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Drug prescribing among Danish children: a population-based study

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Abstract Objectives: To characterise the pattern of drug prescribing in Danish children below 19 years of age. Methods: We used the Odense Pharmacoepidemiologic Database to identify all individual prescriptions for 0- to 19-year-olds in the County of Funen, Denmark, in 1998. The drug consumption was analysed by the defined daily dose methods and anatomical chemical classification system, using analytical templates for individual-based drug utilisation statistics.

Results: Of the examined population, 52.6% had one or more prescriptions issued. Overall, 10% of the children accounted for 67.5% of drug prescriptions. Approximately 40% of the children had a prescription issued before they were 1 year old. In 1- to 2-year-olds, 85% received a prescription. Thereafter, the 1-year prevalence of drug use declined to 40%. The total drug consumption was similar between boys and girls until the early teens; thereafter the girls had a prescription issued twice as often as boys. In all age groups, respiratory drugs dominated and drugs used in dermatology was the second largest group. The third largest group was systemic anti-infective agents for children below 12 years of age, whereas it was psychotropic drugs among the oldest children.

Conclusion: There is the same skewness of drug consumption among Danish children as among Danish adults, but the types of medication differ. Drug use is most extensive among children below 2 years but drug prescribing was considerable in all age groups.

Keywords Paediatric prescribing · Drug consumption · Database

Introduction

Drugs are frequently introduced in children as they prove effective in adults [1, 2]. Due to a complex set of issues, i.e. economic and ethical considerations, children do not often participate in clinical trials, and specific knowledge about the effect of drugs in children is therefore often lacking. In the United States, 80% of the marketed prescription drugs are not approved by the US Food and Drug Administration for use in children [3]. Nonetheless, the qualitative and quantitative drug consumption among children has only been sparsely examined [4], and the methodological development which has been seen regarding evaluation of drug consumption, has only poorly affected children [5]. Among the reports are studies from paediatric hospital wards [6, 7], from paediatric outpatients [8], from doctors outside the hospitals [4, 9, 10, 11, 12], from selected groups of children [13] and from developing communities [7, 14]. Recently, the first large pharmacoepidemiological analysis of drug prescription in children was performed [15]. However, monitoring of drug prescription and analysis of its rationality in a large population-based group of children appears to be a rarity [5].

The aim of the study was to characterise drug prescribing in children below 19 years of age in 1998. We used an analytical template developed for individual-based drug utilisation statistics [16].

Materials and methods

Setting

We used the population-based Odense Pharmacoepidemiologic Database (OPED), which has been described in detail in a previous publication [17]. Denmark has a uniformly organised health care system, and the demographic and social differences between its 17 counties are small. Our database covers the County of Funen, representing approximately 10% of the total Danish population.

More than 98% of the Danish population is registered with their individual general practitioner and receives free medical care.
The rest may consult a general practitioner of their own choice but have to pay a part of the fee themselves. The Health Service programme ensures free access to hospitals and reimburses approximately half of the costs of prescribed drugs, independent of social status and income. In brief, OPED contains person-identifiable data on all computerised prescription refunds from the County of Funen, Denmark, which is subsidised by the National Health Service. In this study, the term prescription is used in the sense of an ordination.

Once a month, this information is transferred to the Danish National Health Service to settle the reimbursement. Each record contains a unique person-identifier, the date of purchase, the pharmacy, the prescriber and a full account of what has been dispensed, including brand name, dose unit and quantity. To protect confidentiality, the data are stored without the person-identifier, which was replaced by a user-specific code containing data on the prescription-holder’s age and sex. The prescribed daily dose and the indication for prescribing are not relevant for the processing of refunds and are not recorded in the database.

The database does not contain data on drugs that are not subsidised by the National Health Service, that is the following prescription drugs: benzodiazepines, cephalosporins, dermatological antibiotics, oral contraceptives and tetracyclines. Neither are drugs sold without prescription registered, for example, cough and cold preparations, nasal decongestants, paracetamol, salicylic acid, systemic antihistamines used for non-chronic disorders, and weak dermatological corticosteroids.

Analysis

We extracted all prescriptions that had been issued for children born 1980 or later during the period of 1 January 1998 to 31 December 1998. The population of the County of Funen was about 472,000 including 104,897 children under 19 years of age on 1 January 1998. Prescriptions for non-residents of the county were excluded by use of the demographic module of OPED. Each prescription was characterised by the following variables: user-specific code, the date of purchase, the pharmacy, the prescriber and the type of drug prescribed according to the anatomical chemical (ATC) classification system. Quantitative aspects of drug use were expressed in defined daily doses (DDDs) [18]. The DDD is established by an expert panel as the assumed average maintenance dose when the drug is used for its main indication by an adult. Thus, the DDDs for two closely related drugs should in principle be equivalent; for example the DDD is 50 mg for captopril and 10 mg for enalapril. Drugs in ATC groups D1 to D3 have been defined as 1 g or 1 ml according to the table from the Danish Medicines Agency.

The data material was analysed by previously developed templates for individual-based drug utilisation statistics [16]. For all drug categories, specified to the fifth digit of the ATC code, we calculated the total amount of purchased drug measured in DDDs, the 1-year prevalence of use of a drug, which was calculated from the number of persons who presented at least one prescription during the survey period, and the incidence of drug use. The latter was calculated from the number of persons who presented their first prescription for the drug during the last 2 months of 1998. These were thought to represent incident therapies, as we considered it unlikely that a patient in ongoing therapy with a drug would not redeem at least one prescription during the first 10 months in the survey period. In addition, we calculated the percentage of boys among the users, average age plus two measures for skewness in drug utilisation, and the cumulated 1- and 50-percentiles. These calculations were performed for all drug categories but are only shown for the 30 most-used drug categories as measured by the number of drug users (Table 1). Also, age-specific distribution of drug consumption was analysed (Fig.3). The children were divided into three age groups, 0–1 years, 2–12 years and 13–18 years, since these age groups (infants and toddlers, young children and adolescents) each have their own specific patterns of disease.

Results

The drug use of the population was found to be very unevenly distributed. A graph of cumulated percentiles is shown in Fig. 1. One per cent of the population (the most heavy users) accounted for 21% of the sales volume as measured in DDDs, 10% accounted for 67.5% and 20% accounted for 82.5%. We had identified 180,949 prescriptions issued to 55,242 different drug users below 19 years of age from a background population of 104,897, giving a crude 1-year prevalence of drug use for children of 52.6%.

Figure 2 shows the age- and sex-specific prevalence of drug use as measured in DDDs by three cut-off points. Approximately, 40% of children younger than 1 year, both boys and girls, had a prescription issued. In the groups of boys and girls, 7% and 4%, respectively, had four or more different prescription drugs. In 1- to 2-year-olds, 85% received a prescription. Thereafter, the 1-year prevalence of drug use gradually declines to 40%. The drug consumption as measured in DDDs is similar among boys and girls until they are approximately 14 years old. Afterwards, the girls consumption increased. Thus, 10% of the girls compared to 5% of the boys used more than four prescription drugs when they were 17 years old. Oral contraceptives are not included.

The age-specific distribution of drug consumption as measured in DDDs is shown in Fig. 3. In all groups, respiratory drugs (R) was the largest group and drugs used in dermatology (D) was the second largest group. The third largest group was systemic anti-infective agents (J) for children below 12 years, whereas it was drugs active on the central nervous system (N) among the oldest children (i.e. analgesics and antiepileptics).

Epidemiological measures of the 30 most-used drugs measured by number of users among individuals below 19 years old are shown in Table 1. These drugs constitute 81.8% of the total drug consumption calculated in DDDs. The cumulative 1-percentile (Lorenz curve 1%) for, for example, insulin expresses the share of the total drug volume purchased by the 1% most heavy users of insulin. A high value for a drug indicates the existence of heavy users of the drug. The cumulated 50-percentile (Lorenz curve 50%) was defined in a similar manner. High values for the 50-percentile indicates many sporadic users [16]. The rank of the drugs according to the period prevalence, i.e. the number of users observed during the survey period, is shown in the table. Thus, J01CE (beta-lactamase-sensitive penicillins) was used by most individuals.

Drugs used in dermatology (D) were widely used in all age groups as shown in Fig. 3. Drugs for acne were used in teenagers, and steroids were used for both small and older children dependent on strength. There was no sex difference in the consumption.

In group H (hormones for systemic use), only vaso-pressin appears on the list among the 30 most bought drugs. Vasopressin is used in the treatment of enuresis