Public beliefs on antibiotics and respiratory tract infections: an internet-based questionnaire study

Jochen WL Cals, Dennis Boumans, Robert JM Lardinois, Ralph Gonzales, Rogier M Hopstaken, Christopher C Butler and Geert-Jan Dinant

ABSTRACT

Background
Patient expectations are among the strongest predictors of clinicians’ antibiotic prescribing decisions. Although public knowledge, beliefs, and experiences of antibiotics contribute to these expectations, little is known about these public views.

Aim
To gain insight into public knowledge, beliefs, and experiences of antibiotics and respiratory tract infections.

Design of study
Cross-sectional, internet-based questionnaire study.

Setting
Members of the general public aged 16 years and over in the Netherlands.

Methods
Public knowledge, beliefs, and experiences of antibiotics and respiratory tract infections, as well as predictors of accurate knowledge of antibiotic effectiveness, were measured using 20 questions with sub-items. The questionnaire was given to a Dutch community-based nationwide internet panel of 15 673 individuals. Of these, 1248 eligible responders were invited to participate; 935 responders (75%) completed the questionnaire.

Results
Of the participants, 44.6% accurately identified antibiotics as being effective against bacteria and not viruses. Acute bronchitis was considered to require treatment with antibiotics by nearly 60% of responders. The perceived need for antibiotics for respiratory tract infection-related symptoms ranged from 6.5% for cough with transparent phlegm, to 46.2% for a cough lasting for more than 2 weeks.

Conclusion
Public misconceptions on the effectiveness of, and indications for, antibiotics exist. Nearly half of all responders (47.8%) incorrectly identified antibiotics as being effective in treating viral infections. Doctors should be aware that unnecessary prescribing could facilitate misconceptions regarding antibiotics and respiratory tract infections. Expectations of receiving antibiotics were higher for the disease label ‘acute bronchitis’ than for any of the separate or combined symptoms prominently present in respiratory tract infection. Public beliefs and expectations should be taken into account when developing interventions targeting the public, patients, and physicians to reduce unnecessary prescribing of antibiotics for respiratory tract infections.

Keywords
antibiotics; community; public beliefs; respiratory tract infections; survey.

INTRODUCTION
In an era of increasing antimicrobial resistance, reducing over-prescribing of antibiotics for respiratory tract infections is considered a priority for general medical practice.1 Respiratory tract infections comprise upper respiratory tract infections, such as the common cold, and lower respiratory tract infections, such as acute bronchitis and pneumonia. Most respiratory tract infections are viral in origin and self-limiting; therefore, antibiotics are seldom warranted. The probable exception is pneumonia which, regardless of aetiology, is usually treated with antibiotics.2,3 Important factors influencing over-prescription of antibiotics for respiratory tract infections are physicians’ diagnostic uncertainty, patients’ expectations of antibiotics, and physicians’ assumptions regarding these expectations.4–7

Patient expectations are among the strongest predictors of clinicians’ decisions regarding prescribing antibiotics; patients’ knowledge, beliefs, and experiences of antibiotics are likely mediators of
these expectations. For example, it has been recognised that a large proportion of people believe that antibiotics improve outcomes for bacterial as well as viral respiratory infections, and previous studies have described patients’ beliefs and expectations at the point of care for respiratory tract complaints. This study aimed to gain insight into the general public’s knowledge, beliefs, and experiences of antibiotics and respiratory tract infections to determine predictors of accurate knowledge on antibiotic effectiveness.

METHOD
A cross-sectional survey among a sample of the general Dutch population was conducted during a 2-week period in October and November 2006, using an internet-based questionnaire. Approximately 800 responders were considered an adequate sample target to ensure generalisability of answers. Expecting a response rate of 60%, 1300 adult responders (aged ≥16 years) were invited to participate. These responders were randomly selected from a community-based nationwide internet panel of 15,673 individuals (Flycatcher Internet Research BV, Maastricht, the Netherlands) after stratification for sex, age, level of education (low/medium/high), and region of residence, based on national figures from Statistics Netherlands.

The questionnaire was developed by experts initially deciding which domains they considered most important. Questions to tap these domains were derived from previous international qualitative and quantitative scientific publications and further expert opinion. Two pilot studies were performed in general practice to check face validity, and the wording of some items was modified in light of this. Twenty questions with sub-items within the domains of the questions were included in the final instrument (for example, ‘How often do you think the following complaints require antibiotic treatment ...’ [question], ‘... if coughing up phlegm?’ [sub-item]). Response options, including yes/no, agree/disagree, and Likert-type scale response items, were used as appropriate for each question.

Biomedically accepted knowledge of antibiotic effectiveness (that is, knowing that antibiotics are effective against bacteria but not viruses) was assessed by combining true/false answers to two separate questions regarding bacteria and viruses: ‘Antibiotics are effective in treating infections caused by bacteria/viruses’. Respiratory tract infection was defined by means of diagnoses (for example, sinusitis, tonsillitis, and acute bronchitis) and associated symptoms. Explanation boxes accompanied most questions. This proved helpful when explaining commonly used medical terms, such as acute bronchitis.

The internet-based questionnaire software required responders to answer a question with sub-items before being able to continue to the next question; the automatic routing of questions prevented responders returning to and altering responses to questions already completed. Total time taken to complete the questionnaire was recorded and stored to detect possible errors (for example, responders who completed the questionnaire quickly and perhaps did not read everything properly).

All responders’ answers were automatically entered into a data file which was checked for accuracy by two independent researchers. Data were analysed using SPSS (version 13.0). Frequencies and cross tables of pre-selected variables were calculated and χ² tests were performed to identify variables associated with the dependent variable ‘accurate knowledge of antibiotic effectiveness’ (that is, knowing that antibiotics are effective against bacteria but not viruses). Variables with P≤0.10 were selected for the multivariate logistic regression model for the dependent variable to examine independence of associations (P≤0.05). Odds ratios (ORs) with corresponding 95% confidence intervals (CIs) were calculated. Sex, age, and level of education were eligible variables for the multivariate model.

RESULTS
Demographics
Of the 1300 adults invited to participate, 52 individuals could not be contacted as a result of undeliverable invitational e-mails. Of the 1248 eligible responders, 935 completed the online questionnaire (response rate 75%) within a set period of 2 weeks (19 responders did not fully complete the questionnaire). In total, 467 responders (49.9%) were male, and 372 (39.8%) and 249 (26.6%) had a medium and high level of
Responders were representative of the general Dutch population with regard to sex, level of education, and experienced state of health, but older people (aged over 60 years) were under-represented. Other characteristics of the study population, including having a chronic disease and parenthood, are detailed in Table 1. There was no notable difference between characteristics of responders and non-responders.

Knowledge, beliefs, and experiences

The majority of responders (83.7%) endorsed the view that antibiotics are effective in treating infections caused by bacteria (Table 2). However, almost half of responders (47.8%) believed that antibiotics are effective in treating viral infections. The results for these two questions were combined to assess overall knowledge of antibiotic effectiveness and 44.6% of responders accurately identified antibiotics as effective against bacterial and not viral infections.

Of the responders, 93.1% correctly identified penicillin as an antibiotic. Most (n = 806, 86%) had used antibiotics at some point in the past: 236 (25.2%) during the past 12 months for any reason, and 92 (9.8%) in the past year for a respiratory tract infection. Almost a third (31.3%) had obtained information on antibiotics in the past 12 months, mostly from a doctor (53.6%). The perceived need for antibiotic treatment for respiratory tract infection-related symptoms ranged from 6.5% for a cough with transparent phlegm to 46.2% for a cough lasting more than 2 weeks. Similar frequencies to those for the perceived need for antibiotic treatment were found for the perceived need to consult a doctor with these symptoms (Table 3).

Predictors of accurate knowledge of antibiotic effectiveness

Acknowledgement of developing antimicrobial resistance (OR 3.18, 95% CI = 1.75 to 5.79) and high level of education (OR 3.03, 95% CI = 2.11 to 4.36) were the strongest predictors of accurate knowledge of antibiotic effectiveness (Table 4). Female sex was also significantly associated with accurate knowledge (OR 1.54, 95% CI = 1.17 to 2.04). No significant association was observed for having a chronic pulmonary disease (χ² = 1.16, degrees of freedom [df] = 1, P = 0.28) or being a parent of at least one child aged ≤12 years (χ² = 1.72, df = 1, P = 0.19).

DISCUSSION

Summary of main findings

These data reveal important misconceptions that members of the general public have about the effectiveness of, and the appropriate indications for using, antibiotics. Only 44.6% of responders accurately identified antibiotics as being effective against bacteria but not viruses. Expectations for antibiotics were higher for the disease label ‘acute bronchitis’ than for any of the separate or combined respiratory tract symptoms prominently present in respiratory tract infection.

Female sex, use of antibiotics at any time previously, and recent information on antibiotics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Responders n (%)</th>
<th>the Netherlands%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>467 (49.9)</td>
<td>49.0</td>
</tr>
<tr>
<td>Age, years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16–29</td>
<td>164 (17.5)</td>
<td>20.8</td>
</tr>
<tr>
<td>30–44</td>
<td>283 (30.3)</td>
<td>28.6</td>
</tr>
<tr>
<td>45–59</td>
<td>303 (32.4)</td>
<td>26.5</td>
</tr>
<tr>
<td>≥60</td>
<td>185 (19.8)</td>
<td>24.1</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>314 (33.6)</td>
<td>33.6</td>
</tr>
<tr>
<td>Medium</td>
<td>372 (39.8)</td>
<td>41.2</td>
</tr>
<tr>
<td>High</td>
<td>249 (26.6)</td>
<td>25.2</td>
</tr>
<tr>
<td>Experienced state of health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good/good</td>
<td>708 (75.7)</td>
<td>79.9</td>
</tr>
<tr>
<td>Poor (less than good)</td>
<td>227 (24.3)</td>
<td>20.1</td>
</tr>
<tr>
<td>Parenthood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children 0–12 years old</td>
<td>234 (25.0)</td>
<td>n/a</td>
</tr>
<tr>
<td>Children 0–5 years old</td>
<td>122 (13.0)</td>
<td>n/a</td>
</tr>
<tr>
<td>Chronic pulmonary disease</td>
<td>105 (11.2)</td>
<td>n/a</td>
</tr>
<tr>
<td>Chronic disease in general</td>
<td>228 (24.4)</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Data derived from Statistics Netherlands 2006 (www.cbs.nl).
were independently associated with accurate knowledge of antibiotic effectiveness. One possible explanation is that women consult more frequently, often with their children, and therefore receive more accurate information on antibiotics; however, the finding that women had more accurate knowledge was independent of having children in the household.

GPs usually apply a low threshold to prescribe for lower respiratory tract infection in patients with chronic pulmonary disease based, for instance, on evidence of some beneficial effects of antibiotics for acute exacerbations in patients with severe chronic obstructive pulmonary disease or specific symptomatology. However, surprisingly, patients with chronic pulmonary disease did not have more accurate knowledge of antibiotics, despite that they generally are high consulters and receive frequent antibiotic treatment.

Strengths and limitations of the study
To date, this is one of the largest studies on public views of antibiotics and respiratory tract infections in Europe. This study was community-based, while most other research has studied patient populations. Performing this study among the general population allowed the researchers to gain more insight into views on antibiotics and respiratory tract infections before people become unwell and consult. A high response rate was achieved and the study sample was representative of the general Dutch population for most baseline characteristics; the only limitation in this regard was that older people were under-represented.

A limitation of any survey is the potential for recall and response bias. The internet-based questionnaire may have introduced selection bias, as only internet users were invited to participate in the study. The assumption that internet users were better educated did not hold in this regard, given that the level of education of the study sample was similar to that of the Dutch population. However, it may partly explain the under-representation of older people in the study.

Comparison with existing literature
Although many people correctly endorsed the view that antibiotics are generally effective against bacterial infections, nearly half of the responders also endorsed the view that antibiotics are effective in treating viruses. This was surprising, as the Netherlands has low prescribing figures for respiratory tract infections which are mostly viral and self-limiting in origin; therefore, it was expected that the Dutch public would have been better informed. A study investigating public views on antibiotics in the US exposed a similar percentage of responders as the current study, who incorrectly identified antibiotics as being effective against viral infections.

Public misconceptions on antibiotic effectiveness are most likely facilitated by unnecessary antibiotic prescriptions for self-limiting respiratory illnesses. Other research has shown that previous antibiotic treatment was the strongest predictor for patients expecting antibiotics in the future. Given this, it is not unusual that a general population might lack some knowledge of antibiotic efficacy.

Implications for clinical practice and future research
The most important step in enhancing public knowledge on antibiotics is to restrict unnecessary prescriptions of them, thereby establishing evidence-based expectations about antibiotic treatment. More effective education about appropriate antibiotic use, focusing on the treatment of cough and acute bronchitis, could help in this regard. Dutch prescription rates for

Table 3. Responders’ perceived need for antibiotic treatment and need to consult for respiratory tract symptoms and infections (n = 935).

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Perceived need for antibiotic treatment (always/often), n (%)</th>
<th>Perceived need to consult (always/often), n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sore throat</td>
<td>65 (7.0)</td>
<td>19 (2.0)</td>
</tr>
<tr>
<td>Cough with transparent phlegm</td>
<td>61 (6.5)</td>
<td>57 (6.1)</td>
</tr>
<tr>
<td>Cough with yellow/green phlegm</td>
<td>264 (28.2)</td>
<td>264 (28.2)</td>
</tr>
<tr>
<td>Cough with fever</td>
<td>243 (26.0)</td>
<td>145 (15.5)</td>
</tr>
<tr>
<td>Cough lasting more than 2 weeks</td>
<td>432 (46.2)</td>
<td>438 (46.8)</td>
</tr>
<tr>
<td>Respiratory tract infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common cold</td>
<td>11 (1.2)</td>
<td></td>
</tr>
<tr>
<td>Acute bronchitis</td>
<td>557 (59.6)</td>
<td></td>
</tr>
<tr>
<td>Pneumonia</td>
<td>850 (90.9)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Factors independently associated with accurate knowledge of antibiotic effectiveness.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds ratio (95% confidence interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1.54 (1.17 to 2.04)</td>
</tr>
<tr>
<td>Level of education</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.00 (reference)</td>
</tr>
<tr>
<td>Medium</td>
<td>1.79 (1.30 to 2.47)</td>
</tr>
<tr>
<td>High</td>
<td>3.03 (2.11 to 4.36)</td>
</tr>
<tr>
<td>Acknowledgement of developing bacterial resistance</td>
<td>3.18 (1.75 to 5.79)</td>
</tr>
<tr>
<td>Use of antibiotics at any time</td>
<td>2.12 (1.38 to 3.25)</td>
</tr>
<tr>
<td>Received or searched for information on antibiotics during the past 12 months*</td>
<td>1.50 (1.12 to 2.01)</td>
</tr>
</tbody>
</table>

*Information obtained from doctor, pharmacist, pharmacy, patient leaflet, the internet, or the media.
acute bronchitis are comparable to the US and the UK, where approximately 80% of patients consulting with this diagnosis are prescribed antibiotics.20–21

The majority of this study’s responders considered antibiotic treatment necessary for acute bronchitis. This misconception was independent of age, sex, or level of education. The proportion of responders who endorsed the view that antibiotics helped the symptoms of acute bronchitis resolve more quickly than recovery without antibiotics was much higher than for any of the separate respiratory tract symptoms (Table 3). In other words, expectations for antibiotics were highest when mentioning the disease label ‘acute bronchitis’ (Table 3), compared with when mentioning separate or combined symptoms commonly used in the definition of acute bronchitis (prominent cough with phlegm occurring for any duration).

Although antibiotics do not meaningfully alter the course of uncomplicated acute bronchitis for most people,2 up to 50% of the public expect a prescription for antibiotics when consulting with an ongoing cough. This expectation exists regardless of country or continent, as found by Pechere in an intercontinental study.16 GPs are often in time-pressured consultations with limited options for dealing with these expectations. Steering clear of disease labels and microbiological distinctions, and focusing on symptoms may help GPs to restrict their prescribing of antibiotics while providing patients with accurate information on the necessity of antibiotics for specific symptoms.

Several interventions that involve giving patients accurate information can improve the appropriateness of prescribing antibiotics. That some 40% of the study population considered a delayed prescription acceptable, despite the rarity of this prescribing strategy in the Netherlands, merits further research. Even when using this strategy of delayed prescription, setting realistic goals about the likely clinical course — and its long duration in particular, both with and without treatment with antibiotics — is crucial to changing incorrect assumptions about treatment using antibiotics. Training physicians in communication skills could be an additional means to achieving this,22 as could educational interventions aimed at informing doctors and patients. Multifaceted educational interventions have proven to be most effective in this regard.24–27

Possible future interventions involving information on antibiotics and respiratory tract infections aimed at the general public should consider focusing on educating younger generations. They will be the ones consulting with respiratory tract infections for many years to come, especially when consulting with their children. For many people suffering from a non-resolving severe cough, treatment using antibiotics appears to be the obvious solution. Such inappropriate expectations persist irrespective of national prescribing figures or international borders. Hence working towards a more appropriate management of respiratory tract infections using antibiotics requires an international effort. Acknowledging the public’s views on antibiotics and respiratory tract infections remains crucial to this endeavour for both researchers and physicians.

Funding body
This study was funded by the Netherlands Organisation for Health Research and Development (ZonMW 945-04-010). None of the sources of funding influenced the study design, the writing of the manuscript, or the decision to submit the manuscript for publication. No ethical approval was required for this questionnaire study.

Competing interests
The authors have stated that there are none.

Acknowledgements
The authors would like to thank Bram de Volder (Flycatcher Internet Research BV), Paula Rinkens and Piet Portegijs (Department of General Practice, Maastricht University) for their assistance in developing the questionnaire and analysing data. Thanks are also extended to the patients and GPs of the GP clinics Wijlre and MC Putstraat for their contribution to the pilot studies.

Discuss this article
Contribute and read comments about this article on the Discussion Forum: http://www.rcgp.org.uk/bjgp-discuss

REFERENCES


