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Review

PREVALENCE OF SELF-MEDICATION WITH ANTIBIOTICS IN EUROPE: A SCOPING REVIEW

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Summary

The most common cause of antibiotic resistance is the irrational use of antibiotics. Most of the irrational use of antibiotics is related to use in the community and the prevalence of self-medication in different populations. This review aimed to explore the prevalence of self-medication with antibiotics in European countries and the main sources of antibiotics. An online search of Pubmed and Scopus was conducted to identify relevant studies. A two-phase mapping approach was used. All steps in this scoping review were carried out using the Covidence® software. A total of 22 studies were included. The prevalence of self-medication with antibiotics is greater in Southern European countries than in Northern and Western European countries. The main sources of over-the-counter antibiotics are community pharmacies and leftovers from previous courses. Targeted communication strategies and interventions are needed to reduce the overuse of antibiotics and to slow down the spread of antibiotic resistance until new classes of effective antibiotics are developed.

Keywords: antibiotics, self-medication, a scoping review

Introduction

According to the World Health Organization, more than 25,000 people die annually in European hospitals as a result of antibiotic resistance (ABR), with costs reaching over 1.5 billion euros [1]. The most common cause of antibiotic resistance is the irrational use of antibiotics. The WHO states that medicines are used rationally when patients receive the appropriate medicines, for appropriate indications, in doses that meet their requirements, for an adequate period, at the lowest cost both to them and society, and with appropriate information. Irrational or unnecessary use of medicines occurs when one or more of these conditions is not met. Long-term antibiotics intake leads to a natural selection process that allows the growth of resistant bacteria at the expense of sensitive ones. It is believed that part of antibiotics misuse is also the

result of the lack of knowledge among patients and the practice of self-medication among some of them [2].

Self-medication with antibiotics is a major cause not only of increasing antibiotic resistance but is also associated with other risks such as drug interactions and the masking of symptoms of underlying diseases [1]. The most common practices reported in the literature include short duration of treatment, inappropriate dosage (too low), sharing medication with household members, and discontinuation of treatment after initial improvement of symptoms [3]. The emergence of resistance to available antimicrobial agents will further limit the already limited therapeutic choices for treating common infectious diseases in many countries.

The prevalence of antibiotic resistance varies between European countries – southern European countries have higher resistance rates than the Nordic countries [4]. Higher antibiotic prescription and consumption rates are connected to high ABR [5]. Most of the irrational use of antibiotics is related to use in the community and the prevalence of self-medication in different populations [6]. One of the main drivers of self-medication with antibiotics is their accessibility without a prescription despite the legal framework stating that antibiotics should be dispensed with a medical prescription and that over-the-counter (OTC) sales of antibiotics are illegal in all Member States of the European Union (EU) [6-9]. Leftover antibiotics from earlier prescriptions also pose a threat. A systematic review by Ocan et al. analyzed data from 34 studies published between 2002 and 2012 that examined the burden, risk factors, and effects of antibiotic self-medication in low- and middle-income countries. The results showed that the most common symptoms and diseases self-treated by patients with antibiotics

are respiratory infections (50%), fever (47%), and gastrointestinal diseases (45%). The most common source of over-the-counter antibiotics was pharmacies (65.5%), followed by leftover medicines in households (50%) [9].

This scoping review aimed to explore the prevalence of self-medication with antibiotics in European countries and the main sources of antibiotics.

Methods

Search strategy and selection criteria

A systematic scoping review is a type of evidence synthesis method aimed at mapping the range of literature that exists on a specific topic of interest and focusing on the research questions by charting existing research findings and identifying research gaps [10]. The study was guided by a scoping review framework, and conforming to the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) guidelines by Arksey and O'Malley [10]. The population, intervention, comparison, and outcome (PICO) framework for determining the eligibility of the studies for the primary research question is presented in Table 1.

We conducted a systematic literature search of Scopus and PubMed databases. The database search occurred in December 2021 and was updated in September 2022. The following keywords were used: (self-medication) AND (antibiotics) AND (Europe).

Screening and selection of relevant literature

All steps in this scoping review were carried out using the Covidence® software. Duplicates were removed before the title and abstract screening using the algorithm provided by

Table 1. Framework for determining the eligibility of research questions (PICO).

Criteria	Determinants
Population	Adults
Intervention	Self-medication with antibiotics
Comparison	Not applicable
Outcomes	Primary outcome: prevalence Secondary outcome: source of antibiotics for self-medication
Setting	European countries

Covidence®. The articles were selected in two stages. In the first stage, two reviewers (HL and SS) screened the titles and the abstracts of the identified publication according to the eligibility criteria (Table 2). There were no discrepancies in the reviewers' responses at this stage. A full article screening was performed, and discrepancies were resolved by a third reviewer (NV). The remaining articles were assessed for eligibility for data extraction.

The process of obtaining relevant studies is depicted through a PRISMA flow diagram [11].

Data extraction

Data was extracted after a full-text review. Relevant information related to the research aim was extracted using a standardized data

extraction form. Any uncertainty about extracted data was discussed with another investigator (SG). Data were extracted from the following domains: lead author and year; country; the aim of the study; study design; population; primary (prevalence of SMA) and secondary (source of antibiotics) outcomes.

Results

Using the search strategy, 171 studies were identified (170 from PubMed and Scopus and one from a reference search). After title and abstract screening, 47 studies were assessed for eligibility and were retained for full-text review (Figure 1). Finally, 22 full-text studies fulfilled the stipulated requirements for inclusion.

Table 2. Eligibility criteria for inclusion of publications in the review.

Inclusion criteria	
Studies conducted in Europe	
Studies reporting the prevalence of self-medication with antibiotics and/or sources of antibiotics for self-medication	
Date of publication 2000-2002	
Exclusion criteria	
Studies conducted in non-European countries	
Studies that do not report on the primary outcome of the study	
Studies focused on a specific pathology or population (medical students, children, etc.)	
Studies published before 2000	
Non-English language studies	

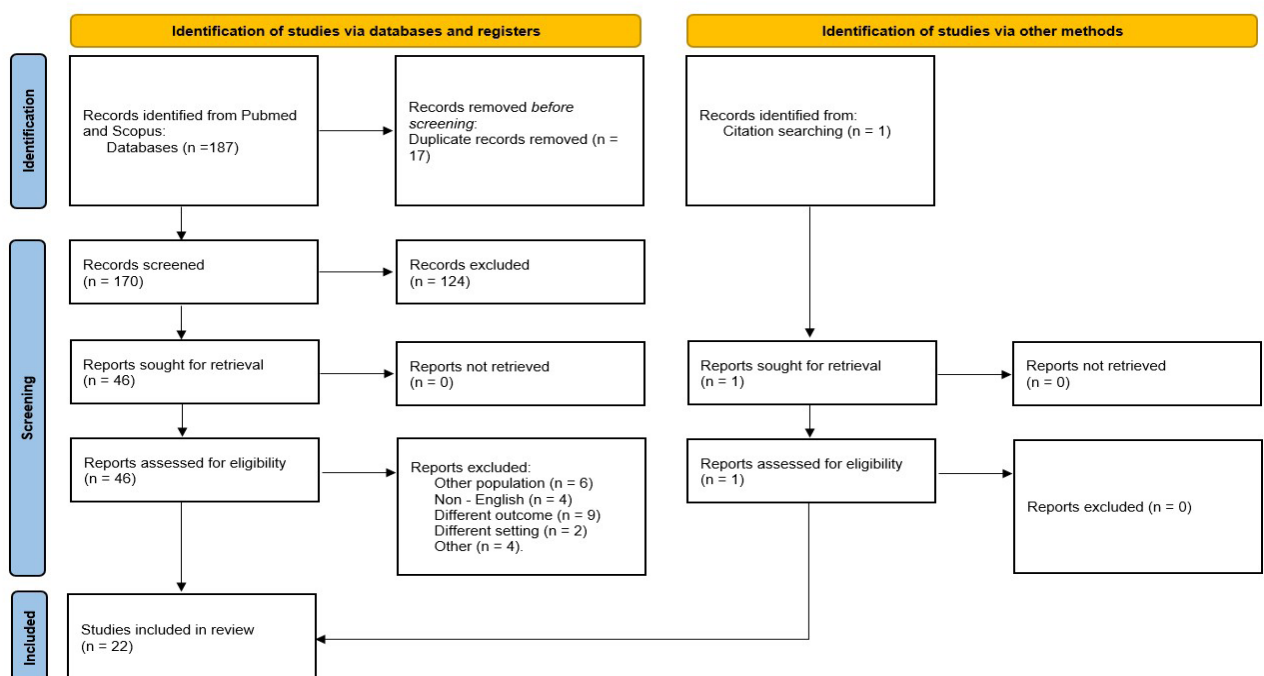


Figure 1. PRISMA flow diagram of study selection

Characteristics of the included studies

A total of 22 studies were identified and included in this scoping review. Their characteristics are presented in Table 3. The studies were mainly cross-sectional questionnaire-based by design [3,8,12-28]. Two studies were conducted as a structured interview [29,30] and one as a semi-structured interview [31]. The number of participants ranged from 200 to 19514, and publication dates ranged from 2002 to 2018. All of the studies had been undertaken in European countries (and Israel) and conducted among the general population in different countries. They reported the non-prescription use of antibiotics as a primary or secondary endpoint. (Table 3).

Prevalence of self-medication with antibiotics

The prevalence of SMA was low in Northern Europe – 4.5% in Denmark [14] and 0.43% in Sweden [20]. Higher rates of SMA were observed in Southern and Eastern Europe with big differences among the countries – from 18.9% in Portugal [8] to 43% in Bulgaria [28] and 44.6% in Greece [3]. Similar rates are observed in Lithuania (22%-31%) [23,24]. Israel is among the countries with the lowest SMA rates – 5.1% [25]. Overall, SMA is greater in Southern European countries than in Northern European countries.

Sources of antibiotics for self-medication

Almost all of the identified studies explored the sources of antibiotics for self-medication among the people who practice it. Most often people obtained antimicrobial medications directly from pharmacies without a prescription and through leftovers from previous prescriptions. Family and friends were also common sources of antibiotics.

Discussion

This study sought to map the prevalence of self-medication with antibiotics among European countries. The use of antibiotics without a prescription is a global phenomenon despite the prescription-only status of these products

[35,36]. The overall reported prevalence of SMA in the literature is 39% [36] and it was estimated in countries where antibiotics are labeled as prescription-only medications and people are undergoing SMA without proper medical consultation [37]. This scoping review also revealed that the prevalence of SMA is much higher in Southern European countries than in Northern and Western Europe. Southern and Eastern European countries that report high levels of antibiotic resistance also have a high prevalence of nonprescription antibiotic use [22]. Many studies have found a connection between socioeconomic status and antibiotic use. Antibiotic consumption is fast increasing in low- and middle-income countries [38] which often face challenges in addressing antibiotic resistance [37].

Easy access to antibiotics without a prescription is the main driver of SMA. All of the identified studies reporting sources of antibiotics stated that self-medicating patients obtained them from community pharmacies without prescription despite the strict EU policies and regulations. Eliminating the possibility of obtaining an antimicrobial product without a prescription will lead to lower rates of SMA. Moreover, proper testing and diagnosis before antibiotic treatment will lead to better clinical results and will lower the humanistic and economic burden of the most frequent infections [39]. Besides OTC selling, another source of antibiotics is leftovers from previous courses. Our review showed that the use of leftovers was most prevalent in Southern, Northern, and Western European countries, whereas obtaining antibiotics OTC is the major source of self-medication in Eastern Europe. This was confirmed in other studies too [22,40]. The presence of leftovers indicated that patients' adherence to antibiotic therapy is low. On the other hand, policies on rational dispensing are needed such as dispensing precise numbers rather than whole packages [41]. A review by Lescure et al. demonstrated that dispensing whole packages leads to a higher number of people who are in possession of leftover antibiotics and that a broad range of determinants of SMA are related to the patient level [40]. Druică et al. suggest that self-medication is strongly predicted by non-cognitive behavioral factors such as pre-existing habits and similarity of symptoms [42]. Self-medication has become a form of routine [43].

Table 3. Characteristics of included studies.

Study #	Author, year, country	Aim	Study design	Setting	Participants (N)	Prevalence of SMA	Sources of non-prescribed antibiotics among the self-medicated
1	Borg et al., 2002 [32] Malta	To establish the level of over-the-counter acquisition of antibiotics in Malta and also provide an insight into factors and perceptions associated with such practices	Questionnaire-based study	General Maltese adult population	291	19.19% (95% CI 13.6-25.9)	Bought at pharmacies without a prescription (76.06% (95%CI 68.2-82.8)) Leftovers (32.22% (95%CI 27.8-43.2))
2	Klemenc-Ketis et al., 2011 [33] Slovenia	To determine the incidence of self-medication and evaluate the effect of sex on self-medication practices among the Slovenian university student population	Cross-sectional anonymous web-based questionnaire study	Students at the University of Ljubljana	1294	31.99%	NR
3	Muscat et al., 2006 [34] Denmark	To describe the patterns of antibiotic use in the Danish community.	A cross-sectional, descriptive population survey was conducted using a self-administered postal questionnaire	General adult population	1959	4.5%	Leftovers (64%)
4	Carrasco-Garrido et al., 2008 [35] Spain	To describe the prevalence of self-medicated drug use among the Spanish adult population and to identify the predictive factors of such self-medication in Spain.	A descriptive, cross-sectional study	General adult population (secondary data collected by the Spanish National Health Survey)	19514	17.7%	NR
5	Demoré et al., 2017 [25] France	To evaluate knowledge and behaviors concerning antibiotics and bacterial resistance in the French population, and identify the socio-demographic factors associated with a high level of such knowledge and appropriate behaviors	Questionnaire-based survey	Northeast France (Nancy)	200	18.0%	NR

Study #	Author, year, country	Aim	Study design	Setting	Participants (N)	Prevalence of SMA	Sources of non-prescribed antibiotics among the self-medicated
6	Zucco et al., 2018 [36] Italy	To establish the extent of Internet and Social Media use to search for antibiotic-related information and the potential implications in health care among the adult population in Italy	Cross-sectional questionnaire-based study	Parents of public school students	913	32.3%	NR
7	Drozd et al., 2015 [27] Poland	To determine in what way patients understand this kind of therapy and what an antibiotic is in the context of a drug of natural origin, how do patients behave while administering antibiotics to themselves and their children? To highlight situations in which patients use antibiotics and the frequency of use of antibiotics, compared to natural methods of treatment	Questionnaire-based study	Adult population in hospitals and health centers in the Lublin Region, Poland	609	10.3%	Bought at pharmacies without a prescription (8.2%) Leftovers (5.5%) Family and acquaintances (4%)
8	Napolitano et al., 2013 [28] Italy	To investigate the level of knowledge, attitudes, and behaviors regarding antibiotics of the general population in Italy, and assess the correlates of these outcomes of interest	Cross-sectional questionnaire-based study	Parents of students attending public primary and secondary schools	419	32.7%	Leftovers (68.6%) Bought at pharmacies without a prescription (43.2%)
9	Svensson et al., 2004 [12] Sweden	To present details of the self-reported use and self-medication with antibiotics in a Swedish population.	Questionnaire-based study	General adult population	690	0.43%	NR
10	Tripković et al., 2018 [13] Serbia	To identify predictors of self-medication with over-the-counter and prescription (Rx) medicines without doctors' prescription	Cross-sectional, questionnaire-based epidemiological study	General population over 15 years of age (data from Serbian National Health Survey 2013)	14623	2.5% (95% CI 2.3-2.8)	NR

Study #	Author, year, country	Aim	Study design	Setting	Participants (N)	Prevalence of SMA	Sources of non-prescribed antibiotics among the self-medicated
11	Grigoryan et al., 2006 [14] 19 European countries (Austria, the Netherlands, Sweden, United Kingdom, Ireland, Denmark, Italy, Malta, Luxembourg, Belgium, Spain, Israel, Romania, Czech Republic, Slovakia, Lithuania, Slovenia, Croatia, and Poland)	To estimate and compare the prevalence of actual self-medication and at-risk for self-medication with antimicrobial drugs in participating countries	Questionnaire-based study	General adult population	15548	Rate per 1000 respondents (95% CI): The Netherlands 1 (0.2-4) Sweden 4 (0.9-12) Denmark 7 (4-12) Luxembourg 9 (3-19) Belgium 9 (5-15) Malta 56 (38-79) The Czech Republic 7 (3-13) Slovakia 42 (27-63) Romania 198 (160-235) Austria 9 (2-23) UK 12 (5-23) Ireland 14 (7-25) Israel 15 (6-31) Italy 62 (33-103) Spain 152 (103-201) Slovenia 17 (10-26) Croatia 31 (1-9-48) Poland 33 (23-47) Lithuania 210 (181-239)*	Eastern countries: Bought at pharmacies without a prescription (68%), leftovers (26%) Southern, northern & western countries: leftovers (51% in southern and 44% in northern and western countries), obtained directly from the pharmacy ((46% in southern and 19% in northern and western countries). Relatives or friends (8% for all countries)
12	Skliros et al., 2010 [3] Greece	To estimate the use of antibiotics without medical prescription in a sample of the rural population presenting in primary care in southern Greece.	Cross-sectional questionnaire-based study	Rural population in Southern Greece	1139	44.6%	Obtained directly from the pharmacy without a prescription (76.2%) Leftovers (15.3%) Friends/family (15.3%)

Study #	Author, year, country	Aim	Study design	Setting	Participants (N)	Prevalence of SMA	Sources of non-prescribed antibiotics among the self-medicated
13	Ramalhinho et al., 2014 [8]Portugal	To estimate the prevalence of self-medication with antibiotics and evaluate the predictive factors associated with such self-medication.	Cross-sectional questionnaire-based study	General population in Algarve, Portugal	1198	18.9 % (95% CI 17-21)	NR
14	Pavydė et al., 2015 [15] Lithuania	To assess public knowledge, beliefs, and behavior concerning antibiotic use and self-medication in Lithuania.	Cross-sectional questionnaire-based study	Patients in community pharmacies in Lithuania	1005	31%	Obtained directly from the pharmacy without a prescription (72.7%) Leftovers (14.8%) Family/friends (9.9%)
15	Berzanskyte et al., 2006 [16]Lithuania	To estimate the prevalence of antibiotic use in the general population of Lithuania with a special interest in self-medication with antibiotics and sources of easy access to their acquisition	Cross-sectional questionnaire-based study	General population in urban/rural areas in Lithuania	746	22.0% (95% CI 19.1-25.1)	Over-the-counter acquisition in community pharmacies (86.0%), leftovers (23.2%), and friends/family (6.1%)
16	Tomas et al., 2017 [37] Serbia	To investigate the extent of storage and self-medication with antibiotic agents in households in Novi Sad, Serbia.	Semi-structured interview	General population in Novi Sad, Serbia	112	27.2%	Over-the-counter acquisition in community pharmacies (20.65%) and friends/family (6.52%)
17	Raz et al., 2005 [17] Israel	To estimate self-medication with antibiotics by a population in northern Israel.	Cross-sectional questionnaire-based study	General adult population in Northern Israel	467	5.1%	Leftovers (2.8% of all participants) Relatives (1.4% of all participants)

Study #	Author, year, country	Aim	Study design	Setting	Participants (N)	Prevalence of SMA	Sources of non-prescribed antibiotics among the self-medicated
18	Väänänen et al., 2006 [38] Spain	To determine whether antibiotics are used for self-medication in southern Spain, a region belonging to European Union	Cross-sectional questionnaire-based study	Finns permanently living in southern Spain	530	41%	NR
19	Grigoryan et al., 2007 [39] Austria, The Netherlands, Sweden, the UK, Ireland, Denmark, Italy, Malta, Luxembourg, Belgium, Spain, Israel, Romania, Czech Republic, Slovakia, Lithuania, Slovenia, Croatia, and Poland	To investigate whether prescribed use triggers self-medication with antibiotics in European countries	Cross-sectional questionnaire-based study	General adult population	15548	1.32% of both prescribed antibiotics and self-medication	Leftovers (46%) Obtained from community pharmacies without a prescription (54%)
20	Grigoryan et al., 2008 [30] Northern/Western (Austria, The Netherlands, Sweden, United Kingdom, and Belgium), Southern (Italy, Malta, Israel), and Eastern (the Czech Republic, Lithuania, and Croatia) European regions	To examine the impact of predisposing (attitudes, beliefs, and knowledge) and enabling factors (country wealth and the healthcare system factors) on self-medication with antibiotics	Interview	General population	1101	23.03%	Perceived possibility of obtaining antibiotics directly from pharmacy yes easily OR 2.51 (1.40-4.48), yes sometimes OR 2.06 (1.28-3.32)
21	Scicluna et al., 2009 [40] Cyprus, Egypt, Jordan, Lebanon, Libya, Tunisia, and Turkey	To identify and document levels and characteristics of antibiotic self-medication within seven Mediterranean countries participating in the Antibiotic Resistance Surveillance and Control in the Mediterranean (ARMed) project	Structured interview	General population in waiting rooms of hospital out-patient clinics or primary health centers	1705	19.1% (from <0.1% in Cyprus to 37% in Lebanon)	NR

Study #	Author, year, country	Aim	Study design	Setting	Participants (N)	Prevalence of SMA	Sources of non-prescribed antibiotics among the self-medicated
22	Dimova et al., 2015 [20] Bulgaria	To study the attitudes and self-medication patterns as related to the use of antibiotics among the general Bulgarian population and their determinants	Questionnaire-based study	General population in Plovdiv district, Bulgaria	1050	43%	NR

Abbreviations: NR – not reported; SMA – self-medication with antibiotics; CI – confidence interval; OR – odds ratio

Conclusion

Evidence from the studies we identified shows that self-medication with antibiotics is highly prevalent in European countries. In countries with the highest rates of SMA, antibiotics are easily accessible either in pharmacies without prescriptions or through leftovers. Therefore, targeted population-, physicians- and pharmacists-focused interventions are needed to reduce the overuse of antibiotics and slow the spread of antibiotic resistance until new classes of effective antibiotics are developed.

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