No significant decrease in antibiotic use from 1992 to 2000, in the French community

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Methods: The analysis used data provided by a representative annual nationwide survey of health care consumption in the community.

Results: The frequency of antibiotic use increased from 4.7 per 100 person-months in 1992 to 7.3 in 1995, and remained stable from 1998 to 2000. Children under 7 years of age were three times more strongly exposed to antibiotics than older subjects. Respiratory tract infections of probable viral aetiology and sore throat accounted for >50% of antibacterial prescriptions.

Conclusions: We identified two major priorities for campaigns designed to reduce antibiotic exposure of the French population in the community, namely respiratory tract infections of presumed viral origin, and children under 7 years of age.

Keywords: pharmacoepidemiology, anti-infectives, public health

Introduction

Population exposure to antibiotics is the main factor responsible for the current increase in bacterial resistance in the community. This has been clearly shown for Streptococcus pneumoniae,1–3 group A β-haemolytic streptococci4–6 and Escherichia coli.4–9 In Europe, France (60 million inhabitants) was recently shown to have both the highest level of antibiotic exposure10 and the highest S. pneumoniae resistance rate to β-lactam agents.11 The spread in Iceland of a resistant S. pneumoniae clonal strain 6B originating in Spain12 suggests that countries with high antibiotic use such as France may generate and export resistant clones to neighbouring European countries.

In order to alert public health authorities, several European scientific meetings have been held over the past 5 years, including: the European Union Conference on ‘The Microbial Threat’, 9–10 September 1998, Copenhagen, Denmark; the European Conference on Antimicrobial Resistance, 13–15 June 2001, Visby, Sweden; and the European Conference on Antibiotic Use in Europe, 15–17 November 2001, Brussels, Belgium. To control this phenomenon, national and European health authorities have recently begun to support surveillance of antibiotic use13 and to promote judicious use of antimicrobials.14

As detailed information on antibiotic use in the community has been lacking since 1992,15 we analysed trends in antibiotic use in France from 1992 to 2000.

Materials and methods

We analysed data from French Health Care and Health Insurance (HCHI) surveys conducted from 1992 to 2000.10 HCHI surveys collect individual data on health care consumption from a representative population sample, and produce annual estimates of antibiotic consumption by the entire French population. Military personnel and people living in nursing homes are not included. The surveys were conducted by CREDES (Centre de Recherche et de Documentation en Economie de la Santé) every year between 1988 and 1998, and every 2 years thereafter.

The survey uses a one-stage random household sampling procedure based on affiliation to the French national health insurance system. All persons living in sampled households are included in the study. Each individual is given a questionnaire on which to prospectively report all medical events and drug acquisitions during two 1-month periods, one in spring and one in autumn. These two periods are chosen to take into account seasonal variations in drug use and morbidity. The information is collected by phone, or by face-to-face interview if phone contact is not possible. Investigators...
Antibiotic use in France from 1992 to 2000

Contact the households twice during each 1-month period, to check the accuracy of individual information. Medical personnel then control the consistency of the recorded information.

Antimicrobials were defined as orally administered drugs belonging to the following groups: penicillins, cephalosporins, macrolides and lincosamides, quinolones, tetracyclines and others. Antibiotic acquisitions were examined according to the Anatomic Therapeutic Chemical classification. 17

The following diagnoses, coded according to the Ninth International Classification of Diseases (ICD-9), were studied: acute nasopharyngitis (codes 460.0, 460.1, 460.2), acute tracheitis (464.1 and 464.2), acute bronchitis (466.0, 466.1, 466.2, 493.9 and 490.9), influenza (487.9), otitis media (381 and 382), sinusitis (461 and 473), laryngitis (464.0), sore throat (462, 463 and 784.1), chronic bronchitis (491, 492 and 494), pneumonia (480, 481, 482, 483, 484, 485 and 486), lower urinary tract infection (041.4, 595.0 and 646.6) and gastroenteritis (009.0, 009.1, 009.2 and 558). Respiratory tract infection of presumed viral aetiology (RTIPV) was defined as acute nasopharyngitis, acute tracheitis, acute bronchitis or influenza. The following skin disorders were also included in the study: ICD-9 codes 191.4, 120.2, 120.3, 120.7, 1907, 1912, 1709, 1710, 1711, 1713, 1714, 1715, 1719, 1721 and 1764; as well as dental disorders 090.1 and 110.1.

Statistical analysis

We first broadly described the frequency of antibiotic acquisition according to age, regardless of the year of survey, and age-related trends from 1992 to 2000. Secondly, we analysed the antibiotic classes used in each indication, separately for children (<15 years) and adults (>15 years).

In order to describe annual trends in antibiotic exposure, we estimated each year the mean weekly frequency of antibiotic acquisition for each survey period, calculated as the number of acquisitions per week divided by the number of persons investigated during the corresponding week. These frequencies were averaged for the periods studied, and were expressed as the observed frequency of antibiotic acquisition per 100 person-months (A o). We separately examined annual trends in the following four age classes: <7 years, 7–15 years, 15–65 years and >65 years.

Twenty-two per cent of the study weeks overlapped with the annual 'flu-like syndrome (FLS) epidemic in France, as reported by the national sentinel network. 23,24 We thus estimated the frequency of antibiotic acquisition corrected for epidemic variations in FLS (A c), by subtracting from the number of acquisitions in each epidemic week (defined as weeks with >60 FLS cases/100 000 inhabitants) the number of acquisitions explained by FLS, as predicted by a linear model linking antibiotic acquisition to the incidence of FLS during epidemic weeks.

Results

The numbers of individuals participating in the annual surveys were 8645 in 1992, 10 717 in 1993, 6868 in 1994, 6775 in 1995, 7691 in 1996, 7166 in 1997, 13 686 in 1998 and 12 015 in 2000. The participation acceptance rate ranged from 66% to 81% per year. The samples were larger in 1998 and 2000, and no data were available for 1999 because CREDES decided to carry out this survey once every 2 years after 1998. The sex ratio and mean age of the participants (between 34 and 35 years) remained stable from year to year, and were consistent with the 1999 French census data (Table 1).

Children under 7 years of age were the principal antibiotic consumers, with A o values always more than 14 per 100 person-months, i.e. three times higher than the A c values for other subjects (Figures 1 and 2).

RTIPV and sore throat accounted for >50% of antibiotic acquisitions, regardless of age. Among children, otitis media was the third infectious disease most frequently treated with antibiotics. Penicillins were the main antibiotic class consumed, regardless of clinical situation and age. Cephalosporins and macrolides were also frequently used, particularly to treat RTIPV in adults (Figure 3).

A c increased from 4.7 per 100 person-months in 1992 to 7.3 per 100 person-months in 1995, then fell slightly until 1998, and remained relatively stable until 2000 (6.8 per 100 person-months). Trends in A c suggested that antibiotic acquisition increased from 1992 to 1995 and remained stable from 1995 to 2000 (Figure 4).

Discussion

From the 1990s, population antibiotic exposure in the community began to decline in some industrialized countries. 21 Despite the fact that France is among the countries with the highest rates of penicillin resistance among S. pneumoniae isolates 11 and that the French public health authorities have started to take appropriate measures over the past 10 years, no significant decrease in antibiotic exposure occurred between 1992 and 2000. 22 The still very high level of antibiotic use in the French community was confirmed by recent global analysis of antibiotic sales data provided to the European Surveillance of Antibiotic Consumption network, 23,24 (H. Goossens, M. Ferech, R. Vander Stichele, M. Elseviers and the ESAC Project Group, personal communication) and underlines the very urgent need for a national programme designed to optimize antibiotic prescription.

One important finding in this analysis is the very frequent use of antibiotics among children: antibiotic consumption among children under 7 years of age is at least three times higher than among older individuals. These results confirm that, in the community, the majority of antibacterial agents are used for RTIPV, an indication for which these drugs are not beneficial. 25 Assuming that sore throat is also due to viral infection in at least 80% of cases, 26 the proportion of unnecessary antibiotic acquisitions in France probably exceeds 50% in both adults and children.

Table 1. Description of population surveyed annually

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of subjects</th>
<th>Mean age ± S.D.</th>
<th>Sex ratio (M/F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>8645</td>
<td>34.7 ± 0.4</td>
<td>0.94</td>
</tr>
<tr>
<td>1993</td>
<td>10 717</td>
<td>35.1 ± 0.4</td>
<td>0.95</td>
</tr>
<tr>
<td>1994</td>
<td>6868</td>
<td>34.4 ± 0.5</td>
<td>0.97</td>
</tr>
<tr>
<td>1995</td>
<td>6775</td>
<td>33.8 ± 0.5</td>
<td>0.92</td>
</tr>
<tr>
<td>1996</td>
<td>7691</td>
<td>34.6 ± 0.4</td>
<td>0.94</td>
</tr>
<tr>
<td>1997</td>
<td>7166</td>
<td>34.2 ± 0.5</td>
<td>0.93</td>
</tr>
<tr>
<td>1998</td>
<td>13 686</td>
<td>34.3 ± 0.3</td>
<td>0.95</td>
</tr>
<tr>
<td>2000</td>
<td>12 015</td>
<td>35.4 ± 0.4</td>
<td>0.94</td>
</tr>
</tbody>
</table>

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Figure 1. Frequency of antibiotic acquisition according to age (per 100 person-months, with 95% confidence intervals).

Figure 2. Trends in antibiotic acquisition, from 1992 to 2000, according to age of patient (per 100 person-months, with 95% confidence intervals). Age groups: white bars, <7 years; diagonally striped bars, 7–15 years; dotted bars, 16–65 years; black bars, >65 years.
HCHI provides important information on antibiotic acquisition in the community, because of its representative and standardized data collection method. Its major value for assessing temporal trends in antibiotic use is the use of the same methodology over a long period of time. Nevertheless, the HCHI has several major limitations. One potential weakness is that the appropriateness of diagnoses cannot be medically assessed. Second, it is not known whether patients completed the course of medication. Furthermore, because the survey considers only two 1-month periods each year, extrapolation of the results to yearly antibiotic exposure may be inappropriate. Nevertheless, the survey designs were identical each year. Thus, analyses of antibiotic use according to age and indication, as well as annual trends in antibiotic use, are not likely to be biased over time.

We found no decrease in antibiotic use in France since 1992, even if it may have been overestimated during weeks with a high incidence of FLS. Correction of antibiotic acquisition for the incidence of FLS offers a more precise estimation of antibacterial drug use.

In conclusion, we have developed a method for analysing trends in antibiotic use in the community, taking into account epidemic-related variations, as a decision aid for public health antibiotic policies. Two original features of our work are the analysis of antibiotic use according to age and the combining of

**Figure 3.** Pattern of antibiotic class according to clinical situation (per 100 antibiotic acquisitions, in children and in adults). Black bars, penicillins (J01C); bars with white dots on a black background, cephalosporins (J01D); white bars, macrolides and lincosamides (J0AF); bars with black diagonal stripes on a white background, quinolones (J01M); bars with black dots on a white background, tetracyclines (J01A); bars with white diagonal stripes on a black background, other antibiotics.

**Figure 4.** Overall evolution of the monthly incidence of antibiotic acquisition, from 1992 to 2000. Filled squares, observed antibiotic acquisition incidence ($A_o$) (per 100 person-months with 95% confidence intervals); open squares, corrected antibiotic acquisition incidence by FLS incidence ($A_c$) (per 100 person-months). *High FLS incidence (>60 per 100 000 person-months).
data on antibiotic use with symptoms related to antibiotic acquisition. Thus, in order to control the antibiotic resistance selection process in the community population, this study identifies two major priorities for campaigns designed to reduce antibiotic exposure of the French population in the community, namely respiratory tract infections of presumed viral origin, and children under 7 years of age.

Acknowledgements

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References