Is self-medication with antibiotics in Europe driven by prescribed use?

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Background: Self-medication with antibiotics may increase the risk of inappropriate use and the selection of resistant bacteria. One of the triggers for using self-medication may be past experience with antibiotics prescribed by health professionals. We examined the association between prescribed use and self-medication with antibiotics.

Methods: A population survey was conducted in 19 European countries, covering 15 548 respondents. Multinomial logistic regression analysis was used to study the relationship between prescribed use and self-medication for all symptoms/diseases and for upper respiratory tract infections (URTIs).

Results: The association between prescribed use and self-medication was modified by source of self-medication, region in Europe and education. This association was consistently stronger for self-medication from leftovers than from other sources, primarily directly from a pharmacy. It was stronger also for respondents from Northern/Western Europe than respondents from Eastern Europe and Southern Europe and those with low education. Prescribed use for URTIs (minor ailments such as throat symptom, influenza, etc.) increased the likelihood of self-medication with leftover antibiotics for these symptoms/diseases in all European regions.

Conclusions: Our study shows consistent associations between prescribed use and self-medication with antibiotics from leftovers, but has not been able to support the hypothesis that self-medication from other sources than leftovers is triggered by earlier prescribed use. Preventing leftovers may be one effective way of preventing self-medication. This can be achieved by ensuring that the amount dispensed corresponds to the amount prescribed, by educating patients and by making doctors aware that prescribing for minor ailments may increase the risk of self-medication for such ailments.

Keywords: antibacterial agents, drug prescribing, drug resistance, bacterial

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Self-medication associated with prescribed use

Introduction

Self-medication with antibiotics may lead to a wrong choice of antibiotics, use of insufficient dosages or unnecessary therapy. This inappropriate use increases the risk of selection of resistant bacteria and may contribute to antibiotic resistance. Previous studies have shown that self-medication with antibiotics occurs in the United States and Europe, in particular for colds and upper respiratory tract symptoms. The rates of antibiotic prescribing for upper respiratory tract infections (URTIs) remain at high levels, although the majority of these illnesses have a viral cause. This may imply that one of the triggers for using self-medication by people can be a past experience with prescribed use of antibiotics.

A study in Spain found that the main reason for using self-medication was a previous medical prescription of the same medication. This is likely to be true for antibiotics as they were one of the commonly used pharmaceutical groups in this study. Moreover, several studies suggested that unrealistic patient expectations regarding the need for antibiotics may be generated by previous inappropriate prescribing by the physician. Information about the relationship between prescribed antibiotic use and self-medication with antibiotics can be helpful in designing interventions to prevent self-medication. To date, no study has explored this relationship. We investigated whether prescribed use triggers self-medication with antibiotics in European countries.

Methods

A cross-sectional survey was conducted simultaneously in 19 European countries. Countries participating in two European networks of surveillance systems [European Surveillance of Antimicrobial Consumption (ESAC) and European Antimicrobial Resistance Surveillance System (EARSS)] were invited to participate in this study. The following countries agreed to participate: Austria, the Netherlands, Sweden, the UK, Ireland, Denmark, Italy, Malta, Luxembourg, Belgium, Spain, Israel, Romania, Czech Republic, Slovakia, Lithuania, Slovenia, Croatia and Poland. The design of the study, the characteristics of the respondents in each country and the prevalence rates of self-medication and prescribed use in each country have been published elsewhere. A multistage sampling design was used for sample selection in each participating country.

Within each country, a region with average prescribed antibiotic consumption was chosen and in each chosen region a middle-size city and rural area were selected. Questionnaires were mailed to adults randomly selected in the identified cities and rural areas.

Questions included the respondent’s use of antibiotics during the past 12 months, name of the medicine, source, symptom or disease (coded with ICPC10) and demographic characteristics. Symptoms and diseases included in this study were self-reported. When the reported symptom overlapped with a disease (i.e. cough and bronchitis) only the disease was included. Only antibacterials for systemic use (ATC class J01) were included in the analyses.

Respondents were classified as self-medicated if they reported that they had taken any antibiotic in the previous 12 months without a prescription from a physician, dentist or a nurse and as prescribed users if antibiotics had been prescribed in the same time period.

In this study, we studied the relationship between prescribed use and self-medication in general (for all symptoms/diseases). We also studied the relationship between prescribed use and self-medication for URTIs. URTIs were classified as cough, sneezing/nasal congestion, throat symptom, sinus symptom, sinusitis, upper respiratory infection, acute tonsillitis, influenza and strep throat. These minor ailments are very common in the general population. Each adult experiences at least two colds per year. We may therefore assume that all respondents had experienced at least one of these in the previous 12 months.

Statistical analyses

Multinomial logistic regression analysis was used to study the relationship between prescribed use of antibiotics and self-medication with antibiotics in general (for all symptoms/diseases) and for URTIs. All 15 548 respondents were included in each regression analysis. In the multinomial logistic regression for antibiotic use in general, we considered three groups as follows: (i) respondents who used leftover antibiotics for self-medication; (ii) respondents who used self-medication with antibiotics obtained directly from a pharmacy or other source; and (iii) as a reference group respondents who did not self-medicate. We examined separately self-medication with leftover antibiotics and self-medication with antibiotics obtained from other sources as a stronger relation must be expected between prescribed use and self-medication with leftovers. In the multinomial logistic regression for URTIs, the reference group consisted of the people who did not self-medicate for URTIs, including respondents who did not self-medicate and those who used self-medication for other symptoms.

The models were adjusted for the factors associated with self-medication use (region in Europe, education, age and presence of a chronic disease) based on earlier results. Countries were grouped together in regions (Northern/Western Europe, Southern Europe and Eastern Europe) based on combination of different criteria as described elsewhere. Education was categorized into low (incomplete primary education, completed primary education and lower vocational or general education) and high (intermediate or higher vocational or general education, college or university).

In order to identify effect modifiers we tested for each model possible statistical interactions between prescribed use and other determinants of self-medication. We tested interactions between prescribed use and determinants found to be significant and set the significance at \( P < 0.01 \) for interaction terms.

Data were analysed using SPSS (version 12) for Windows (SPSS, Inc., Chicago, IL, USA).

Results

Of the 15 548 respondents who completed the questionnaires, 206 had used both prescribed antibiotics and self-medication (Figure 1). Of these 206 respondents, 95 (46%) used leftover antibiotics for self-medication and 111 (54%) used antibiotics obtained directly from a pharmacy or other source. In both subgroups many respondents used prescribed antibiotics and self-medication for the same symptoms/diseases or used the same antibiotic for both (Figure 1).

URTIs were the most common reasons for self-medication in all three European regions (44% of all respondents who used self-medication in Northern/Western Europe, 56% in Southern Europe and 41% in Eastern Europe). The second most common reasons were teeth or gum symptoms in Southern (16%) and Eastern (19%) Europe and cystitis/urinary infection in Northern/Western Europe (13%).

The use of prescribed antibiotics was associated with self-medication with antibiotics in the previous 12 months. The
unadjusted odds ratio (OR) was 3.6 (95% CI 2.6–4.8) for self-medication with leftover antibiotics and 1.6 (95% CI 1.3–2.0) for self-medication from other sources. The first group in the multinomial logistic regression included 173 respondents who used leftover antibiotics for self-medication (including 95 who had been prescribed antibiotics and 78 who had not). The second group included 312 respondents who used self-medication with antibiotics obtained directly from a pharmacy or other source (including 111 who had been prescribed antibiotics and 201 who had not). The reference group is comprised of those who did not self-medicate (including 3653 who had been prescribed antibiotics and 11,410 who had not).

Significant statistical interactions were found between prescribed use of antibiotics and region in Europe and prescribed use and education (P < 0.001 for both interaction terms). Based on these interactions in the multinomial logistic model, we calculated the ORs within each region of Europe for both self-medication with leftovers and self-medication from other sources (Table 1). As expected, the relationship between prescribed use and self-medication with leftover antibiotics was stronger than with self-medication from other sources; however, this was only significant in Northern/Western and Eastern regions (Table 1). In Southern Europe we saw the same tendency, but the associations were not significant. Educational level was the second effect modifier. Prescribed use was a stronger determinant of self-medication in the lower educated respondents than in the higher educated respondents. The relationship between prescribed use and self-medication from sources other than leftovers was significant only in Northern/Western and Eastern Europe. In both regions the association for URTIs implies that self-medication with antibiotics in general implies that antibiotics prescribed for one symptom/disease may be used both as self-medication for (repeated) episodes of the same symptom/disease and for another symptom/disease. The association for URTIs implies that prescribed use for URTIs increases the probability of self-medication for URTIs.

For URTIs, a significant association was found between prescribed use and self-medication with leftover antibiotics. The unadjusted OR was 7.2 (95% CI 4.6–11.1) for self-medication with leftover antibiotics and 1.7 (1.1–2.8) for self-medication from other sources. The first group in the multinomial logistic regression included 84 respondents who used self-medication for URTIs with leftover antibiotics (including 35 who had been prescribed an antibiotic for URTIs and 49 who had not). The second group included 129 respondents who used self-medication with antibiotics obtained directly from a pharmacy or other source (including 19 who had been prescribed an antibiotic for URTIs and 110 who had not). The reference group includes those who did not self-medicate for URTIs (including 15,063 who did not self-medicate and 272 who used self-medication for other symptoms/diseases).

A significant interaction was found between prescribed use and region in Europe (P < 0.001). In Northern/Western Europe, respondents who had used prescribed antibiotics for URTIs had a 37.45 (95% CI 9.89–141.75) higher odds of self-medication for URTIs. The effects were smaller in Southern Europe (OR 3.64, 95% CI 1.60–8.25) and Eastern Europe (3.64, 1.96–6.74). These associations were not significant for self-medication from sources other than leftovers (1.96, 0.45–8.67 in Northern/Western Europe, 1.58, 0.51–4.87 in Southern Europe and 1.06, 0.59–1.93 in Eastern Europe). No interaction was found between prescribed use and education for URTIs.

**Discussion**

To our knowledge, this is the first study exploring the relationship between prescribed antibiotic use and self-medication with antibiotics. The association between prescribed use and self-medication in general implies that antibiotics prescribed for one symptom/disease may be used both as self-medication for (repeated) episodes of the same symptom/disease and for another symptom/disease. The association for URTIs implies that prescribed use for URTIs increases the probability of self-medication for URTIs.

Our results indicate an association between prescribed use and self-medication with antibiotics in general from a leftover source in Northern/Western and Eastern Europe. In both regions the effect of prescribed use was larger in lower educated respondents. One could hypothesize that respondents with low education are less aware about the consequences of repeating prescriptions of the doctors for the same symptom/disease or for another symptom/disease. This effect of education disappeared when looking at the relation between prescribed use and self-medication for URTIs. The effect of prescribed use on self-medication for URTIs with leftover antibiotics in all European regions was the
same for both educational levels. For self-medication from sources other than leftovers the associations did not reach statistical significance. This might be due to a lack of statistical power to detect a smaller effect.

A limitation of our study is the low response rate in some of the countries. However, the results were similar after exclusion of countries with response rates below 40% (data not shown). Therefore, we believe that the bias resulting from non-response did not result in an overestimation of the relationships reported in this study. A second limitation is that no data were available about actual occurrence of URTIs. However, evidence indicates that practically everybody experiences such symptoms/diseases more than once a year. Therefore, we based our analysis on the assumption that all respondents have had at least one URTI in the previous year.

Our findings indicate that preventing leftovers from prescribed courses may be one effective way of preventing self-medication with antibiotics. This can be done by technical measures, such as promoting the dispensing of the exact numbers of tablets or by educating patients. In addition, doctors should be aware that prescribing for minor ailments may also increase the risk of self-medication for such ailments. The effect to be expected may be the strongest in Northern/Western Europe, but in that part of Europe self-medication is low, implying that the absolute effect would be limited. In Eastern European countries, though self-medication with antibiotics obtained directly from pharmacies is the most common, the absolute expected effect may be more pronounced, since self-medication from leftovers occurs frequently. In Southern Europe, the relevance of prescribed use seems to be limited to using leftovers for self-medication for URTIs. This may justify trying to reduce the use of leftovers among respondents from Southern Europe. The use of leftover antibiotics should not be used unless there is reason for concern, URTIs are usually not an appropriate indication for the use of antibiotics, and the use of antibiotics is often inappropriate. In- and Northern/Western Europe, the use of antibiotics for self-medication from leftovers should be prevented.

Besides leftovers, self-medication from other sources should also be prevented. Strengthening pharmacy regulations and educating the public about the dangers of self-medication may prevent this behavior. We are grateful to Reli Mechtler (Austria), Anja Trombecka (Austria), Arjana Tambic-Andrasevic (Croatia), Retnosari Andrajati (Czech Republic), and Koen Laureys (Belgium) for their contributions to the study.

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<tr>
<th>Table 1. Effect of prescribed use on self-medication in subgroups of regions in Europe and educational level</th>
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<td><strong>Adjusted OR</strong> (95% CI)</td>
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<td>within Northern/Western Europeb</td>
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<td>among respondents with low educationc</td>
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<td>among respondents with high education</td>
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<td>within Southern Europeb</td>
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<td>among respondents with high education</td>
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<tr>
<td>With leftover antibiotics</td>
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<td>With antibiotics obtained directly from a pharmacy or other source</td>
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*Adjusted for presence of chronic diseases and age.

**Northern/Western Europe** includes Sweden, Denmark, The Netherlands, Austria, Belgium, Luxembourg, the UK and Ireland; **Southern Europe** includes Malta, Italy, Spain and Israel; and **Eastern Europe** includes Czech Republic, Slovenia, Croatia, Poland, Slovakia, Romania and Lithuania.

*Low education was defined as incomplete primary education, completed primary education, and other vocational or general education.

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In conclusion, our study shows consistent associations between prescribed use and self-medication from leftovers, but there may still be some room for improvement in preventing self-medication from other sources. Strengthening pharmacy regulations and educating the public about the dangers of self-medication may prevent this behavior. We are grateful to Reli Mechtler (Austria), Anja Trombecka (Austria), Arjana Tambic-Andrasevic (Croatia), Retnosari Andrajati (Czech Republic), and Koen Laureys (Belgium) for their contributions to the study.
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Transparency declarations

None to declare.

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