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The correlation between regulatory conditions and antibiotic consumption within the WHO European Region

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ABSTRACT

Background: In a global perspective, bacterial infections are still a major cause of morbidity and mortality; therefore, effective antibiotics are needed. However, the emergence of antibiotic resistance due to irrational use has now become a serious public health problem. Hence, the objective of this study was to analyse the association of regulatory aspects with antibiotic consumption.

Methods: A data set representing 20 countries throughout the WHO European Region was chosen based on data availability so as to analyse the correlation between specific regulatory conditions and antibiotic consumption, using total consumption data for 2011 and information about national provisions regarding rational use of medicines. Linear regression models were designed in order to evaluate individual aspects as well as the overall level of regulation.

Results: A high level of regulation, assessed by an overall index, was significantly correlated with lower antibiotic consumption; however, of all individual items analysed, only the presence of Standard Treatment Guidelines for hospital care as well as paediatric conditions, the non-availability of antibiotics without a prescription, and the existence of training modules for pharmacists covering rational use of medicines gave significant results, i.e. lower use of antibiotics, when regarded in isolation.

Conclusion: Although national regulatory conditions intended to foster rational use of antibiotics seem to be correlated with antibiotic consumption, this association is potentially influenced by a wide range of contextual aspects.

1. Introduction

Infectious diseases have always been a major cause of morbidity and mortality [1], and despite the fact that non-communicable diseases nowadays account for the majority of disability adjusted life-years (DALYs) in many countries [2], infectious diseases still are a problem. In particular, the fight against diseases caused by resistant strains of bacteria – most prominently multi-drug resistant Tuberculosis (MDR-TB) – is now considered one of the biggest societal problems in many countries, and has been recognised globally as an imminent Public Health problem [3]. Resistances among bacteria may prolong treatment and, for example in the case of MDR-TB, may also necessitate the substitution of well-tolerated and relatively safe medicines with more toxic and potentially less powerful substances; therefore, high levels of antibiotic resistance pose high risks for patients and health systems alike, resulting in higher health

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care costs, and eventually a higher mortality attributable to communicable diseases [3].

Although antibiotic resistance may evolve naturally by means of spontaneous mutation, the recent rapid increase among certain species of bacteria can be attributed to prevailing practices of how antibiotics are used [4]. In theory, the utilisation of antibiotics is restricted to diseases actually caused by bacteria, and optimally, the susceptibility of the bacterium in question to available antibiotics should be tested before treatment is started; this would enable the choice of a suitable and efficient drug as well as the optimal dose and duration of treatment, ensuring a high probability of treatment success and a low likelihood of side effects. In addition, patients are required to adhere to recommended treatment and take medication as prescribed; only a completed course of antibiotic treatment is efficacious in combating bacteria as intended [5]. However, treatment with antibiotics is not always rational, for several reasons: susceptibility testing is rarely done, and instead broad-spectrum antibiotics – "one fits all-solutions" – are used; patients stop taking medicines as soon as they feel better and "save the rest for later"; or antibiotics are taken although the disease is not caused by bacteria but, for example, by a virus. This list is by no means exhaustive, and in many cases, more than one of these issues can be observed. But whatever the reasons for and the observable problems with irrational use of antibiotics are, the consequences are likely to be the same: using either inadequate antibiotics and/or utilising insufficient amounts (either due to wrong doses, or due to premature disruption of treatment) as well as overusing antibiotics further increase antibiotic resistance, rendering several of the currently used drugs useless and, eventually, inhibiting our ability to treat bacterial infections [6].

1.1. Strategies against antibiotic resistance

Organisations such as the World Health Organisation (WHO), the American Centres for Disease Control and Prevention (CDC), and the European Centre for Disease Prevention and Control (ECDC) have now established committees and published treatment guidelines and policy recommendations in order to halt the spread of antibiotic resistance, and many countries are in progress of developing regulatory conditions so as to foster rational use of medicines and reduce the overall consumption of antibiotics.

According to the CDC [6], four core actions are vital in order to fight the problems evoked by antibiotic resistance: preventing infections; tracking resistant bacteria; improving today's use of antibiotics; and developing new antibiotics. For practical reasons, the enhancement of how we use the antibiotics available today is of particular importance – by means of "antibiotic stewardship", meaning the promotion of rational use of medicines through treatment guidelines, restrictions for the use of antibiotics, and surveillance of antibiotic usage and evolving resistances [7]. However, regulations and surveillance of antibiotic use as well as monitoring of antibiotic resistance differ widely globally, depending on an individual country's health care system and the overall governmental structures, the resources available, and the existence of specific health policies and legislations. Therefore, antibiotic consumption and resistance data available is frequently incomplete and difficult to compare due to divergent and inconsistent data collection methods; hence, generalisability of research findings so far is questionable.

Regulatory conditions to minimise the further spread of antibiotic resistance on a national level are quite diverse, but frequently include the implementation of Standard Treatment guidelines (STGs) in order to promote adequate prescribing practices; intensified training of doctors and pharmacists with respect to rational use of medicines in general and antibiotic resistance in particular; and public education campaigns to increase awareness for the problems surrounding the utilisation of medicines and to promote prudent use of antibiotics. In addition, surveillance and monitoring of all aspects of antibiotic stewardship programmes are currently implemented and/or extended in many countries [8–12]. Studies evaluating these provisions are, however, still rare, and are usually spatially, temporally and in terms of their focus and research design quite restricted [13–18].

1.2. Purpose of this study

The purpose of this study is to add to the existing body of knowledge by analysing the correlation between existing regulatory conditions and antibiotic consumption across a range of diverse countries, based on the hypothesis that adhering to the principles of antibiotic stewardship will reduce the overall consumption of antibiotics and, subsequently, positively influence antibiotic resistance patterns. Based on the findings of this study, some exemplary aspects will be discussed.

2. Material and methods

More specifically, this study aims at analysing the correlation between existing regulatory aspects and antibiotic consumption within the WHO European Region on a national level by using an exploratory, cross-sectional study design, comparing antibiotic consumption data with available information regarding rational use of medicines.

2.1. Data collection

Antibiotic consumption data was extracted from two different sources, depending on the country in question. First, the publicly available online database offered by the European Surveillance of Antibiotic Consumption network (ESAC-net), run by the ECDC in Stockholm and providing access to reliable, validated data from several EU member countries [19]; and second, the recently established surveillance network for non-EU member countries within the region, created by the WHO Regional Office for Europe in cooperation with the University of Antwerp, Belgium [20].

ESAC data collection started in 1997, and data was available until and including 2011 when this study was conducted; the website is however updated on a regular basis. For the year 2011, 30 countries provided data,