Analysis of non-hospital antibacterial pharmacotherapy in Poland

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Received 9 July 2007; accepted 16 December 2007
Corresponding Editor: William Cameron, Ottawa, Canada

KEYWORDS
Antibacterial pharmacotherapy analysis; Antibiotics; Drug policy

Summary
Objectives: The aim of this research was to analyze the antibacterial drug consumption pattern in a 1-million-plus strictly defined population in Poland. We assessed outpatient antibiotic sales (ATC J01) in relation to patient age and season of the year, and sought to determine the group of patients with the most frequent recurrence of bacterial diseases.

Methods: The Lubuskie Regional Unit of the National Health Fund (NHF) and the Central Statistical Office (GUS) were the main sources of data. For the period 2002–2005, data on outpatient sales of antibiotics (ATC J01) in Lubuskie Province were collected and expressed in DDD (defined daily dose; World Health Organization anatomical therapeutic chemical (ATC)/DDD version 2006) per 1000 inhabitants per day (DID).

Results: During the period 2002–2005, the average level of antibiotic use amounted to 19.8 DID in the Lubuskie population. During the 3-year period, 64.3% of the population was treated with antibiotics. This value varied for different age groups. Of the patients, 22.7% utilized 62.6% of a 3-year supply of antibiotic therapy in the province; a small 1.9% of the population used 10.0% of the supply. The seasonal variation of antibiotic consumption in different age groups showed a strong tendency to be flatter as the older age groups were analyzed.

Conclusions: The data gained from the payers, i.e., the healthcare system, is a very valuable source of information for pharmacoepidemiological studies. Our study shows that seasonal variation in antibiotic use is strictly linked with the age of patients. Special attention should be paid to the relatively small group of patients that utilizes a significant percentage of the year’s supply. We have established an effective way to present recurrence data (a map showing the infectious disease incidence). This could be a very useful tool for comparing antibiotic consumption in different countries.

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doi:10.1016/j.ijid.2007.12.014
Introduction

In Poland, as in other countries, drug resistance in bacterial pathogens is on the increase.1—4 This process is, to a large extent, linked to the excessive, often unnecessary consumption of antibiotics.5 The Polish National Health Fund (NHF), a health insurance organization that forms the major public source of healthcare financing, records a continuous increase in spending on antibacterial treatment.6 This problem is of interest to specialists in multiple healthcare disciplines.7,8 It is also reflected in numerous publications attempting to present the quantitative and qualitative trends in the use of antibiotics in the treatment of different diseases.2,9 These publications provide information about the level of consumption of these drugs (using DDD (defined daily dose) methodology), seasonal variations, and long-term trends in this area of pharmacotherapy.

Available studies are based on a few basic types of data of varying reliability: survey data, data provided by companies analyzing the pharmaceutical market, insurance company wholesale reports, as well as hospital and pharmacy records. These sources provide general information referring to populations of entire countries or regions. There is a lack of in-depth analyses of antibiotic utilization patterns within studied populations. This probably stems from the difficulty of acquiring reliable data that can fully describe drug consumption in a large, closed population.10 Thus, the following aspects remain unidentified: the level of consumption of antibiotics and their seasonal variations in different age groups, as well as identification of the patient population having the key influence on the drug reimbursement system, in relation to antibacterial pharmacotherapy.

The aim of this research was to analyze consumer behavior in the area of antibacterial pharmacotherapy, based on the large (1.009 million), closed population of Lubuskie Province in Poland. The analysis was undertaken using data from the Lubuskie Regional Unit of the NHF. We aimed to determine the relationship between antibacterial drug use, the frequency of ambulatory treated infectious diseases, and the age of patients. The unique character of the available data enabled us to create a map representing the repetition of antibacterial therapy.

Methods

Data

The following sources of information were used during this research: data from the Lubuskie Regional Unit of the NHF11 and demographic data from the Central Statistical Office (Główny Urząd Statystyczny; GUS).12

The regional units of the NHF gather information on the volume of sales of drugs eligible for reimbursement in order to repay the pharmacies. In Lubuskie Province, the collected data include a unique number (PESEL) identifying each patient who has been prescribed a drug. This allows the tracking of the reimbursed drug sales operation (SO) in relation to every individual patient. Data from the NHF used for this study included the documentation of medication dispensed to the outpatient in the years 2002—2005 in Lubuskie Province. In total, the authors received approximately 25 million records. Each record corresponds to a single sale of a reimbursed drug in a pharmacy (SO). Of these records, 3.2 million refer to the therapeutic group ATC J01 (antibacterial for systemic use).

According to the demographic data, the analyzed population amounts to 1.009 million inhabitants; this value did not change by more than 0.1% during the study period. SO of the reimbursed drug had been recorded for 0.975 million patients during the study period. For the purpose of the analysis 3.034 million records (SO) have been included, corresponding to 0.699 million patients.

The data used in this study, despite the different methods of collection (potential information processing error) are compatible with official publications from the NHF.13 Comparing the structure of consumption with data from the whole of Poland, a lower use of furazidin and cefuroxime pharmaceuticals in Lubuskie Province is noticeable. The antibiotic consumption in the population of Lubuskie Province is about 5% lower than the national average.14 Taking this into consideration, we estimate the data as representative of the whole country.

Terms used

Sale operation (SO): refers to every single purchase of an antibacterial drug by a patient.

Antibiotic therapy course (ABC): refers to a single case of purchase of an antibacterial drug by a patient, each case being separated by a 30-day period of time from one to another. If in the defined period of time more than one instance of an antibacterial drug sale occurred, it was treated as belonging to one course.

Recurrent courses of antibiotic therapy (RABC): the analysis of the recurrence of treatment was made for the period August 2002—July 2005, divided into six 6-month sub-periods. Six-month sub-periods were used in order to facilitate comprehension—native data are available daily.

Statistical analysis

In the presentation of results the approximation of numbers to the first digit after the decimal point has been used. Microsoft Office components were used for data processing as well as Statistica15 6.0 (StatSoft Inc.) and SPSS v.14 (SPSS Inc.) packages.

The presentation of results is based on the anatomical therapeutic chemical (ATC)/DDD classification system (World Health Organization, ATC/DDD version 2006),15,16 expressed in DDD per 1000 inhabitants per day (DDD) as well as percentage of total drug consumption (%DDD). The results referring explicitly to the SO are expressed in SO per 1000 inhabitants per day (%SO) as well as percentage of SO (%SO).

Results

The average level of antibiotic consumption in the population of Lubuskie Province for the period 2002—2005, amounts to 19.8 DID. School-aged patients (5—19 years) rank above the average, as well as people aged 60 years and over (Figure 1). The maximum deviation from the estimated average occurs for the oldest patients, those aged over 75 years.
A parallel analysis was made based on the criterion of registered SO and the quantity of dispensed packages of drugs (Figure 2). This revealed that 20–59-year-old patients are characterized by a stable average SO equal to 1.6 SOID. The amount gradually increases with patient age, reaching a level of 3.1 SOID for patients over 80 years old. The highest number of SO was recorded for patients under 10 years of age (5.4 SOID in the group of patients under 4 years of age). Using the accumulated data (not presented in the figure) we can see that the age group 0—9 years, while constituting only 10.2% of the population, generated 23.6% of all recorded SO, whereas the oldest group of patients (those aged 65 years-plus), amounting to 11.6% of the population, generated 13.9% of the total amount of this service.

The estimated seasonal fluctuations in consumption referring to the total population of the province (Figure 3) agree with available publications. The patient population is not homogeneous in terms of seasonal changes. In all age groups, the months of greatest consumption are March and December, whilst the lowest consumption is recorded for the summer months: June, July, and August. The youngest patients (0—4 years of age) show a significant peak in consumption at the beginning of the winter season (December); the intake of antibiotics in this month is 3.7 times higher than the consumption in August. Children aged 5—9 years tend to have two consumption peaks: the months of December and March. They are higher than the yearly average for this age group by 58.2% and 68.6%, respectively. Patients aged 10—19 years show a significant peak of consumption in March (3.1 times higher than in July; 122.7% of the average yearly consumption). The seasonal value curve shows a strong tendency to be flatter as the older age groups are analyzed. Patients who are
Figure 3  Comparison of seasonal variations in the consumption of antibiotics in the different age groups. The percentage deviation from the yearly average was calculated separately in each age group case and for the whole population.

Figure 4  Yearly percentage of patients treated with antibacterial drugs in different age groups; average data for the 2002–2005 period.

Figure 5  Average percentage of antibiotic consumption by successive 10% groups of the 1-year treated population (YTP). Patients were set in order of increasing yearly antibiotic consumption, and then divided into 10 equal groups (every 38 543 treated patients); average data for every 1-year period (2002–2005) in DDD.
20 years old and more have a single peak incidence in March, when the level of consumption is 2.4 times higher than the decreased consumption in August (March +52.1%, August –36.1% of the average age group consumption).

One can indirectly infer the incidence of ambulatory treated infectious diseases based on ABC (Figure 4). The average yearly incidence for patients in the age group 20—59 years is on the level of 30.2% rising to 48.3% for the oldest patients. The maximum is reached in the age group 5—9 years (67.2%).

Using the DDD methodology we attempted to estimate the size of the high-consumption group. In every calendar year at least one SO is recorded for an average of 38.2% of the Lubuskie Province population (0.385 million patients). They constitute the yearly-treated population (YTP) corresponding to the axis label in Figure 5. Ten percent of them used 30.9% DDD of the total antibiotics consumed, whereas 50%, characterized by the lowest consumption level, used only 20.9% DDD of these medications (Figure 5).

The number of recurrent antibiotic therapy courses for particular patients was calculated for a 3-year period (according to the methods described) taking at least one purchase of an antibiotic in a 6-month period as an RABC occurrence. Medical visits resulting in the prescription and subsequent purchase of an antibacterial drug were recorded for 64.3% of the Lubuskie Province population during the

**Figure 6** Map of the 3-year incidence of recurrent courses of antibiotic therapy (RABC) in the Lubuskie Province population. Subsequent horizontal layers show incidence history in respective patients. To facilitate legibility the patients are grouped in a descending manner, according to the criterion of increasing frequency of incidence, into 63 categories of a differentiated time structure of incidence (colored bar means occurrence of RABC in period of time: white bar = none, black and gray are used only to facilitate comprehension of the data).
period of analysis (Figure 6). Ten percent of the total 3-year supply of antibacterial drugs was used for only 1.9% of patients. Comparing the yearly data to the 3-year data, we saw that 10% of the most frequently or most severely ill patients utilized 59.6% and 35.2%, respectively, of the DDD supply of antibacterial drugs (cumulative data for the whole Lubuskie Province population, not presented in Figure 6 or Table 1).

Discussion

The DDD methodology provides unquestionable advantages in studies of drug use, ensuring the comparability of analyses made in different countries. Despite its advantages, the DDD methodology, as reported in numerous publications, fails to accurately describe drug consumption in children. Differentiation of consumption in different age groups presented in the DDD methodology does not exceed 48.9% deviation (the oldest groups). In the case of young patients, their caretakers expect a quick recovery from the infection and the doctor is under pressure to prescribe an antibacterial drug. A very significant increase in antibiotic prescriptions in periods of epidemic viral infections among the youngest patients as well as school children, shows that the potentially most effective target groups for education programs are the parents, caretakers, and doctors.

The key point of this study was the analysis of the consumption level in a 1-year period and the creating of a map showing the infectious disease incidence in a 3-year period of time in a large, closed (over one million patients) population (Figure 6). We demonstrated that a group constituting 22.7% of the population is responsible for the use of 62.6% of a 3-year supply of antibiotics in the province. Significantly, it was possible to isolate the 1.9% of the population that used over 10% of these supplies, and to show an almost chronic use of antibiotics. This subject requires a separate analysis. In general, the existence of a particularly frequently treated group, therapeutically justified cases notwithstanding, might be related to therapeutic errors, the identification of which will trigger actions aimed at rationalizing the treatment to be taken. Creation of the incidence map is, in the authors’ opinion, their unique contribution to the knowledge of consumption behavior in the scope of antibacterial pharmacotherapy. Creating comparable studies in populations from different countries as well as the possibility of observing timelines in this discipline would facilitate the drawing of broader conclusions concerning the health of the society in question.

The data collected by the payers of the health system are a very important source of information for pharmacoepidemiological studies. The possible scope of conclusions based on this data is directly related to the level of detail in the collected information. The fact that the payer (NHF) is centralized with most antibiotics eligible for reimbursement, is crucial to the actions that need to be taken. Being centralized, the NHF is able to carry out reliable analyses of the healthcare system and to create automated systems to monitor pharmacotherapy in the future.

We are conscious of some bias in the information sources, which has limited our research. The dataset used for this study covers drugs permitted for sale in Poland and included in the system as a reimbursed treatment. The system of reimbursed treatment encompasses most of the J01 drugs registered in Poland (98%). During the period of study, the main differences as far as inclusion into the system of refunded treatment was concerned, occurred in two groups: J01E (sulfonamides and trimethoprim) and J01M (quinolone antibacterials) of the ATC system. Most of the antibiotics that are excluded from the refunded treatment system belong to these two groups. The data concerning consumption of the drugs belonging to these therapeutic groups might not reflect the actual total consumption. The underestimation error might apply to patients who made only one purchase of a drug from the ATC J01 group during the study period and is strictly linked to the data preprocessing methodology. The weakness of the data from the insurance systems is a lack of information about drugs outside of the reimbursement system (patients without insurance, drug sale within the pharmaceutical prescriptions).

Acknowledgements

The authors would like to express their gratitude to the management and the employees of the Lubuskie Unit of the National Health Fund, for their kindness and input into the collection of the data used in this study.

Conflict of interest: No conflict of interest to declare.

References


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RABC, recurrent courses of antibiotic therapy; DDD, defined daily dose; SO, sales operations.

a Population size 1.009 million people.
b Total consumption 23.69 million DDD.
c Total sales operations 2.74 million.