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Ivan Oryshchyn

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The Uncontrolled Use of Antibiotics in Eastern Europe

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1 Introduction

Nowadays, the uncontrolled use of antibiotics has become the common practice in the countries of Eastern Europe, being the considerable threat to human health and development. As the result of this negative phenomenon, the developed microbial resistance leads to the growth of morbidity and premature mortality.

According to the World Health Organization, humanity is currently facing the dramatic lack of effective antibiotics of a new line, which makes it impossible to cope with the hazard of antibiotic resistance. Even the most successful modern antimicrobial medicines can be regarded as the short-term solution. This fact is extremely disturbing because only tuberculosis is the cause of death of approximately 250 thousand individuals, being resistant to antimicrobial drugs (World Health Organization, 2017). Dr. Tedros Adhanom Ghebreyesus, who is Director-General of World Health Organization, argues that “antimicrobial resistance is a global health emergency that will seriously jeopardize progress in modern medicine” (World Health Organization, 2017).

According to the report of the European Commission of 2017, in the European countries, doctors cannot save lives of approximately 25,000 individuals annually because the considerable resistance to antibiotics makes serious bacterial infections incurable (European Commission, 2017). On the global scale, the victims of the developed antibiotic resistance account for approximately 700,000 individuals annually (European Commission, 2017). Being caused by the strong necessity to decrease negative consequences of antimicrobial resistance, the annual spending on additional medicines and medical facilities makes above EUR 1.5 billion worldwide (European Commission, 2017). In Ukraine, the disturbing situation because of detrimental outcomes remains the same, posing numerous challenges. According to the predictions of the World Bank, by 2050, humanity will lose up to 300 million individuals in case of ignoring the problem of uncontrolled use of antibiotics (The World Bank, 2018).

Experts draw the world public’s attention to the challenge of diminishing occasions of the uncontrolled therapy, distinguishing the causes of this negative phenomenon, comparing the ways and techniques of prescribing antibiotics, and making the accent on the connections between an incorrect usage of the medicines and living standards in the community.

Since time immemorial, the mankind has been co-existing with the microbial world, which embodies three key types of bacteria according to their effect on an individual’s health.

While the influence of some groups of bacteria is neutral, the rest of the microbial population can belong to stabilizing or pathogenic types (Etebu, & Arikekpar, 2016). The last group of bacteria can cause serious diseases and even an individual's death.

Nowadays, the rate of infectious diseases like pneumonia, tuberculosis, and gonorrhea is increasing, while the effectiveness of antibiotics is falling. Experts draw attention to the rapid growth of antibiotic resistance, which leads to detrimental consequences (Zaman et al., 2017). Being used with the purpose to prevent and cure bacterial infections, antibiotics are performing the detrimental function nowadays. As the result of incorrect usage of antibiotics, bacteria transform, becoming resistant to the action of the medicines. These new forms of bacteria infect individuals and animals, while the diseases they cause are hard to cure because of the developed antibiotic resistant characteristics. The detrimental consequences of antibiotic resistance include the strong necessity to spend great money on medicines and medical facilities, leading to long-term individuals' stays in hospitals and increased levels of mortality (World Health Organization, 2018).

The rates of antibiotic resistance are not similar in different European countries, depending on the provided measures on managing the uncontrolled antibiotic consuming (Nomamiukor et al., 2015). The experience of Austria as the state with one of the lowest rates of incorrect use of the medicines can be the best practice for Ukraine to follow.

Aim of the Study

Exploring the above-mentioned challenge, the present paper examines the problem of the uncontrolled use of antibiotics in Eastern Europe, and in Austria and Ukraine in particular. The main goal of the study is to investigate and give the assessment of the current state of affairs in the field of uncontrolled antibiotherapy based on medical practices in these countries. The paper explores effective ways of reducing occasions of the uncontrolled use of antibiotics and considers the factors that lead to this negative phenomenon. Special attention is paid to comparing methods and procedures of prescribing antibiotics in the countries under the analysis. The research establishes the connection between living standards and incorrect use of antibiotics, studying the range of primary sources, such as databases from official medical editions, interviews with practitioners, medical managers, and the personal experience.

2 Research Methods

Exploring the issue of the uncontrolled use of antibiotics in Eastern Europe, this study implements a range of qualitative methods:

- a structured literature review,
- the method of a historical investigation,
- personal experience and interview methods,
- and the method of a comparative analysis

as the effective tools for exploring the issues of the uncontrolled use of antibiotics in Eastern Europe. The combination of several research techniques would contribute to the relevancy, reliability, and better comprehension of the material.

The research employs the method of historical investigation, while examining the transformations in antibiotics effectiveness, which have been taking place since the moment of their discovery in 1909 up to the current moment.

Employing the method of a structured literature review, this study investigates the theoretical and evidence-based information in medical journals and databases up to 2018, which were published in official medical sources, such as surveys in PubMed, information shared on the websites of Ministry of Healthcare of Ukraine and the World Health Organization.

The study employs the Health and Demographic Surveillance Sites and evidence-based guidelines for getting details. Interviews with practitioners and pharmacists in both Ukraine and Austria are taken into account as well. Finally, the personal experience as a pharmacist and a medical representative contributes to better understanding of the issue under analysis. The method of personal experience highlights the current state of affairs in the everyday pharmacist's practice. Interview methods enhance the knowledge of the problem, helping to get the relevant information about the typical ways of prescribing and selling of antibiotics.

Establishing similar characteristics and differences, the method of comparative analysis is implemented, contrasting the ways and procedures of prescribing antibiotics in Ukraine and Austria. This technique is the effective tool to demonstrate major benefits and drawbacks of the current state of affairs in both countries, evaluate it, and identify positive issues as the best practice for implementation in the further reforms.

The usage of a mixed set of qualitative methods contributes to developing a complete and evidence-based picture of the situation in the field of the uncontrolled use of antibiotics in Eastern Europe based on the experience of Austria and Ukraine.

3 Factors Leading to the Uncontrolled Use of Antibiotics

The factors causing the uncontrolled use of antibiotics are mixed and interrelated, belonging to several levels:

- low restrictions of selling antibiotics to individuals without a prescription
- incomplete course of treatment
- individuals' insufficient knowledge of medicine and their previous successful experience with intake of antibiotics
- self-medication
- treatment of viral infections with antibiotics
- failure to control the dosages of antibiotics
- uncontrolled and/or illegal use in animals
- low attention of the authorities to the legislative aspect

However, the key factor is the low restrictions of selling antibiotics to individuals without a prescription that leads to detrimental consequences.

The tendency about the intake of antibiotics is similar in all the states where the selling of the drugs of the above-mentioned category is not forbidden by the legislation. The major part of individuals does not get the complete course of treatment because they feel better after intake of several pills. As the result, incorrect antimicrobial consumption promotes the development of antibiotic resistance (Surji, 2016).

According to the report of the European Commission, "the use of antibiotics without a prescription is a complex phenomenon that can only be explained by looking at a variety of determinants on different levels" (European Commission, 2017). These factors include the patient, healthcare professional, healthcare system and country levels.

Thus, there are several factors that are the causes of the uncontrolled use of antibiotics. These factors influence each other and depend on other components of the system in their turn, belonging to three key levels, such as the patient, the healthcare professional, the healthcare system and country levels:

3.1. Patient level

On the patient level, the incorrect use of antibiotics takes place as the result of individuals' insufficient knowledge of medicine and their previous successful experience with intake of antibiotics (European Commission, 2017).

Treatment of serious diseases demands proper knowledge of the medicine. As ill individuals do not consult practitioners, self-medication leads to the intake of antibiotics to cure such viral infections as colds, influenza, purulent nasal discharge, cough, regardless the fact that they are upper tract respiratory infections and antibiotics are useless under these circumstances (Togoobaatar 2010).

The phenomenon of antibiotics resistance takes place as the result of free access to purchase of antibiotics because of low attention of the authorities to the legislative aspect of the problem of the uncontrolled use of medications. On the other hand, the increase of antibiotics prescription can boost self-medication with antibiotics (Togoobaatar et al., 2010).

The failure to control the dosages of antibiotics intake often leads to sharing a pathogen in a population because bacteria adapt to the dose, developing their resistance to the treatment.

3.2. Healthcare professional level

On the healthcare professional level, the errors in prescribing antibiotics occur because of practitioners' poor knowledge on the pharmacy. Prescription of antibiotics can appear to be the incorrect treatment because differentiating between viral and bacterial infections is the time-consuming and expensive way. To reduce costs, physicians often choose antiobiotherapy as the remedy, ignoring the type of infection.

Children are the most vulnerable category under the circumstances as their parents ask general practitioners to give the prescription for antibiotics as the effective remedy. As the result, some experts, who lack time or proper knowledge, implement antibiotics in treating viral upper respiratory tract infections, non-specific diarrhea or sore throats (Togoobaatar et al., 2010).

3.2. Healthcare system and country levels

On the healthcare system and country level, the incorrect use of antibiotics can be observed because of producing and selling medicines in whole packages instead of exact calculating the number of drugs (European Commission, 2017).

The above-mentioned factors are tightly interrelated and influence each other. They lead to antibiotic resistance, which, in its turn, is the serious threat to health of the humanity, being the cause of fatal consequences.

Several additional important factors exist, drawing attention of numerous experts. In many countries, antibiotics are not the remedy for people predominantly, being implemented to cure cattle, poultry, and fish. As the result, bacteria mutate, becoming resistant to the treatment.

The rapid growth of population poses challenges of poor hygiene and low sanitation standards. Under the circumstances, identification, isolation, and treatment of a pathogen is complicated that causes the increasing rates of infectious diseases. This factor leads to the failure to restrict the spread of infection in urban centers and overpopulated areas.

The poor income and unavailability of a health insurance system that would cover the major part of citizens is another factor, causing the irrational usage of antibiotics (Rizky, 2012).

Next, the thriving market of drugs suggests numerous substandard products which may lead to low therapeutic effect because of inaccurate dosage or even absence of the active ingredients in medicines (Rizky, 2012).

Despite the great variety of negative factors, which lead to the incorrect intake of antibiotics, the low restriction of selling antibiotics to individuals without a prescription ranges the top place in this chart.

4 The Ways to Reduce Occasions of the Uncontrolled Antibiotherapy

The rate of the uncontrolled therapy and its negative consequences can be reduced by several ways. A set of recommendations can be suggested to individuals, policy-makers, health experts, and the institutions, which control the state of affairs in healthcare industry.

4.1. Dispensation of medication only with prescription

The key way to diminish the challenge of the uncontrolled use of medicines is to provide the conditions when antibiotics should be sold and purchased only with the prescription practitioners gave. Decreasing the incorrect intake of antibiotics is the launch of the system of antibiotics prescription on the national level, when the purchase of medicines of the above-mentioned category without consulting a doctor and his/her prescription of the antibiotics becomes practically impossible. To provide the effectiveness of the innovation legislation, penalty measures for non-compliant sellers of medicines are to be initiated. Possible obstacles may include discrepancy between the amount of regulators and retail outlets. Then, absence of sanctions and penalties for non-compliance does not contribute to the effectiveness of the measure.

Thus, more resources are to be allocated to launch the proper legislation into the everyday practice. Wise sanctions and penalties are to be imposed for non-compliant providers. Representatives of the non-governmental organizations are to be involved to boost the level of awareness of the challenge among the population and increase the level of medical literacy both among practitioners and their patients (Nguyen et al., 2013).

4.2. Control Committees in hospitals

To insure the absence of misuse of duties, hospitals are to establish a Drug and Therapeutic Committee. The challenge can suggest the absence of the necessary experience among the members of these Drug and Therapeutic Committees. To solve the problem, the effective tools and guidelines are expected to be initiated, dealing with hospital antibiotic stewardship. Members of these organizations are to obtain the relevant information about the antibiotic resistance rates among the local population (Nguyen et al, 2013).

Hospitals need infection control committees, which would deal with performing the activities of the monitoring process. The possible challenge can suggest absence of standardized surveillance bodies in the region, where the major part of hospitals do not set up infection control committees. This challenge can be solved by giving the above-mentioned committees the necessary costs to provide their activities and develop their infrastructure. Special training courses are to be arranged to implement standardized surveillance approaches and techniques to monitor the process (Nguyen et al, 2013).

Hospital antibiotic use surveillance is to be arranged. The possible challenge can suggest the absence of the standardized information base about the consumption of antibiotics on the area. This problem can be solved by means of standardizing antibiotic usage indicators, which are to correspond to international requirements, such as Defined Daily Dosage (DDD) per 100 bed days (Nguyen et al, 2013).

4.3. Laboratory enhancement programs

Laboratory enhancement programs are to be initiated. This step can face the challenge of incorrect resistance testing that would give false results. To overcome this obstacle, national testing guidelines are to be provided, comprising quality control strains. National reference centers of excellence are to be established for monitoring antibiotic resistance testing and performing external quality control. The interactive activities are to comprise tools for sharing information, such as relevant date, guidelines, and expertise (Nguyen et al, 2013).

4.4. National antibiotic surveillance

Structural transformations are to be initiated both on the local and regional levels. On the level of policy makers, several steps should be initiated. First, the officials are expected to introduce effective national programs, which deal with regulation of antibiotics prescription, selling, and their control. Second, strict surveillance of antibiotic-resistant infections is to be imposed. Third, to guarantee the safety to the community, special policies, programs, and measures of infection prevention and control are to be launched. Fourth, the quality standards of the proper usage and disposal are to be provided. Finally, the community should have free access to the information, which deals with the detrimental influence of antibiotic resistance on an individual’s health.

National antibiotic surveillance is to be arranged on the state level. The initiative can face certain difficulties, such as poor communication between organizations that deal with the information about the uncontrolled use of antibiotics. To solve this challenge, relevant information on the issue is to be obtained from hospitals to build the resistance database on the national level. The research structures are expected to edit national annual reports, highlighting the issues of the uncontrolled use of antibiotics and the information about the antibiotic resistance (Nguyen et al, 2013).

4.5. Guidelines and Pharmacovigilance

Standard treatment guidelines are to be edited. The challenge can include the absence of the relevant data about current treatment guidelines. To overcome this difficulty, timely and evidence-based updates are to be provided, giving the relevant information about infectious diseases and local resistance data (Nguyen et al, 2013).

The next way to decrease the occasions of the uncontrolled usage of antibiotics suggests pharmacovigilance. The potential challenge includes the lack of adequate finding and resources. To settle this problem, the center for pharmacovigilance is to be involved into dealing with the challenge of incorrect antibiotic prescribing (Nguyen et al, 2013).

4.6. Antibiotic use in agriculture

In the agricultural sector, several recommendations would be useful to cope with the challenge of preventing and managing antibiotic resistance. First, strict veterinary supervision is to control any giving antibiotics to the cattle, poultry, and other domestic animals. Second, the usage of antibiotics as the effective measure to boost the rapid growth of animals is to be forbidden. Third, healthy animals should not take antibiotics as the measure to prevent infectious diseases. Fourth, to decrease the necessity of implementing antibiotics for treating ill animals, vaccination is to be provided.

In case of having alternatives to antibiotics, the preference is to be given to the first ones. In fact, best practices of producing and processing foods from animal and plant sources are to be implemented at all the stages of these activities.

Finally, the implementation of antibiotics in the agriculture and in breeding the cattle and poultry is to be forbidden. This measure can face the problem of enforcement concentrating on

farmers who grow the harvest and animals for export. To solve the problem, the proper legislation is to be initiated. Similar antibiotic use and resistance systems of surveillance are to be arranged for managing the agricultural sector. National annual reports are to include the relevant information about the use of antibiotics and the resistance date in the above-mentioned field (Nguyen et al,2013).

Finally, agricultural workers must pay great attention to improving biosecurity, following the standards of hygiene and animal welfare. Thus, the set of the above-mentioned measures would be extremely beneficial to prevent and control infections in the agricultural sector, diminishing the increased rates of antibiotic resistance.

4.7. Hygiene measures

People should escape close contact with individuals, who are suffering from infectious diseases. Practicing safer sex and having vaccination are important as well. The great attention must be paid to keeping to hygienic standards while cooking dishes. In fact, experts have developed five key rules to escape sharing infections because of poor sanitary standards. These norms comprise keeping to the ideal order in the place food is cooked, separating raw food and dishes that have been already cooked.

Cooking some meal, an individual must pay responsible attention to his/ her duties, keep meat, sausage, milk, butter, eggs, and other food at safe temperatures. He/she must be sure that the used water and raw materials are safe for people's health. Finally, the preference is to be given to the foods which have been produced without the implementing antibiotics to boost the growth of disease control of the cattle or the poultry.

On the level of health professionals, a range of special preventive measures needs to be implemented. First, health experts must keep their medical instruments in the sanitary conditions, providing the proper condition of the surrounding environment. The hygienic measures are the key issue in the fight with the antibiotic resistance. Second, doctors should remember of the contradictory influence of antibiotics on individuals. Thus, health experts must not follow their patients' requests to prescribe them antibiotics as the effective drug if there is no the strong necessity for this prescription.

Finally, there is no denying the fact that the preventive work contributes to the diminishing rated of infections. Health professionals would facilitate the tough situation in the

field of antibiotic resistance if they carry out permanent and systematic information work, explaining their patients the necessary measures to prevent infections, such as vaccination, safer sexual contacts, and covering nose and mouth while sneezing.

4.8. Personal responsibilities

Great attention is to be paid to the increase of the level of awareness about the great threat of self-treatment among the population.

On the individuals' level, people are to understand that they bear the personal responsibility for their health. Thus, to prevent and manage the extension of antibiotic resistance, people should keep to several rules:

- First, they may take antibiotics only when these medicines are prescribed by a certified health expert.
- Second, individuals are respect health professionals and never insist on prescribing antibiotics for them in case their doctors argue that antibiotics are not the right treatment of their illness.
- Third, patients must always keep to their health professionals' recommendations, which deal with the intake of antibiotics.
- Fourth, individuals are to remember that leftover antibiotics can be extremely dangerous. Therefore, sharing or the usage of the medicines with the expired validity are to be the taboo.
- Fifth, people should remember that there is the strong link between infectious diseases and lack of adequate sanitation. Therefore, individuals have to wash their hands on the regular basis, while coming home or sitting at table to have some meal.

To sum up, to diminish the high rate of occasions of the uncontrolled antibiotherapy and its adverse consequences, several policies can be introduced.

- The measure of the primary importance for diminishing the challenge of the uncontrolled use of medicines is providing the proper conditions when antibiotics should be sold and purchased only with a doctor's prescription. Wise sanctions and penalties are to be imposed for non-compliant providers.

- Hospitals are to establish a Drug and Therapeutic Committee, which would deal with performing the activities of the monitoring process. Laboratory enhancement programs are to be initiated. National antibiotic surveillance is to be arranged on the state level. Hospital surveillance, which would control antibiotic use, is to be arranged.
- There is the string necessity in the new edition of ineffective standard treatment guidelines. Centers for pharmacovigilance are to be originated, dealing with the challenge of incorrect antibiotic prescribing. Finally, the implementation of antibiotics in the agricultural sector, in breeding the cattle and poultry is to be banned.

All these measures would contribute to decreasing the high level of the uncontrolled use of antibiotics in the community that causes antimicrobial resistance with its adverse consequences.

Following the given recommendations, members of the community should remember that none of the modern antibiotics can be effective against the most dangerous forms of antibiotic-resistant bacteria regardless the fact that numerous antibiotics of the new line are developing nowadays (World Health Organization, 2018).

According to Dr Tedros Adhanom Ghebreyesus, who is Director-General of World Health Organization, “there is an urgent need for more investment in research and development for antibiotic-resistant infections including TB, otherwise we will be forced back to a time when people feared common infections and risked their lives from minor surgery” (World Health organization, 2017). To contribute to the welfare of the community, the management of the health industry is expected to provide the policy, which is directed to the financial support of the preventive and controlling measures. To illustrate, investing in researches on creating and developing new effective antibiotics and vaccines would be helpful to decrease the high rates of antibiotic resistance.

5 Comparison of Methods and Procedures of Prescribing Antibiotics

The authorities are expected to pay the due attention to proper methods and procedures, which determine prescribing, selling, and purchasing medicines, and antibiotics in particular. Regulating this key healthcare field, the government can reduce the rates of mortality among the population and decrease the costs for treating diseases which are becoming incurable.

General instructions are expected to be widely implemented to support the proper antibiotic prescription. Government control on pure following these guidelines would contribute to effective antibiotic treatment and protect the correct usage of the medicines to cure infections and decrease the level of the spread of resistant organisms. The experience of the European countries, and Austria in particular, can provide the useful information for Ukraine, where reforms in the health care system have been providing recently.

The following chapters will highlight the key features of prescribing antibiotics in the European countries, giving the illustrative materials in the form of tables for the better perception. Legal support within the sector of prescribing antibiotics in the ambulatory care in European countries will be in the focus of attention.

Chapter 5.2 will highlight methods and procedures of prescribing antibiotics of the best practices in Austria. Table 2 ‘Social indicators in Austria’ will facilitate the understanding of the provided material. The key focus will be on the data, dealing with population growth rate, urban population, urban population growth rate, fertility rate, life expectancy at birth, and population age distribution during the period from 2005 to 2017.

Chapter 5.3 will suggest the useful information about prescribing antibiotics in Ukraine. Table 3 ‘Social indicators in Ukraine’ provides the information about the state of affairs in Ukraine, dealing with the issues of the population growth rate, urban population, fertility rate, life expectancy at birth, and population age distribution. These data illustrate the state of affairs in Ukraine during the period between 2005 and 2017.

5.1. Prescribing antibiotics in the European Countries

Many differences can be observed in the tendencies of using antibiotics in the countries, which belong to the European Union.

According to the surveys, a large part of all antibiotics within the European Union are sold without the doctor's approving. To illustrate, during the period between 2009 and 2013, approximately 5% of all antibiotics were bought without prescription (European Commission, 2017). In 2016, experts observed the growth of the tendency to ignore doctor's examination while purchasing antibiotics. In fact, the rate of self-prescribed antibiotics raised up to 7% (European Commission, 2017). Moreover, in some European countries like Greece and Romania, and Cyprus, the level of antibiotics which were consumed without a prescription increased up to 10% (European Commission, 2017).

Experts distinguish several forms the population of the European countries used antibiotics without a prescription, such as over-the counter (OTC) sales by pharmacists, intake of leftover antibiotics, or acquiring the medicines through the Internet. This phenomenon took place because the lack of medical guidance, dealing with the usage of drugs belonging to the antimicrobial type. As the result, this negative tendency could lead to detrimental effects and to the growth of the amount of drug-resistant microorganisms.

Understanding the strong necessity of the development of the effective strategies to stop the further extension of antibiotic resistance, experts insisted on the providing the proper policies in the field of regulating antibiotic use. To support this initiative, the ARNA project was initiated. Taking place during the period from 2014 to 2016, the ARNA project had the goal to encourage the careful usage of antibiotics in the European countries, highlighting the strong necessity to avoid the intake of antibiotics without a prescription. This initiative aimed to evaluate the real state of affairs in the European countries and support the prudent attitude to the usage of medicines from the antimicrobial group (European Commission, 2017).

To cope with the challenge, the 28 European countries developed the legislative base, which either encourages the prudent use of antibiotics or considers their sale without a prescription illegal. Stating that sales of OTC medications unlawful, the legislation makes the exception for popular antibiotics, such as creams and eye drops (European Commission, 2017). Being extremely diverse, health care legislation makes the great influence on the state of affairs in the field of prescribing, selling, and consumption in the European countries.

The analysis of peer-reviewed articles suggests the following results, dealing with the state of affairs in the field of prescription of antibiotics in European countries.

Table 1: **Legal support within the sector of prescribing antibiotics in the ambulatory care in European countries** (Versporten et al., 2016)

Country	***The obligatory condition to sell and buy antibiotics with a practitioner's prescription only***	***Other healthcare professional who has the legal right to prescribe antibiotics***			
		Pharmacist	***Nurse/ Midwife***	***Non-practicing clinician (researcher, retired)***	***Other***
Spain	Yes, all antibiotics (systemic and topical use)		1		1
Austria					1
Croatia					1
Denmark					1
Greece					1
Iceland					1
Italy					1
Lithuania					1
Luxembourg					1
Malta					1
Norway					1
Portugal					1
France		1	1	1	
Czech Repub.				1	
Hungary				1	
Slovenia				1	
Estonia			1	1	
Ireland			1		
Netherlands			1		
Sweden			1		
Slovakia	Yes, all antibiotics (except for topical use)				1
Belgium				1	
Bulgaria				1	
Cyprus				1	
Poland			1		
UK		1	1		
Latvia					

General practitioners' activity is under state surveillance in thirteen among twenty-one European states (Versporten et al., 2016).

European Member States have developed specific standards and provisions on the regulations, which manage distribution and consumption of antibiotics in Europe. In the major part of the European countries (N = 17 countries, 61%), a delayed prescription is the document permitting the purchase of antibiotics (Versporten et al., 2016). The current legislation prohibits selling antibiotics on a delayed prescription in four European countries, such as the Netherlands, Cyprus, Malta, and Bulgaria (Versporten et al., 2016). The authorities of Greece, Lithuania, Portugal, and Belgium permit OTC trading service on selling antibiotics. Finally, clients have the opportunity to buy antibiotics on the Internet, escaping legal ways of purchasing medicines (Versporten et al., 2016).

In 11 countries (39%), the authorities adopted a third-party reimbursement system in the field of antibiotic prescription (Versporten et al., 2016). Specific legislation, which deals with refunding of antibiotics according to certain categories of disorders, exists in Norway. In Ireland, specific conditions are the reason for refunding of antibiotics. The legislation of Iceland and Malta does not suggest reimbursement. General practitioners' professional activities are under surveillance in 13 out of 21 European countries (Versporten et al., 2016).

Being extremely diverse, specific legislative base targets at regulating procedures of prescribing and selling antibiotic in European countries. However, this legislation can appear to be controversial and unworkable, which often leads to inappropriate antibiotic consumption. Thus, in the sector of selling antibiotics, many differences exist in the European countries. There are several forms of selling antibiotics without a prescription, including OTC sales by pharmacists, intake of leftover antibiotics, or acquiring the medicines through the Internet. Taking place during the period from 2014 to 2016, the ARNA project had the goal to encourage the careful usage of antibiotics in the European countries, highlighting the strong necessity to avoid the intake of antibiotics without a prescription.

The further analysis of methods and procedures of prescribing antibiotics in Austria and Ukraine will give a brief overview of the state of affairs in the healthcare sector in these countries. This illustration would give the opportunity to employ European best practices and escape possible pitfalls in the field of incorrect consumption of antibiotics.

5.2. Methods and procedures of prescribing antibiotics in Austria

Best practices of Austria in the field of health care and solving the challenge of the uncontrolled use of antibiotics in particular, can be explored for their effective implementing in further reforms in Ukraine.

In Austria, distribution of antibiotics is provided through two channels, such as

- hospitals and
- pharmacies or dispensing doctors.

The only legal method of getting antibiotics is buying the medicines according the doctor's prescription.

In Austria, the practice of selling antibiotics rejects other methods of purchasing these medications, like

- obtaining antibiotics over the counter,
- ordering them on websites or
- receiving antimicrobial drugs from foreign countries in the legal way.

In Austria, the over the counter market is extremely restrictive. In fact, purchasing antibiotics over the counter is impossible, aside from several exceptions. Trying to get drugs, individuals cannot obtain any legal opportunity to get antibiotics on the Internet or through another country.

In Austria, the procedures of prescribing antibiotics suggests several steps.

- First, an individual should turn to the "Anmeldung/ Leitstelle".
- Second, the patient has to submit the electronic health care card or passport.
- Third, evaluating the patient's state of health, physicians call individuals according to their emergency priority.
- Fourth, having examined the patient, his/her physician can give him/her the prescription for the antibiotics if their usage is necessary for treating the illness.

In case of prescribing medications, the client is to submit the special document from his/ her physician, confirming the patient's personal needs. Being filled in according to the special form, this document includes the individual's personal information, notifies the necessity of the treatment with antibiotics, and suggests generic names of the medicines and their dosage (M. Daruda, personal communication, May 22, 2018).

Experts of European Centre for Disease Prevention and Control report about the fluctuations in the rate of antibiotics consumption in Austria. To illustrate, approximately 14% of citizens of the country bought antibiotics for systematic use in 2012 (ECDC, 2017).

In 2012, experts draw attention to the growth of the individuals who took the medicines, accounting for about 16.3%. Experts observe the tendency to diminishing the popularity during the period from 2014 up to 2016, when the part of antibiotics consumption was equal to 13.9% in 2014, 14% in 2015, and 13.3% in 2015 (ECDC, 2017). Thus, the number of individuals, who took antibiotics for systematic use has decreased, reaching the maximum in 2013, and demonstrating the minimum rate in 2016.

International organizations pay great attention to the state of affairs in the field of the intake of antibiotics and their selling and purchasing. According to the report of the European Commission, the estimate of over the counter sales of antibiotics is equal to 0% in Austria (The European Commission, 2017).

According to the survey of 2015 within the ARNA project, consumers can purchase antibiotics only in case of submitting a medical prescription in Austria. Practicing doctors or dentists write a prescription of these drugs, while pharmacists, nurses, midwives, and non-practicing clinicians do not enjoy the legal right to prescribe antibiotics to individuals. According to Austria's legislation on reimbursement of antibiotics in the ambulatory care field, an expert must examine an individual who is sick. In fact, telephone consultation with a patient or his/her relative are not the reason for prescribing drugs and doctors may write a prescription for antibiotics only after they have examined patients personally (K.Palchak, personal communication, May 20, 2018). The prescription is valid within the one-month period, and a surveillance, which keeps watch on antibiotic prescribing practices, is not obligatory. The audit procedures can be initiated on a purely voluntary basis in a paper form (Versporten et al., 2016).

Being two European initiatives, European Antimicrobial Resistance Surveillance System (EARS-Net) and European Surveillance of Antimicrobial Consumption (ESAC) suggest relevant information on the state of affairs in the examined field in Austria. EARS-Net permanently monitors the antimicrobial susceptibility, examining the data of laboratory analyses of samples from hospitalized individuals.

Experts note that the information on the microbial flora of the samples taken from hospitalized patients differ from the data obtained while exploring the state of affairs within the

community in Austria. Moreover, in the everyday practice, the antibiotic resistance samples are examined only when the individuals' state of health did not improve (Hoffmann et al., 2011). In Austria, the growth of antibiotic resistance is considered to be the serious challenge for the national healthcare system. According to the survey, about 90% of antibiotics are prescribed to individuals in the outpatient sector (Hoffmann et al., 2011).

Table 2: **Social indicators in Austria**

	2005	**2010**	**2017**
Population growth rate (average annual %)	0.5	0.4	0.6
Urban population (% of total population)	65.8	65.9	66.0
Urban population growth rate (average annual %)	0.5	0.4	0.4
Fertility rate, total (live birth per woman)	1.4	1.4	1.4
Life expectancy at birth (females/males/years)	81.7 /75.9	82.8/ 77.3	83.5 / 78.4
Population age distribution (0-14 and 60+years, %)	1 136.3 /13.8	1 276.0 /15.2	1492.4 / 17.5

(Austria, 2018)

Experts draw attention to the fact that the rate of morbidity as the result of antibiotic resistance infections is increasing in approximately two times (Hoffmann et al, 2011). Austria's national healthcare system is expected to suffer from the inevitable growth of morbidity and premature mortality. This phenomenon would impose significant expenditure on patients' treatment and their staying in hospitals.

Thus, Austria's best practice can be the pattern for the implementation in Ukraine during the process of reforming its national healthcare system to restrict the uncontrolled usage of antibiotics by individuals. The key secret to escape the great rate of incorrect use of antibiotics in

Austria is the implementation of the law, which allows the selling of medicines of the above-mentioned category only with prescriptions.

The further chapter will suggest the information about the current situation, dealing with prescribing antibiotics in Ukraine.

5.3. *Prescribing antibiotics in Ukraine*

In Ukraine, the legislation does not impose any strict requirements to selling or purchasing antibiotics. As the result, individuals can obtain antimicrobial medicines by many channels. Like in Austria, people can obtain antibiotics through two key channels, such as

- hospitals
- pharmacies

Rejecting Austria's practice, the access to buying antibiotics is not restricted in Ukraine. Aside from hospitals and chemist's, individuals can buy the medicines without any prescription through other channels, such as

- getting antibiotics over the counter,
- ordering them on the Internet,
- receiving the medicines from foreign countries in the legal way (K. Barkan, personal communication, May 25, 2018).

This state of affairs requires urgent measures in the national policy to boost the prudent use of antibiotics, establishing the effective procedures of prescribing, selling, and purchasing of the drugs.

The table "Social indicators in Ukraine" (Table 3) illustrates the state of affairs in the sector. As one can see, Ukraine has the indicators of urban population, which correspond to Austria's statistical data in this sector (Table 2). However, the indicators of the growth of urban population and the total population rates are extremely small.

Taking careless attitude to own health, many Ukrainians tend to uncontrolled use of antibiotics that often leads to detrimental consequences. In fact, any self-treatment is not the good solution in case of a serious disease, when a doctor must examine and prescribe the necessary drugs to the ill person (K. Gopshter, personal communication, May 25, 2018).

Table 3: **Social indicators in Ukraine**

	2005	**2010**	**2017**
Population growth rate (average annual %)	- 0.8	-0.5	- 0.5
Urban population (% of total population)	67.8	68.7	69.7
	2005	**2010**	**2017**
Fertility rate, total (live birth per woman)	1.1	1.4	1.5
Life expectancy at birth (females/males/years)	73.4 /61.8	73.8/ 62.2	76.0 / 66.1
Population age distribution %) (0-14 and 60+years, %)	14.6 /20.4	14.1 /21.0	15.5 / 23.2

(Ukraine, 2018)

Both physicians and pharmacists argue that self-treatment can be the serious threat to a person's health, and only doctors may give advice about the necessary treatment to ill people. However, the great majority of individuals ignore this golden rule, turning to pharmacists for advice. Moreover, many people, especially the elderly, believe information from advertisements on television, newspapers, or just a person who does not possess the proper knowledge of medicine. In case of treating individuals with antibiotics, the situation aggravates with the fact that using the drugs in an uncontrolled way, a person can undermine both own health and the community well-being (M. Kovtun, personal communication, May 25, 2018).

Doctors express their concern about the consequences of the uncontrolled usage of antibiotics. In Ukraine, this challenge is extremely serious. In fact, the result of examination of a total of 134 patterns of *S. pneumoniae* and 67 of *H. influenza*, which were collected from eight cities in Ukraine, demonstrate undesirable outcomes. Approximately 87.3% of *S. pneumoniae* turned to be "penicillin susceptible by The Clinical and Laboratory Standards Institute (CLSI) oral breakpoints and 99.3% by CLSI iv breakpoints" (Feshchenko et al., 2016). Taking into account CLSI and Pharmacokinetic/Pharmacodynamics (PK/PD), resistance to

amoxicillin/clavulanic acid (amoxicillin), ceftriaxone and levofloxacin was equal to 100% (Feshchenko et al., 2016). The cephalosporin and macrolide resistance accounted for approximately 95.5% and 88.1%, respectively, implementing CLSI breakpoints (Feshchenko et al., 2016). Trimethoprim/sulfamethoxazole demonstrated the low degree of activity toward pneumococci. Having tested 67 *H. influenzae*, experts revealed that 4.5% were β-lactamase positive and all *H. influenzae* were "fully susceptible to amoxicillin/clavulanic acid, ceftriaxone, ciprofloxacin, cefixime and levofloxacin (all breakpoints)" (Feshchenko et al., 2016).

Despite the fact that the degree of antimicrobial resistance was rather low in respiratory pathogens during the last few years, the resistance to amoxicillin or clavulanic acid (amoxicillin) and levofloxacin causes great concerns among Ukrainian health professionals (Feshchenko et al., 2016). The typical cold is becoming difficult to cure because of the incorrect usage of antibiotics by the Ukrainians (K. Gopshter, personal communication, May 25, 2018).

Unlike citizens of the European countries, the Ukrainians have not developed the wise attitude toward medicine and drugs which must to be prescribed. If most Europeans go to physicians to consult, citizens of Ukraine go to a pharmacy to buy pills (M. Kovtun, personal communication, May 25, 2018). The saddest thing about the Ukrainians is that, unlike many people in European countries, they do not have the opportunity to buy expensive healthy food for keeping their health on the due level. The Ukrainians prefer to purchase medicines instead of keeping healthy diet (O. Dovhan, personal communication, May 23, 2018).

According to Victor Lyasko, who is the head of the non-governmental organization 'Infection Control in Ukraine', antibiotics account for approximately 25% of all medicines Ukrainians buy (Ukraine Crisis Media Center, 2018). There is the tendency of decreasing the doctors' authority among the Ukrainian population. Being attracted by commercials, people purchase antibiotics in pharmacies by a random choice. In many cases, individuals ignore the necessary dosage of antibiotics intake or just cannot calculate it in the proper way.

Nowadays, the Ukraine's authorities have been providing dramatic transformations in the national healthcare system. Being the important aspect of the health care, selling, prescribing, and consumption of antibiotics will undergo the reforms as well. Transformation of habitual methods and procedures of prescribing antibiotics will face the dramatic resistance from all pharmaceutical companies and other business entities and individuals that make money from selling antibiotics in Ukraine. Pharmaceutical companies obtain the profit up to UAH 15 billion,

selling antibiotics in Ukraine (Ukraine Crisis Media Center, 2018). Therefore, providing significant changes in the field of restricting the uncontrolled use of antibiotics will cause their great financial losses, leading to the strong resistance of pharmacy companies.

According to predictions of experts, the great majority of antibiotics will not help in treating diseases by 2050 (Infection control in Ukraine, 2018). The uncontrolled use of antibiotics is the key reasons of this adverse phenomenon, being along with incorrect prescription of antibiotics by practitioners and the uncontrolled adding of medicines to food for animals as their growth support. In fact, just in several years, antibiotics can become useless in curing most typical diseases. Thus, pneumonia, gonorrhea, tuberculosis and postoperative complications will become detrimental for the humanity, taking thousands of lives.

Antibiotics should not be prescribed in the case of viral infections, such as influenza, bronchitis, sinusitis, ear infections, wounds, and as a preventive measure because the medicines of the above-mentioned group cannot destroy viruses. Moreover, serious mutations often take place that lead to increasing bacterial resistance to medical treatment, and to antibiotics in particular. The problem requires an urgent solution because Ukraine’s population will face the necessity of time-consuming and expensive treatment of most infectious diseases and postoperative complications, which will turn into a fatal threat for mankind in the near future.

The Ukrainian legislation allows free access to antibiotics without any consulting a doctor and prescribing the necessary drugs by experts. As the result, the rate of incorrect intake of antibiotics by individuals is high, being the threat to the health of the Ukrainians. This phenomenon requires urgent intervention of the authorities on the national level to prevent the growth of mortality and incurable infectious diseases because of the increase in antibiotics resistance.

6 Living Standards and Incorrect Usage of Antibiotics

It is the common knowledge that living standards determine the great part of the community's welfare. The provided national policy makes the significant influence on the mode of life, which the country's population leads, its values, dreams, leisure time, income, and the state of health as well. The further chapters will provide numerous facts, illustrating the role of the national policy in preventing an incorrect use of antibiotics and will focus on correlations between income inequality and antimicrobial resistance.

Several tables will be suggested to facilitate the comprehension of the provided data. Table 4 will illustrate correlations between income inequality, *E. faecalis* antimicrobial resistance and antimicrobial consumption within European countries. Table 5 will highlight the state of affairs, dealing with *E. faecium*. Table 6 will depict the situation with *E. coli*, while Table 7, Table 8, and Table 9 will illustrate *K. pneumonia*, *S. aureus*, and *S. pneumonia*, respectively.

6.1. The role of the national policy in preventing an incorrect use of antibiotics

There is no denying the fact that the role of the state and the national policy in the guaranteeing its citizens' wellbeing is significant.

The national policy in preventing an incorrect use of antibiotics is directed to a number of issues, such as

- examining and analyzing the rates of illnesses and diseases among the country's population,
- antimicrobial resistance monitoring,
- investigating the state of affairs in the field of selling and buying medicines,
- supporting individuals from low income socially vulnerable levels,
- launching effective reforms to improve the unsatisfactory situation.

A review of the current state of affairs in the aspect of illnesses and diseases among the country's population gives the picture of potential threats to be escaped. In fact, this measure is effective to understand the degree of danger and provide programs for escaping an incorrect use of antibiotics.

Antimicrobial resistance monitoring plays the dramatic role in the case of preventing an incorrect use of antibiotics. In fact, investigating antimicrobial resistance in pathogens, which cause major communicable diseases, is truly considered the issue of great public health concern. The saddest fact is that resistance has emerged even to the most effective antimicrobial agents, such as carbapenems. Antimicrobial resistance monitoring demonstrates that the free access to practically all the range of antibiotics in pharmacies, on the Internet, over the counter, and through other ways has led to the wide consumption of these medicines by people and their significant implementation in the agriculture. To prevent the aggravation of this negative tendency, the authorities are to provide definite policies in diminishing an incorrect use of antibiotics.

Investigating the state of affairs in the field of selling and buying medicines is the important step to understand the current circumstances and launch the necessary reforms.

All the above-mentioned issues play the significant role in preventing an incorrect use of antibiotics. However, supporting individuals from low income socially vulnerable levels would be the effective measure to improve the situation in this field.

A nation’s economic policy and living standards of a state’s population determine numerous outcomes within the community, and individuals’ state of health among them. Income inequality and poor living standards of the population make the significant effect on the consumption of antibiotics and the rates of developing antibiotic resistance. As the economics of different countries vary, living standards and the levels of antibiotic resistance are not similar in these countries.

There is no denying the fact that diseases caused by bacteria are the key cause of high mortality rates in low-income countries. The great majority of the negative consequences can be prevented with encouraging personal hygiene, immunization of the population, and environment sanitation. Nevertheless, the antibacterial treatment remains the key remedy under the above-mentioned conditions.

Individuals can obtain the medicines through a variety of ways, including pharmacies, hospitals, medicine stalls, and over the counter sales on the Internet. The situation aggravate a number of factors, such as

- absence of proper regulation of the antibiotics consumption on the national level,
- poor developed supervisory systems,

- unstable drug supply, and ineffective laboratory services.

As the result, high profit margins of expensive drugs and antibiotics in particular, can induce inappropriate practices.

On the national level, insufficient directing funds to the healthcare results in further increased expenditure on treating diseases, which are becoming incurable because of antibiotics resistance.

World Health Organization draws attention that the key reasons of antimicrobial resistance include "poor or non-existent IPC programmes, poor-quality medicines, weak laboratory capacity, inadequate surveillance and poor regulation or enforcement of regulations to assure access to high-quality antimicrobial medicines and their appropriate us" (World Health Organization, 2017). This, launching effective reforms will be the necessary step to improve the current situation.

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6.2. Correlations between income inequality and antimicrobial resistance

Living on prosperous area compared with the deprived territories is associated with high-levels of odds of antibiotic resistance for all eight antibiotics analyzed. Examining the correlation between living conditions and antibiotic resistance, experts discovered that "the magnitude of these associations included an OR of 2.04 (95% CI 1.03-3.07) for cefalexin, 2.16 (95% CI 1.16-4.05) for ciprofloxacin, 2.47 (95% CI 1.08-5.66) for nitrofurantoin and 1.33 (95% CI 1.07-1.75) for trimethoprim" (Nomamiukor et al.,2015).

The key point of the issue is that the amount of antibiotic consumption influences the rates of antimicrobial resistance. In fact, the level of antibiotic resistance grows correspondently to the amount of antimicrobial drugs the population of a country consumes. To illustrate, *E. faecalis* resistance to aminopenicillins is tightly connected with living standards of individuals, demonstrating r= 0.54, 95% confidence interval (Cl) 0.49 to 0.6 (Kirby & Herbert, 2013). It reveals the moderate level of connections between vancomycin resistance, 0.73, 0.68 to 0.79, and increased level of gentamicin resistance, which accounts to 0.62, 0.55 to 0.69 (Kirby & Herbert, 2013).

Table 4: **Correlations between income inequality, antimicrobial resistance *(E. faecalis)* and antimicrobial consumption within European countries**

Bacterial species	***Antibiotic group***	***Pooled correlation***	***95% Confidence interval***	***p-value***
E. faecalis	Aminopenicillins	0.54	0.49 to 0.60	<0.0001
	High level gentamicin	0.62	0.55 to 0.69	<0.0001
	Vancomycin	0.73	0.68 to 0.79	<0.0001

(Kirby & Herbert, 2013)

E. faecium vancomycin resistance demonstrates the moderate level of dependence on income inequality, which is equal to 0.72, 0.64 to 0.80 (Kirby & Herbert, 2013). *E. faecium* resistance to the increased level gentamicin and aminopenicillins reveals the low level of interrelation, such as 0.38, 0.17 to 0.58 and 0.26, 0.06 to 0.44, respectively (Kirby & Herbert, 2013).

Table 5: **Correlations between income inequality, antimicrobial resistance *(E. faecium)* and antimicrobial consumption within European countries**

Bacterial species	***Antibiotic group***	***Pooled correlation***	***95% Confidence interval***	***p-value***
E. faecium	Aminopenicillins	0.26	0.06 to 0.44	0.012
	High level gentamicin	0.38	0.17 to 0.58	<0.0001
	Vancomycin	0.72	0.64 to 0.80	<0.0001

(Kirby & Herbert, 2013)

What is the difference between Table 4 and 5??? This is not clear for the reader

E. coli resistance to aminoglycosides is tightly connected with poor living standards as well, demonstrating r=0.84, 95% CI: 0.80 to 0.88 (Kirby & Herbert, 2013). *E. coli* resistance to aminopenicillins, fluoroquinolones and 3rd generation cephalosporins reveals the moderate levels of dependence on income inequality, which were equal to 0.73, 0.70 to 0.77; 0.71, 0.6 to 0.82 and 0.7, 0.68 to 0.73, respectively(Kirby & Herbert, 2013). *E. coli* resistance to carbapenems

demonstrates the low level of dependence on living standards, accounting to 0.34, 0.18 to 0.49 respectively (Kirby & Herbert, 2013).

Table 6: **Correlations between income inequality, antimicrobial resistance *(E. coli)* and antimicrobial consumption within European countries**

Bacterial species	***Antibiotic group***	***Pooled correlation***	***95% Confidence interval***	***p-value***
E. coli	Aminoglycosides	0.84	0.80to 0.88	<0.0001
	Aminopenicillins	0.73	0.70 to 0.77	<0.0001
	Carbapenems	0.34	0.18 to 0.49	<0.0001
	Third generation cephalosporins	0.70	0.68 to 0.73	<0.0001

(Kirby & Herbert, 2013)

K. pneumonia reveals the following resistance to aminoglycocosides, third generation cephalosporins and fluoroquinolones, which accounts for r=0.50, 95% CI: 0.42 to 0.57; 0.57, 0.54 to 0.60 and 0.50, 0.42 to 0.57, respectively, demonstrating the moderate degree of dependence on income inequality (Kirby & Herbert, 2013). Carbapenem resistance is connected with living standards in a low degree, giving the results like 0.33, 0.29 to 0.37 correspondingly (Kirby & Herbert, 2013).

Table 7: **Correlations between income inequality, antimicrobial resistance *(K. pneumonia)* and antimicrobial consumption within European countries**

Bacterial species	***Antibiotic group***	***Pooled correlation***	***95% Confidence interval***	***p-value***
K. pneumonia	Aminoglycosides	0.50	0.42 to 0.57	<0.0001
	Carbapenems	0.33	0.29 to 0.37	<0.0001
	Third generation cephalosporins	0.57	0.54 to 0.60	<0.0001
	Fluoroquinolones	0.50	0.42 to 0.57	<0.0001

(Kirby & Herbert, 2013)

S. aureus methicillin demonstrates the high degree of connections, which correlate as r=0.86, 95% CI: 0.83 to 0.89. S. aureus rifampicin resistance and income inequality is equal to 0.56, 0.52 to 0.60.

Table 8: **Correlations between income inequality, antimicrobial resistance *(S. aureus)* and antimicrobial consumption within European countries**

Bacterial species	***Antibiotic group***	***Pooled correlation***	***95% Confidence interval***	***p-value***
S. aureus	Methicillin	0.67	0.65 to 0.69	<0.0001
	Rifampicin	0.63	0.56 to 0.69	<0.0001

(Kirby & Herbert, 2013)

S. pneumonia is resistant to penicillin and macrolides in a low degree, demonstrating the correlation with living standards equal to r=0.34, 95% CI: 0.25 to 0.43 and 0.28, 0.08 to 0.47 (Kirby & Herbert, 2013).

Table 9: **Correlations between income inequality, antimicrobial resistance *(S. pneumonia)* and antimicrobial consumption within European countries**

Bacterial species	***Antibiotic group***	***Pooled correlation***	***95% Confidence interval***	***p-value***
S. pneumonia	Penicillin	0.34	0.25 to 0.43	<0.0001
	Macrolides	0.28	0.08 to 0.47	<0.0001

(Kirby & Herbert, 2013)

Thus, exploring the analyzed species *E. faecalis, E. faecium, E. coli, K. pneumoniae, P. aeruginosa, S.* aureus *and S. pneumonia,* one can observe the positive correlation between living standards and the degree of antibiotic resistance.

According to the statistics, incorrect usage of antibiotics is tightly related to living standards of the population, living on the territory. Belonging to low-income social levels,

individuals tend to buy substandard antibiotics as the cheapest drugs which often can be of low quality because of incorrect dosage or absence of active ingredients.

The correlation between the degree of income inequality and antimicrobial resistance is closely related with other factors, which makes effect on antibiotic resistance. They include culture, health expert traditions that deal with prescription of medicines, individuals' awareness of the possible adverse effect antibiotics can lead to, the level of infection control on the national scale, waves of migration, and the tendencies of implementing antibiotics in the agricultural sector (Kirby & Herbert, 2013).

To sum up, there is the tight connection between living standards and individuals' incorrect intake of antibiotics. The income level of the population makes the effect of individuals' capacity to buy effective medicines. Lacking the access to drugs of high quality, individuals often purchase low-standard antibiotics that boost the rate of antimicrobial resistance. High profit margins of expensive drugs, and antibiotics in particular, can induce inappropriate practices. Innovative PC programs, high-quality medicines, and profound laboratory capacity would contribute to solving the problem of the uncontrolled usage of antibiotics.

Taking into account the above-mentioned recommendations, the authorities should pay the due attention to financial aspect of the challenge. Antibiotics reimbursement would contribute to diminishing the level of the uncontrolled use of antibiotics, saving thousands of lives. Thus, living standards make the great influence on the conduct patterns of individuals and on their incorrect usage of antibiotics in particular. The role of the state and the national policy as the guarantee of its citizens' wellbeing is significant. Income inequality and poor living standards of the population make the dramatic adverse effect on the consumption of antibiotics and the rates of developing antibiotic resistance. Belonging to low social levels, an individual often undergoes of detrimental outcomes of his/her uncontrolled use of antibiotics because of various reasons.

The lack of proper regulation of the antibiotics consumption on the national level, poor developed supervisory systems, unstable drug supply, and ineffective laboratory services aggravate the situation. As the result, high profit margins of expensive drugs, and antibiotics in particular, can induce inappropriate practices.

The provided analysis of species *E. faecalis*, *E. faecium*, *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. aureus* and *S. pneumonia*, one can observe the positive correlation between living standards and the degree of antibiotic resistance.

7 Conclusion

To sum up, the problem of the uncontrolled use of antibiotics still remains acute because the long-term ignorance of surveillance in the sector of prescribing, selling, and purchasing medicines, and antibiotics in particular, has led to the detrimental consequences. Being the panacea from serious diseases at the beginning of the twentieth century, antibiotics are gradually becoming useless.

To give the complete picture of the problem, this study implemented a range of qualitative methods:

- a structured literature review,
- the method of a historical investigation,
- personal experience and interview methods,
- the method of a comparative analysis.

These research techniques helped to demonstrate the relevant picture of the state of affairs in the field.

The factors, which lead to the incorrect use of antibiotics, are mixed and interrelated. They include several causes of this phenomenon, such as

- low restrictions of selling antibiotics to individuals without a prescription
- incomplete course of treatment
- individuals' insufficient knowledge of medicine and their previous successful experience with intake of antibiotics
- self-medication
- treatment of viral infections with antibiotics
- failure to control the dosages of antibiotics
- uncontrolled and/or illegal use in animals
- low attention of the authorities to the legislative aspect

However, the low and even absence of restrictions to sell antibiotics to individuals without a prescription is the key cause of the incorrect implementation of the medicines of the above-mentioned category.

The best practices are explored to be launched in the life. As one can see, individuals and business entities are obliged to demand submitting prescriptions for selling antibiotics in all European countries, and in Austria in particular.

In Austria, distribution of antibiotics is provided through two channels, such as

- hospitals and
- pharmacies or dispensing doctors.

The only legal method of getting antibiotics is buying the medicines according the doctor's prescription.

Unfortunately, Ukraine has not developed the proper legislative base which would regulate the process. Aside from hospitals and chemist's, individuals can buy the medicines without any prescription through other channels, such as

- getting antibiotics over the counter,
- ordering them on the Internet,
- receiving the medicines from foreign countries in the legal way.

Establishing special committees and laboratory enhancement programs would contribute to further managing the ineffective use of medicines and decrease the high rates of antibiotic resistance. National antibiotic surveillance is to be arranged on the state level. Regulating this key healthcare field, the government can reduce the rates of mortality among the population and decrease the costs for treating diseases which are becoming incurable.

Nowadays, Ukraine's government is providing dramatic transformations of the national healthcare system. As Austria is considered to be the country where the government has developed one of the most effective systems of measures and procedures in Europe to decrease the detrimental consequences of the uncontrolled use of antibiotics, Austria's experience is under the consideration.

In Austria, the sales of antibiotics to individuals without a prescription is forbidden. According to Austria's legislation on reimbursement of antibiotics in the ambulatory care field, an expert must examine an individual who is sick. In fact, telephone consultation with a patient or his/her relative are not the reason for prescribing drugs and doctors may write a prescription for antibiotics only after they have examined patients personally. Unlike Austria, the access to buying antibiotics is not restricted in Ukraine. Individuals can buy the medicines without any prescription in pharmacies and on the Internet.

Implementation of European best practices and escape possible pitfalls in the field of incorrect consumption of antibiotics.

According to the statistics, incorrect usage of antibiotics is tightly related to living standards of the population, living on the territory. Belonging to low-income social levels, individuals tend to buy substandard antibiotics as the cheapest drugs which often can be of low quality because of incorrect dosage or absence of active ingredients.

The correlation between the level of living standards and antibiotic resistance is tightly connected with other factors, the antimicrobial resistance depends on. They include culture, health expert traditions, which deal with prescription of drugs, individuals' awareness of the possible negative effect antibiotics can lead to, the level of infection control on the national scale, waves of migration, and the traditions of implementing antibiotics in the agricultural sector.

Thus, restricting the sales of antibiotics without a prescription, establishing special committees and laboratory enhancement programs, and paying due attention to financial aspect and antibiotics reimbursement would contribute to diminishing the level of the uncontrolled use of antibiotics in Ukraine, saving thousands of lives.

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Abstract

The paper deals with the challenge of the uncontrolled use of antibiotics, which is truly considered to be the serious threat to human health and development. The theme is relevant because bacteria's mutation and resistance are constantly developing, making the intake of popular antibiotics useless. This negative phenomenon becomes the cause of permanently growing rates of mortality cases.

As the rate of antibiotic resistance varies in different European countries, this research explores the issue of the incorrect use of antibiotics on the examples of Ukraine and Austria. While significant reforms have been providing in Ukraine recently in the healthcare field, Austria's best practices would be extremely useful as this country has developed the effective techniques of the settling the challenge of incorrect usage of medicines.

Exploring the issue of the uncontrolled use of antibiotics in Europe, this study implements a range of qualitative methods, such as the method of a historical investigation, the method of a structured literature review, personal experience and interview methods, and the method of a comparative analysis.

The paper comprises introduction, five chapters like the research methods, factors causing occasions of uncontrolled antibiotherapy, ways to reduce occasions of uncontrolled antibiotherapy, comparison of methods and procedures of prescribing antibiotics, living standards and incorrect use of antibiotics, conclusion, and references.

This study investigates the theoretical and evidence-based information in medical journals and databases up to 2018, which were published in official medical sources, such as surveys in PubMed, information shared on the websites of Ministry of Healthcare of Ukraine and the World Health Organization.

The paper employs the Health and Demographic Surveillance Sites and evidence-based guidelines for getting details. Interviews with practitioners and pharmacists in both Ukraine and Austria are taken into account as well. Finally, the personal experience as a pharmacist and a medical representative contributes to better understanding of the issue under analysis.

Key words: uncontrolled use of antibiotics, bacteria's mutation, antibiotics resistance.

Zusammenfassung

Die vorliegende Diplomarbeit befasst sich mit der Problematik eines unkontrollierten Konsums von Antibiotika, der in der Tat als ernsthafte Bedrohung für die menschliche Gesundheit und Entwicklung angesehen wird. Das Thema ist relevant, weil die Mutation und die Resistenz von Bakterien sich ständig weiterentwickeln und die Einnahme von gängigen Antibiotika nutzlos machen. Dieses negative Phänomen wird die Ursache für permanent steigende Sterblichkeitsraten.

Da die Antibiotikaresistenzrate in verschiedenen europäischen Ländern unterschiedlich ist, untersucht diese Forschungsarbeit das Problem des falschen Einsatzes von Antibiotika an Beispielen der Ukraine und Österreich. Während in der Ukraine in jüngster Zeit bedeutende Reformen im Gesundheitswesen durchgeführt wurden, wäre das Erfolgsmodell Österreichs äußerst nützlich, da dieses Land die wirksamen Techniken entwickelt hat, um die Problematik eines falschen Einsatzes von Medikamenten zu bewältigen.

Die Forschungsarbeit untersucht das Problem des unkontrollierten Konsums von Antibiotika in Europa und setzt eine Reihe von qualitativen Methoden, wie die Methode einer historischen Untersuchung, die Methode einer strukturierten Literaturrecherche, persönliche Erfahrungen und Befragungsmethoden sowie die Methode eines vergleichenden Analyse um.

Die vorliegende Diplomarbeit enthält die Einleitung, fünf Kapitel: Forschungsmethoden, Faktoren, die zu unkontrollierter Antibiotikagabe führen, Möglichkeiten, die Häufigkeit unkontrollierter Antibiotikatherapien zu reduzieren, Vergleich von Methoden und Verfahren zur Verschreibung von Antibiotika, Lebensstandards und falscher Einsatz von Antibiotika, Schlussfolgerung und Literaturnachweis.

Diese Forschungsarbeit untersucht die theoretischen und evidenzbasierten Informationen in medizinischen Zeitschriften und Datenbanken bis zum Jahr 2018, die in offiziellen medizinischen Quellen veröffentlicht wurden, wie etwa Studien in PubMed, Informationen, die auf den Websites des Gesundheitsministeriums der Ukraine und der Weltgesundheitsorganisation veröffentlicht wurden.

Die vorliegende Diplomarbeit enthält Verweise auf die Gesundheits- und Demografiestudien-Websites und evidenzbasierte Richtlinien. Interviews mit Praktikern und Apothekern in der Ukraine und in Österreich werden ebenfalls in Betracht gezogen. Schließlich trägt die persönliche Erfahrung als Apotheker und medizinischer Vertreter zu einem besseren Verständnis des zu analysierenden Themas bei.

Schlüsselwörter: unkontrollierter Konsum von Antibiotika, Bakterienmutation, Antibiotikaresistenz.