to formulate policies and guidelines to encourage prudent antibiotic prescribing to reduce the avoidable cost and burden of microbial resistance.

Another cross-sectional community-based study in Jordan sought to explain patterns of antibiotic self-medication; it was found that, of 1,928 respondents, 40.4% had used an antibiotic without a prescription in the previous month, mainly for a sore throat or influenza-like symptoms. The authors also reported that 57.2% of participants who self-medicated with antibiotics had obtained them primarily from pharmacies. Of these patients, 34.8% relied primarily on pharmacists for medical advice and 35.2% relied on their own previous experience. The study concluded that self-medication with antibiotics is still very prevalent in Jordan; hence, to limit the use of antibiotics without a prescription, the authorities need to act to manage this serious health issue [12].

A cross-sectional study on university students in Jordan analyzed the prevalence, level of knowledge and motivation for antibiotic self-treatment. The study showed that the general level of knowledge regarding self-treatment with antibiotics was good, and students in the medical field knew more about it than students studying other fields. Although most participants reported that they had not self-medicated with antibiotics, as a family medicine doctor in Jordan, I believe that this problem is underreported. Furthermore, this study showed that antibiotic self-treatment was influenced by gender, age, and the most recent antibiotic use. Upper RTI was the most common reason for antibiotic use and self-treatment with antibiotics was most frequently because it was seen to be a quick and easy fix. This study also reported that students at universities primarily learned about antibiotic use and resistance on the internet;

its authors, therefore, suggested that to stop or minimize the misuse of antibiotics, it is important to enforce and activate the roles of the media, physicians, pharmacists and even the university curriculum [20].

In the same vein, a cross-sectional study was performed to assess Jordanians' knowledge and attitudes regarding the use of over-the-counter medications. The study showed that 68.5% of participants believed antibiotics must always be prescribed, emphasizing the importance of this issue to the public and the impact it may have on future generations [21].

Another cross-sectional study compared the awareness of antibiotic use and resistance in the Jordanian community based on socioeconomic status. Although this study showed that west Amman respondents (higher socioeconomic status) had a much better understanding of antibiotic usage and how antibiotics work, 51.1% of all participants had used them at least twice in the last year and 80.2% of householders who had used antibiotics at least once in the previous year did so on pharmacist's advice. The authors concluded that, despite their findings, the study may not be representative of the entire Jordanian population; nevertheless, it showed the need to improve public awareness and recommended professional practice monitoring of antibiotic prescribing [22].

In a similar cross-sectional study in Jordan using a pre-validated questionnaire to investigate gaps in community members' knowledge and usage of antibiotics, a sample of 1,060 randomly chosen people in northern Jordan was investigated. Of all the participants, a significant number (70%) were unaware of the concept of 'antimicrobial resistance', 41% reported using oral antibiotics, 38% used antibiotics without a prescription, and 32% did not finish the course of therapy. The authors recommended that the community should be educated about the consequences of antibiotic overuse [23].

In Jordan, where most antibiotics are sold as over-the-counter medication on pharmacist advice (based on my observations), it is important to study the awareness and attitudes of pharmacists toward regulating this problem. A recent study did just that by assessing pharmacists' knowledge, attitudes, behaviors, and information sources on antibiotic use and resistance in Jordan. This study surveyed 384 pharmacists and showed that only 13.3% were aware of the presence of antimicrobial resistance action plans, while 36.2% were unaware and 50.5% were unsure. Furthermore, the study showed that 55% of pharmacists expressed a desire to learn more about antibiotic resistance and diseases for which antibiotics are prescribed [24].

In a similar study that researched the knowledge, attitudes, and practices regarding antibiotic use and resistance among 114 community pharmacists, it was reported that most respondents recognized antibiotic resistance as a worldwide issue. Some 59.7% of those surveyed informed patients about the dangers of using antibiotics inappropriately. The study concluded that pharmacy university programs must be improved, with a focus on interprofessional education and the creation of specialized interventions. They also recommended that antibiotic dispensing laws should be applied [25]. These changes should also enforce pharmacists' implementation of any future regulations that limit certain antibiotics to prescription-only medications in Jordan; this may be the start of legislation to make antibiotics prescription-only medications

similar to other countries such as Australia, where I practiced medicine for ten years.

Two studies explored the knowledge and attitudes towards the use of antibiotics in teaching hospitals in Jordan. In the first study, the authors explored these issues in childhood upper RTI [26]. This cross-sectional study revealed that half of the respondents thought antibiotics had no side effects; 60% were aware that the majority of upper RTI was viral in nature and 72.4% thought that antibiotics should be administered if a child develops a fever. In response to these findings, the study recommended that parents' knowledge of antibiotics should be raised through educational programs to decrease inappropriate use [26]. The second study explored the knowledge, beliefs, and attitudes about the uses and side effects of antibiotics among outpatients [27]. This audit was conducted using a self-administered, validated questionnaire completed by people who visited the outpatient pharmacy of two significant teaching hospitals in the north of Jordan. The study showed that 20.1% of those polled believed that antibiotics should be used for bacterial infections, while 18.3% selected viral infections and 43.6% chose both bacterial and viral infections. Although this study showed that the notion that antibiotics may be administered without a prescription was rejected by over 75% of the participants, it did show that a large percentage of the population had limited knowledge of antibiotic side effects and the proper use of antibiotics for bacterial infections only [27].

Two studies in Jordan explored the knowledge and attitudes to antibiotic use among prescribers and patients (Palestinian refugees and their healthcare workers in the United Nations Relief and Works Agency, or UNRWA). In the first study, a questionnaire was used to evaluate prescribers at the primary healthcare facilities of the UNRWA Jordan field office regarding their knowledge, attitudes, and practices toward the use of antibiotics and their options for improved prescribing. The study reported that participants did not think there was a link between their prescribing and antibiotic resistance. The authors concluded that, although there was a strong awareness of antibiotic resistance, there was insufficient desire for rational prescribing or behavioral change [28]. The second study explored the knowledge, attitudes, and behaviors of Palestine refugees using UNRWA primary healthcare facilities in Jordan. The study reported that 63% of patients exchanged drugs at home, 38% utilized leftover antibiotics, and 60% bought antibiotics from a pharmacy without a prescription. The authors reported many reasons for this, including that 90% of patients, although they had faith in their doctor, were discouraged by excessive waiting times for care; this has greatly increased self-medication. The study recommended public education on antibiotics, and for health institutions to take measures to reduce waiting times and enforce rules to make antibiotics prescription-only medications [29].

Likewise, another study researched the misuse of antibiotics in the Iraqi community in Jordan. This cross-sectional questionnaire study showed that 90% of the participants mentioned viral illnesses as a reason for prescribing antibiotics. Furthermore, 62% of participants were in favor of obtaining antibiotics without a prescription, 29% were in favor of obtaining them from friends or family, and 46% were in favor of saving leftover antibiotics for later use. The study encouraged health authorities to consider

carefully methods of limiting access to antibiotics and increasing community knowledge of the proper use of these antibiotics [30].

A group of researchers investigated the knowledge, attitude, behavior, and use of antibiotics among Jordanian university students and employees as an example of the higher educated section of the Jordanian community. This cross-sectional study of medical, nursing, and pharmacy students in Jordan included 716 participants. This study reported that only 21.0% agreed or strongly agreed that careful antibiotic usage has been well-promoted and that more information is needed 'according to participants' on antibiotic resistance, medical problems for which antibiotics are prescribed, and proper antibiotic usage. Nevertheless, the authors mentioned there could be a selection bias toward people with internet access because the instrument was distributed online [31].

Another study from 2016 also explored the prevalence of self-medication practices among medical and pharmacy students. This study reported that self-medication was widespread among students in Jordan at the University of Science and Technology, regardless of their level of medical understanding. This study revealed that common colds and headaches were frequent illnesses that led people to self-medicate. Antibiotics and analgesics were regularly used to treat these illnesses without medical advice. This study concluded that the right use of medications as a therapeutic tool must be taught to students in medical education institutes [32].

In another cross-sectional study in Jordan on antibiotic use and misuse among 1,158 university students, the authors included three of Jordan's largest public institutions and used a self-administered questionnaire. The students exhibited improper antibiotic usage practices and had limited knowledge and perspectives on antibiotic use. Furthermore, about two-thirds of the students responded that the purpose of using antibiotics was to reduce fever, relieve weakness or malaise, or manage pain. In addition, antibiotics 'according to nearly half of the students' can be used to treat viral infections. Also, around 50% of the participants said they always used antibiotics without a prescription from a doctor. More positively, 75.8% of the students believed that using antibiotics frequently and without a prescription had negative effects. In response to these results, the study recommended that education campaigns on antibiotic use and abuse in Jordan, aimed at university students as well as the local population, might mitigate this problem in Jordan [14].

Another cross-sectional study researched the use of antibiotics by university employees and students at Al-Hussein Bin Talal University in south Jordan. This study reported that 33.7% of surveyed participants said they learned about antibiotic use from doctors, while 20% did so from enclosed pamphlets and 18% from pharmacists. The study also reported that 20% of individuals used antibiotics without a prescription from places such as pharmacies and 20% from drugs left over from prior treatments of a household member. On the other hand, 47.9% reported using prescribed antibiotics, based mostly on their symptoms, with about 50% of the participants saying they had taken antibiotics for three days or less and did not finish the course. The study indicated that it is essential to educate people about the proper use of antibiotics prescribed by a doctor and recommended raising awareness of proper antibiotic usage in the community [13].

In a recent cross-sectional study on changes in public knowledge and perceptions about antibiotic use and resistance in Jordan over an eight-year period, attitudes to the use of antibiotics significantly improved over that period. Furthermore, the study reported that the percentage of people who disagreed with buying antibiotics without a doctor's prescription increased by 9% and those who disagreed with saving antibiotics for later use increased by 13%. Additionally, there was a statistically significant rise from 70% to 83% in individuals who indicated that they would trust their doctors' judgment regarding the need for antibiotics, while those who would not request antibiotics from doctors rose from 56% to 75%. On the other hand, the factors that encourage self-medication, such as acquiring antibiotics from a friend, buying antibiotics without a prescription, and getting information about medication use from a leaflet without consulting a healthcare provider, did not alter significantly. The percentage of people who agreed that antibiotic resistance was an issue in Jordan dramatically rose from 44% to 60%. The authors concluded that, despite the improvement in awareness, some confusion remains about antibiotic use and resistance, and so more effective public education initiatives and regulations were recommended [4].

Two studies have researched health care providers' attitudes and knowledge about antibiotic misuse in Jordan. One cross-sectional study aimed at assessing dentists' preferred information sources, knowledge of accessible resources, and awareness of activities concerning responsible antibiotic prescribing practices in Jordan. The study included 204 dentists who completed the survey. Although this study reported that 35.5% relied on published guidelines, it showed that only 9.3% of dentists were aware of the existence of national antimicrobial resistance action plans while 33.8% were unaware and 56.9% were unsure. Nevertheless, the sampled dentists expressed a wish to learn more about antibiotic resistance and medical disorders for which antibiotics are prescribed. This study also mentioned several limitations including a small sample size and, although the study was cross-sectional, it did not reflect any change in attitudes and awareness over time [33].

Another cross-sectional study in Jordan included 613 physicians and dentists from all sectors; it aimed to assess the knowledge, attitudes, and actions of prescribers regarding antibiotic use and resistance. This study showed that, in comparison to their understanding of the development of antibiotic resistance, which was as low as 62.2%, respondents' knowledge of the effective use, inappropriate usage, and associated adverse effects of antibiotics was higher than 90%. In addition to this, 63.4% of respondents who prescribed antibiotics said they would never or occasionally provide information on how to use antibiotics wisely for illnesses. Although the results of this study may not be representative of the entire Jordanian population, it was very important because it showed the views of healthcare professionals. Furthermore, the authors cited that the respondents' viewpoints may not be closely related to the beliefs of other family members or the population in general. According to the results of this study, the authors recommended that public awareness and professional practice monitoring of antibiotic use are required to regulate the use of antibiotics and educate healthcare professionals about the inappropriate uses of antibiotics and the issue of antibiotic resistance [34].

A relevant study titled 'Exploring Information Available to and Used by Physicians on Antibiotic Use and Antibiotic Resistance in Jordan' aimed to evaluate the information that physicians had access to and used when making decisions about the use of antibiotics, as well as how this knowledge affected their attitudes and behaviours when prescribing antibiotics. Some 409 physicians from all health sections of Jordan participated in cross-sectional research using an online questionnaire. The study revealed that the primary sources of knowledge on minimizing unneeded antibiotic prescribing were published guidelines (31.8%), the workplace (25.7%), co-workers or peers (20.0%), group or conference training (18.3%), and medical professional bodies (18.1%). Healthcare practitioners demonstrated interest in learning more about a variety of related subjects, including antibiotic resistance, how to use antibiotics, and the medical conditions for which antibiotics are used. Furthermore, around 33% of doctors said they were unaware of any campaigns to raise public awareness of antibiotic resistance. These results could help doctors to administer antibiotics correctly and possibly create successful antimicrobial stewardship [35].

In our search, we found two articles that discussed the issue of antibiotic misuse in Jordan post COVID-19 (coronavirus disease of 2019). The first is a cross-sectional study in which people's knowledge and awareness of antibiotics and antibiotic resistance were explored during the COVID pandemic. The study showed that more than half of the participants had a sufficient understanding of antibiotics and antibiotic resistance, and nearly two-thirds of those surveyed had adequate health literacy. The study also discovered that the participants were well informed about possible antibiotic resistance solutions. This study reported some limitations including unequal access to the internet as well as differences in social media usage patterns and frequency. In addition, respondents potentially interested in the issue of antibiotics may be more inclined to complete the survey, which could result in self-selection. This study concluded that further programs should be implemented to tackle the challenges of self-medication and antibiotic resistance by focusing on every aspect of health literacy [36].

The second article from 2021 is titled 'An Assessment of the Impact of Coronavirus Disease (COVID-19) Pandemic on National Antimicrobial Consumption in Jordan'. This study compared changes in antimicrobial use for the year before and the year after the COVID-19 pandemic. The study reported that the total amount of antibiotics consumed in 2020 declined by 5.5% from 2019. While amoxicillin usage dropped significantly in 2020 (by about 53%), azithromycin usage rose by 74%. During the pandemic period, there was also an increase in the use of certain antibiotics known to be associated with increasing resistance. The authors recommended that efforts to enhance national antimicrobial stewardship are needed to ensure rational use of antimicrobials [37].

DISCUSSION

To understand the issue of antibiotic misuse in Jordan and globally, we decided to compare this issue in Jordan to other countries. For example, a comparison of antibiotic misuse in Jordan in a 2010 study evaluated 405 pharmacists, 381 of whom (94%) believed that drugs, mainly antibiotics, were distributed without a prescription by their staff [38]. Another study was conducted on 171 general practitioners in Ireland, for which data were collected on 16,899 consultations, demonstrating that potentially inappropriate prescribing was occurring in primary care and the high rate of broad-

spectrum antimicrobial agents was a major concern. The Irish healthcare system is advanced and antibiotics are only prescribed by a doctor; nevertheless, antibiotics were prescribed at 20.16% of these consultations and most were prescribed for symptoms or diagnoses associated with the respiratory system [39]. Furthermore, we compared Jordan to a developing country where antibiotics can be sold without a prescription. In this cross-sectional study of antibiotic dispensing patterns in Egyptian pharmacies, more than 63% of the recorded antibiotics were dispensed on official prescriptions, 23.3% upon a pharmacist's recommendation, and 13% upon patient request [40].

All these studies show that antibiotic misuse is a global issue and, in many encounters, antibiotics are either given without a doctor's advice or that advice is not even indicated in many consultations when given through a prescription.

The emergence of multi-drug resistant (MDR) organisms has posed a global challenge to modern medicine since the discovery of antibiotics. Antibiotic resistance occurs naturally, but unsustainable antibiotic use and misuse have expedited the process, putting humans and their health in danger [41, 42]. An estimated 700,000 people die annually as a result of antimicrobial resistance (AMR), which is defined as bacteria surviving under the influence of antimicrobial agents [43]. In addition to this, the economic cost of the healthcare system is enormous. In a study in the USA, it was reported that the Institute of Medicine estimated the annual cost of infections caused by antibiotic-resistant bacteria to be 4–5 billion dollars, and the misuse of antibiotics increased antibiotic resistance, resulting in an estimated cost to the US health care system of over 20 billion dollars per year [44].

Most of the published studies reviewed here for their recommendations suggested combating the issue of antibiotic misuse by focusing on planning and implementing laws and regulations, surveillance, and intervention protocols to reduce antibiotic misuse and its impacts [44–47]. All the above studies have suggested intervention strategies to reduce antibiotic misuse, both in Jordan and globally. These strategies include health education campaigns to increase the awareness of healthcare workers, not to mention the education of the population, which plays an essential role in reducing antibiotic misuse, particularly among children. Furthermore, doctor-patient relationships, communication, and interaction are vital, as the patients can be involved in their treatment for the best possible compliance and improved outcomes; particularly, explaining the need for antibiotics and discussing the issue of antibiotics misuse is suggested [15, 19, 48].

The Infectious Diseases Society of America (IDSA) defines antimicrobial stewardship as optimizing the indication, selection, dosing, and route of administration and duration of antimicrobial therapy, to maximize clinical cure or prevention of infection [49]. Antimicrobial stewardship (AS) programs are effective in improving clinical outcomes associated with antimicrobial therapies while improving patient safety by reducing adverse events and the development of bacterial resistance. The primary aim of stewardship is to optimize clinical outcomes while minimizing the unintended consequences of antimicrobial use, including toxicity, the selection of pathogenic organisms, and the emergence of resistance [3].

The studies included in this review discussed the issue of antibiotic misuse in Jordan in many ways, from the healthcare worker's perspective and the patient's perspective,

among the population in different geographical areas in the north and south of Jordan, in the higher and lower educated sections of the community, and the higher and lower socioeconomic sections of the community. All these studies highlighted the impact of antibiotic misuse in Jordan and globally, in addition to the importance of dealing with this issue. The authors also provided many reasons for this phenomenon, including, but not limited to, economic factors, healthcare accessibility, the availability of antibiotics with a prescription, and the lack of legislation limiting their use. They also suggested many ways of tackling this issue, such as patient education, health care worker education, and improving laws and legislation to make antibiotics prescribed-only medications, which may limit the large amounts of antibiotics used without proper need or indication. These reports also highlighted the need to use antimicrobial resistance stewardship in all healthcare facilities [6, 16, 28, 35]. For a detailed summary of the studies included please see Table 1.

Table 1. Summary of reviewed studies, including year, title, author, population and study design

Study population	Study title	Study design	Year	References
General Population	An Assessment of the Impact of Coronavirus Disease (COVID-19) Pandemic on National Antimicrobial Consumption in Jordan	cross-sectional study	2019 and 2020	37
	A Survey Assessing Antimicrobial Prescribing at UNRWA Primary Health Care Centers in Jordan	cross-sectional study	2022	28
	Knowledge, practices & attitude toward antibiotic use and bacterial resistance in Jordan	cross-sectional study	2018	23
	Antibiotics use among Palestine refugees attending UNRWA primary healthcare centers in Jordan	cross-sectional study	2018	29
	The prevalence and patterns of self-medication with antibiotics in Jordan: A community-based study	cross-sectional study	2020	12
	An audit on the knowledge, beliefs and attitudes about the uses and side effects of antibiotics among outpatients attending teaching hospitals in Jordan	cross-sectional study	2013	27
	The awareness of the Jordanian population about OTC medications: A cross-sectional study	cross-sectional study	2019	21
	Awareness of Antibiotic Use and Resistance in Jordanian Community	cross-sectional study	2020	22
	Awareness of antibiotic use and antimicrobial resistance in the Iraqi community in Jordan	cross-sectional study	2014	30
	Public Health Literacy, Knowledge, and Awareness Regarding Antibiotic Use and Antimicrobial Resistance during the COVID-19 Pandemic: a cross-sectional study	cross-sectional study	2021	36
	Changes in public knowledge and perceptions about antibiotic use and resistance in Jordan: a cross-sectional eight-year comparative study	cross-sectional study	2021	4

Study population	Study title	Study design	Year	References
	Patterns of antibiotic prescribing and appropriateness for RTI in a teaching hospital in Jordan	retrospective secondary analysis	2021	19
University Students	High prevalence of self-medication practices among medical and pharmacy students: a study from Jordan	cross-sectional study	2016	32
	Knowledge, Attitude, and Behavior about Antimicrobial Use and Resistance among Medical, Nursing and Pharmacy Students in Jordan	cross-sectional study	2022	31
	Self-Treatment with Antibiotics: Knowledge level, Prevalence and Indications for Practicing Among University Students in Jordan	cross-sectional study	2020	20
	Misuse of Antibiotic Therapy among University Community in South Jordan	cross-sectional study	2016	13
	Antibiotics Use and Misuse among University Students in Jordan	cross-sectional study	2015	14
Pharmacist (Inpatient and Outpatient)	Antibiotic Prescribing Patterns in Outpatient Emergency Clinics at Queen Rania Al Abdullah II Children's Hospital, Jordan	cross-sectional study	2013	15
	Pharmacists' Knowledge, Attitudes, Behaviors and Information Sources on Antibiotic Use and Resistance in Jordan	cross-sectional study	2022	24
	Antibiotic prescribing patterns for pediatric illnesses in ambulatory settings in Jordan	cross-sectional study	2021	16
	Prevalence and nature of Off-label antibiotic prescribing for children in a tertiary setting	cross-sectional study	2016	17
	Knowledge, attitudes, and practices regarding antibiotic use and resistance among community pharmacists	cross-sectional study	2021	25
Physicians (including dentist)	Antibiotic use and resistance: information sources and application by dentists in Jordan	cross-sectional study	2022	33
	Prescribers' Knowledge, Attitudes and Behaviors on Antibiotics, Antibiotic Use and Antibiotic Resistance in Jordan.	cross-sectional study	2021	34
	Exploring Information Available to and Used by Physicians on Antibiotic Use and Antibiotic Resistance in Jordan	cross-sectional study	2021	35
Parents	An exploration of parents' knowledge, attitudes and practices towards the use of antibiotics in childhood upper respiratory tract infection in a tertiary Jordanian hospital	cross-sectional study	2018	26
Inpatients	Patterns of antibiotic use and administration in hospitalized patients in Jordan	cross-sectional study	2018	18
	Prevalence of antibiotic usage in a tertiary academic hospital: a venue for antimicrobial stewardship programs	cross-sectional study	2020	6

CONCLUSION AND RECOMMENDATIONS

Misuse of antibiotics is a serious concern in the health system in Jordan and worldwide. Most Jordanian literature emphasizes prevalence studies and reveals a considerable

high prevalence of antibiotic misuse among the Jordanian population, particularly among children. On the other hand, there is a lack of studies regarding the numbers and amounts of antibiotics used/misused and the economic burden on the Jordanian healthcare system. In response to this, future researchers need to address this aspect and increase public awareness about the impacts of antibiotic misuse. Furthermore, we suggest some recommendations to improve the issue and control it in a better way, for example, by enhancing the role of social media in raising awareness of proper antibiotic use. Also, educational sessions can focus on school and university students to teach them about the proper use of antibiotics and general health education. In addition to this, brochures, leaflets, and pamphlets given to outpatients during their outpatient clinic follow-up in health care centers may help patients understand these health issues better. Education sessions can also be organized for the general population in primary health care centers to educate on antibiotic misuse and encourage medical students to participate in spreading awareness regarding antibiotic use through workshops, courses, and free medical days on campus to colleagues and other university students. If implemented, all these recommendations can hopefully lead to the enforcement of laws that prohibit pharmacists from selling antibiotics without a prescription and the application of antimicrobial stewardship programs for inpatient care.

Finally, there was an update from the Jordanian Food and Drug Administration on January 19, 2023, which reported the need for a committee to monitor antibiotic misuse and possibly implement laws and legislation to help resolve the issue of antibiotic misuse or at least control better, indicating that more legislation will hopefully come soon.

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إساءة استخدام المضادات الحيوية: مراجعة منهجية للدراسات الأردنية المنشورة

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الملخص

الخلفية والأهداف: أصبح إساءة استخدام المضادات الحيوية قضية صحية عامة رئيسية في جميع أنحاء العالم، وأصبح هذا السلاح ضد البكتيريا مهددًا بشكل متزايد بسبب إساءة استخدام المضادات الحيوية. في الأردن على وجه التحديد، يعد سوء استخدام المضادات الحيوية وبيع المضادات الحيوية بدون وصفة طبية من بين عوامل أخرى أحد العوامل الرئيسية لإساءة استخدام المضادات الحيوية.

المنهجية: ينصب تركيزنا على مراجعة الأدبيات المنشورة حول إساءة استخدام المضادات الحيوية في الأردن. لاستكشاف العوامل المساهمة في هذه القضية وآثارها، وربما أيضًا لوضع استراتيجيات يمكن استخدامها في الحد من إساءة استخدام المضادات الحيوية في الأردن. الطريقة: تم استكشاف المقالات المنشورة حول إساءة استخدام المضادات الحيوية في الأردن من يناير 2013 إلى يناير 2023 عبر قاعدة بيانات PubMed وقواعد البيانات الأخرى مثل النشر الطبي البصري وبوابة البحث والباحث الدلالي. تم تضمين 28 مقالاً تناقش انتشار إساءة استخدام المضادات الحيوية، والمعرفة والوعي بهذه المشكلة، والعوامل المساهمة في هذه المشكلة لدى السكان الأردنيين، وآثارها، واستراتيجيات التدخل التي يمكن استخدامها في الحد من هذه المشكلة.

النتائج: أظهرت الأدبيات ارتفاع معدل انتشار إساءة استخدام المضادات الحيوية بين السكان الأردنيين وخاصة الأطفال المصابين بعدوى الجهاز التنفسي العلوي. هناك أسباب متعددة لهذا الانتشار المرتفع، وقد تم ذكر العديد من العوامل المساهمة، بما في ذلك على سبيل المثال لا الحصر العوامل الثقافية والظروف المالية ومستوى التعليم.

الاستنتاجات: تلقي هذه المراجعة الضوء على هذه المشكلة الصحية الرئيسية في نظام الرعاية الصحية الأردني، والتي قد تؤدي إلى مقاومة المضادات الحيوية. هناك حاجة إلى العديد من التدخلات لتقليل هذا التحدي الصحي الرئيسي.

الكلمات الدالة: إساءة استعمال المضادات الحيوية، الأردن، المضادات الحيوية، وصفة المضادات الحيوية، مقاومة المضادات الحيوية.