Prevalence and influence of diagnostic tests for acute respiratory tract infections in primary care

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Background: General practitioners (GPs) use diagnostic tests to help distinguish between viral and bacterial acute respiratory tract infections (ARTI). We investigated the prevalence of these tests, and how tests are associated with diagnosis, treatment and patient satisfaction.

Methods: As part of a clinical trial, 45 GPs screened 1108 patients with ARTI and collected information on signs and symptoms, diagnostic test results, and subsequent diagnosis and treatment. A sample of 636 patients was interviewed after 7 days and their opinions recorded. We used multivariate mixed models to estimate associations between the use of tests and (1) baseline characteristics, (2) subsequent antibiotic treatment, and (3) patient satisfaction.

Results: GPs carried out at least one test in 42% of the 1108 patients screened. The tests used were (percentage of patients): CRP (35%), leucocyte count (17%), rapid Strep A (9%), chest X-ray (5%), sinus X-ray (1%), and throat culture (1%). The use of tests was associated with increasing patient age, education, and degree of discomfort. Antibiotic therapy was strongly associated with a positive test, with odds ratios of 26 (95% CI, 10–67) for a CRP above 50 mg/l; 9.6 (95% CI, 3.6–26) for a leucocyte count above 10000/µl; and 122 (4.4–3435) for a positive StrepA test. There was no evidence of an association between the use of tests and patient satisfaction.

Conclusions: Nearly half of these patients with ARTI received a diagnostic test. Older patients, those with higher education and those in more discomfort were more likely to get tests. A positive test was strongly associated with antibiotic treatment.

Key words: respiratory tract infections; primary care; diagnostic tests; prevalence; antibiotic therapy

Introduction

Antibiotics are often prescribed for acute respiratory tract infections (ARTI) in primary care, although ARTI are mainly viral in origin and self-limiting [1]. A correct aetiological diagnosis is crucial for the judicious use of antibiotics, but even with laboratory or radiographic tests it is difficult to distinguish between viral and bacterial ARTI [2]. The unnecessary use of antibiotics increases both bacterial resistance to common pathogens [3] and drug expenditure [4]. Increasing bacterial resistance together with a dramatic reduction in investment in developing new anti-infective agents has created a pressing public health problem [5].

Some Scandinavian studies have suggested that diagnostic tests for ARTI are overused in primary care [6, 7]. However, apart from questionnaire studies [8], little is known about how Swiss general practitioners (GPs) diagnose and treat ARTI. In this study we use prospectively collected data on diagnostic tests and treatment for ARTI from all patients screened for a randomised controlled trial (ISRCTN57824788) [9]. We considered (1) whether patient baseline characteristics were associated with the use of tests, (2) whether test results were associated with ARTI-diagnosis and antibiotic treatment, and (3) whether the use of diagnostic tests was associated with patient satisfaction or enablement.
Methods
Design and participants
The patients in this study were those screened in a cluster randomised controlled trial [9]. This trial evaluated the effect of training GPs in communication skills on the prescription of antibiotics for ARTI in primary care. We invited all 345 GPs in two cantons (Basel-Stadt and Aargau – in both, self-dispensation of drugs is not allowed) to participate in the trial; 45 gave written informed consent and were recruited. The first 30 GPs were randomised in equal numbers to receive both evidence-based guidelines for the management of ARTI and training in patient-centred communication, or evidence-based guidelines only. The remaining 15 GPs served as a control without any intervention, to blind the physicians in the other two groups to the true comparison. Between January and May 2004 study GPs screened consecutive patients aged 18 years or older, with a first consultation for an acute infection of the respiratory system (symptoms first experienced within the previous 28 days) until each GP had recruited 20 patients for the trial (see flow-diagram of participants, figure 1 of [9]). Possible diagnoses were common cold, rhinosinusitis, pharyngitis, exudative tonsillitis, laryngitis, otitis media, bronchitis, exacerbated COPD, influenza, and community-acquired pneumonia.

Data and outcomes
We obtained baseline data on all eligible GPs from the registry of the Swiss Medical Association. Study GPs used a case report form to collect baseline data on signs and symptoms, diagnostic tests, diagnosis, comorbidity and prescribed medication for each of the 1108 patients screened. Medical students, blinded to the goal of the trial, interviewed a sample of 636 patients at 7 days by phone. Due to limited resources they interviewed only recruited patients in the two randomised groups and a convenience sample (one third) of the recruited patients in the control group (response rate >98%; see figure 1 of [9]). Patient satisfaction and enablement were measured using validated scales [10, 11]. We entered the collected data electronically into a database using Teleform®-Software (Cardwell, Cardiff, GB).

Prevalence of diagnostic tests
Most of the 45 GPs were able to carry out diagnostic tests in-house: 96% could provide a near-patient CRP, 91% could provide a leucocyte count, 80% could provide a rapid StrepA test, and 64% could provide an X-ray (table 1).

Of the 1108 screened patients, GPs carried out at least 1 diagnostic test in 460 (42%) patients, and at least 2 in 226 (20%). The most common tests were the near-patient CRP test (n = 117), patients with a leucocyte count (n = 160), patients receiving a rapid StrepA-test (n = 78), and patients without a test (n = 547). Each model used the same random and fixed effects as before.

Results
Data from the Swiss Medical Association suggests that participating GPs were similar to all eligible GPs in the 2 cantons with respect to characteristics recorded by the Association [9]. The median age of the 45 participating GPs was 52 years (interquartile range, IQR, 11); 18% were female; 58% and 33% were board approved in General Medicine and Internal Medicine, respectively, with a median of 9.2 years (IQR 3.0) of postgraduate training and of 14 years (IQR 15) of experience in private practice.

Among the 1108 screened patients with ARTI, the median age was 42 years (IQR 26); 58% were women; the median degree of discomfort (on an increasing scale from 1 to 10) at consultation was 5 (IQR 3); and the median days with restrictions from ARTI before consultation was 4 (IQR 4) [9].
Diagnostic tests for acute respiratory infections

Table 1
Overview of diagnostic tests used for ARTI in general practice.

<table>
<thead>
<tr>
<th>CRP test</th>
<th>NycoCard® Single test</th>
<th>QuickRead®</th>
<th>Other near-patient CRP tests</th>
<th>Sent to external laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>32 (71)</td>
<td>7 (16)</td>
<td>4 (9)</td>
<td>2 (4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Leucocyte count</th>
<th>Automatic cell counter</th>
<th>Microscope</th>
<th>QBC®</th>
<th>Sent to external laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td>19 (42)</td>
<td>19 (42)</td>
<td>3 (7)</td>
<td>4 (9)</td>
</tr>
</tbody>
</table>

Rapid StrepA test

<table>
<thead>
<tr>
<th>Testpack plus StrepA with OBC II® (Abbott)</th>
<th>NEO StrepA® (Intex)</th>
<th>Others</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 (27)</td>
<td>9 (20)</td>
<td>15 (31)</td>
<td>9 (20)</td>
</tr>
</tbody>
</table>

X-ray facility

| Available in practice | 29 (64) |

Table 2
Prevalence of diagnostic tests for ARTI in a clinical trial.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Total n</th>
<th>No tests* n (%)</th>
<th>CRP n (%)</th>
<th>Leucocytes n (%)</th>
<th>X-ray chest n (%)</th>
<th>X-ray sinus n (%)</th>
<th>Rapid StrepA n (%)</th>
<th>Throat-culture n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common cold</td>
<td>427</td>
<td>282 (66)</td>
<td>132 (31)</td>
<td>55 (13)</td>
<td>8 (1.9)</td>
<td>3 (0.7)</td>
<td>13 (3.0)</td>
<td>1 (0.2)</td>
</tr>
<tr>
<td>Acute rhinosinusitis</td>
<td>171</td>
<td>106 (62)</td>
<td>57 (33)</td>
<td>38 (22)</td>
<td>4 (2.3)</td>
<td>9 (5.3)</td>
<td>7 (4.1)</td>
<td>0</td>
</tr>
<tr>
<td>Acute pharyngitis</td>
<td>109</td>
<td>52 (48)</td>
<td>37 (14)</td>
<td>12 (11)</td>
<td>3 (2.8)</td>
<td>0</td>
<td>32 (29)</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td>Acute exudative tonsillitis</td>
<td>51</td>
<td>13 (26)</td>
<td>13 (26)</td>
<td>10 (20)</td>
<td>0</td>
<td>0</td>
<td>35 (69)</td>
<td>7 (14)</td>
</tr>
<tr>
<td>Acute laryngitis</td>
<td>29</td>
<td>15 (52)</td>
<td>12 (41)</td>
<td>5 (17)</td>
<td>2 (6.9)</td>
<td>0</td>
<td>4 (14)</td>
<td>0</td>
</tr>
<tr>
<td>Acute otitis media</td>
<td>23</td>
<td>18 (78)</td>
<td>5 (22)</td>
<td>3 (13)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Acute bronchitis</td>
<td>160</td>
<td>76 (48)</td>
<td>78 (49)</td>
<td>36 (23)</td>
<td>20 (13)</td>
<td>2 (1.3)</td>
<td>2 (1.3)</td>
<td>0</td>
</tr>
<tr>
<td>Influenza</td>
<td>100</td>
<td>76 (76)</td>
<td>23 (23)</td>
<td>16 (16)</td>
<td>6 (6.0)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exacerbated COPD</td>
<td>18</td>
<td>8 (44)</td>
<td>10 (56)</td>
<td>3 (17)</td>
<td>2 (11)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CAP</td>
<td>20</td>
<td>2 (10)</td>
<td>15 (75)</td>
<td>11 (55)</td>
<td>15 (75)</td>
<td>1 (5.0)</td>
<td>1 (5.0)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1108</td>
<td>648 (59)</td>
<td>382 (35)</td>
<td>189 (17)</td>
<td>60 (5.4)</td>
<td>15 (1.4)</td>
<td>94 (8.5)</td>
<td>10 (0.9)</td>
</tr>
</tbody>
</table>

* History taking and clinical examination only

CRP, C-reactive protein; rapid StrepA test, rapid Streptococcus A antigen detection test;

Table 3
Predictors for diagnostic tests.

<table>
<thead>
<tr>
<th>Predictors for tests</th>
<th>Odds ratio (95% confidence interval) n = 932 *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of tests (yes/no)</td>
<td>Number of tests (0,1,...,5)</td>
</tr>
</tbody>
</table>

| Degree of discomfort (1–10) | 1.16 (1.06–1.27) | 1.16 (1.08–1.25) |
| Days with restrictions     | 1.02 (0.98–1.07) | 1.02 (0.98–1.06) |
| Age (per 10 years)         | 1.12 (1.08–1.24) | 1.14 (1.04–1.25) |
| Gender (men)               | 1.21 (1.07–1.67) | 1.28 (0.96–1.70) |
| Education (per 5 years) ** | 1.42 (1.04–1.94) | 1.35 (1.02–1.77) |

<table>
<thead>
<tr>
<th>Treatment group of GPs:</th>
<th>Odds ratio (95% confidence interval) n = 932 *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.00 (reference)</td>
</tr>
<tr>
<td>Guidelines</td>
<td>0.58 (0.20–1.65)</td>
</tr>
<tr>
<td>Guidelines + communication training</td>
<td>1.70 (0.59–4.87)</td>
</tr>
</tbody>
</table>

* Multivariate mixed models for binary (left column) and ordinal (right column) outcomes with the GP as a random effect. Missing values led to a reduced sample.

** Based on sensitivity analysis (n = 630) with education as an additional fixed effect in the model
a CRP above 50 mg/l, 9.6 (95% CI, 3.6–26) for a leucocyte count above 10 000/µl, and 122 (95% CI, 4.4–3435) for a positive StrepA test (table 5). This suggests that GPs rely on test results when deciding whether to prescribe antibiotics for ARTI.

**Discussion**

GPs carried out diagnostic tests in 42% of 1108 first consultations for ARTI. GPs were more likely to use tests when patients were older, better educated or felt more discomfort. The data suggest that GPs relied on test results when making decisions about diagnosis and antibiotic treatment. However, there was no evidence for a strong association between the use of tests and patient satisfaction or enablement.

This study has strengths and weaknesses. We used data collected in a clinical trial [9], and this may reduce the external validity of our results. GPs may behave differently when monitored in the setting of a trial (a Hawthorne effect [13]), and those
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who participate in a trial are perhaps more motivated than other GPs. Moreover, the evidence-based guidelines for ARTI given to two thirds of the GPs in our trial may have influenced their behaviour. However, the trial intervention was designed to reduce antibiotic use, and the evidence-based guidelines were focused on the appropriate use of antibiotic therapy rather than on the use of diagnostic tests. Two large surveys in Sweden both reported a similar distribution of ARTI diagnoses and similar use of the CRP test (in 42% [6] and in 31% [7] of patients respectively, compared to 35% in this study). Like all GPs in Switzerland, study GPs with in-house lab facilities potentially have a financial incentive to carry out diagnostic tests, because they get reimbursed by social health insurers for the use of these tests. However, their use of CRP and rapid StrepA tests was no more frequent than in Swedish primary health care centres where GPs have no such financial incentive [6, 7].

Strengths of this study were its wide range of documented clinical information and the prospective design with data from patients linked to data from their GP. We used validated instruments to measure patient satisfaction [10] and enablement [11]. In all our analyses, we took into account the clustered nature of the trial design and its 3 intervention groups.

Evidence-based guidelines recommend the use of rapid StrepA tests when there are at least 2 out of 4 Centor criteria (tonsillar exudates, absence of cough, history of fever, tender anterior cervical adenopathy) [12]. These were met in 84% of our patients with a StrepA test that indicates fair agreement with guidelines. There was no excessive use of rapid StrepA tests among our patients (8.5%) as found in Sweden (22% of encounters) [7]. The use of throat cultures (less than 1% of our patients) is discouraged by guidelines, mainly because they do not allow “real-time” decisions. So, if no rapid test is available, antibiotics should be reserved for patients with 3 or 4 Centor criteria [12].

Results from this study suggest that GPs relied on results of diagnostic tests when making decisions about antibiotic therapy. Unfortunately CRP or leucocyte counts do not accurately distinguish between viral and bacterial infections [7, 14]. The intervention of our trial may have had a subtle effect on GPs’ testing and prescribing behaviour. GPs in the guidelines and communication training group were perhaps more likely to carry out diagnostic tests (table 3: OR 1.70; 95% CI, 0.59–4.87), but less likely to prescribe antibiotics to those patients not given a test (table 5: OR 0.25; 95% CI, 0.08–0.79). We see this shift in behaviour as a consequence of GPs trying to prescribe fewer antibiotics while still maintaining patient safety. There is an obvious need for more accurate diagnostic tests, and we are currently running a trial where antibiotic therapy for patients with ARTI is guided by a new Procalcitonin test [17].

Acknowledgements

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