

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

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| <b>TITLE (PROVISIONAL)</b> | Adherence to guidelines on antibiotic treatment for respiratory tract infections in various categories of physicians. A retrospective cross-sectional study of data from electronic patient records |
| <b>AUTHORS</b>             | Tell, David; Engström, Sven; Mölsted, Sigvard   |

### VERSION 1 - REVIEW

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| <b>REVIEWER</b>        | Carl Llor<br>Primary Healthcare Centre Barcelona-2B (Via Roma), Catalonia, Spain<br><br>I report receiving research grants from the European Commission (Sixth and Seventh Programme Frameworks), Catalan Society of Family Medicine, and Instituto de Salud Carlos III (Spanish Ministry of Health). |
| <b>REVIEW RETURNED</b> | 23-Apr-2015   |

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| <b>GENERAL COMMENTS</b> | <p>The main concern of this retrospective study is the accuracy of the diagnostic codes used by GPs in your country and some of the queries I have are related to that (see below). I would like to know if you have a subgroup of high-quality medical records you can trust or have you compared the whole database with a subgroup of the best practices.</p> <p>The cases of tonsillitis clearly outnumber the episodes of pharyngitis (table 2) by nearly four-fold, with antibiotics prescribed in 88.3% and 18.5% of the cases, respectively. This contrasts with the percentage of streptococcal episodes of sore throat that require antibiotics. How do you explain these figures?</p> <p>The number of pneumonias is also shocking, with more cases than episodes of acute bronchitis. I imagine that Swedish GPs do not perform radiological study to confirm these cases and I reckon that some of these cases are false positives. You should clarify this finding. Curiously, older GPs tend to prescribe fewer antibiotics than their younger counterparts in cases of pneumonia. However, national guidelines recommend the use of narrow-spectrum antibiotics in such cases. How do you explain this finding?</p> <p>Another curious finding is the use of 'cough' as a diagnostic code, with more cases of cough than episodes of acute bronchitis in patients aged less than 50. Obviously, the retrospective nature of the study is unable to answer the reasons why GPs select either of these two diagnoses; however, because the number of cases of cough is not negligible in this study, more information about how Swedish GPs diagnose the infections is necessary.</p> |
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|  | <p>Guidelines often use other variables not considered in your paper. For instance, other variables not taken into account, such as demographic and socioeconomic issues can also explain the variability of antibiotic prescribing across countries and in the same country, across counties, as you mention in your paper. Since this is an international journal and many readers are not aware of these aspects in Jönköping County, can you better explain if socioeconomic differences are present in this county and, if they are present, is there any bias that those from poorer areas are more likely to be visited by locum doctors?</p> <p>The presence of significant comorbidities is increasingly considered in guidelines on respiratory tract infections on whether antibiotic treatment should be prescribed or not. Despite being mentioned as a limitation I would like to know how you coped with this in this paper and how much did this affect the results of the study? For instance, according to the results in your manuscript older GPs visited older patients than younger GPs. Do you consider that this age difference could partly explain the results obtained?</p> <p>Along with the previous query, the severity of the infection, that is not usually coded, can also justify the antibiotic prescribing in otherwise self-limiting infections, such as an acute bronchitis, as currently considered in many guidelines. Since the main outcome was the prescription of antibiotics and the percentage of penicillin V prescribed in various infections, an adjustment seems reasonable. Do you usually register how severe the patient is in your medical records? How did you cope with this?</p> <p>Nothing is mentioned in this study about the use of point-of-care tests for lower respiratory tract infections. Did you analyse its use retrospectively? Do you think that the differences of antibiotic prescribing observed among the different GP categories could also be explained by an uneven utilisation of rapid tests? You mention that locum doctors are more often stuck to stricter schedules and they have more time constraints than the other doctors, and therefore, these doctors might have used fewer rapid tests than the others. Could you discuss this issue more in depth?</p> <p>Table 2. Correct misspelled words</p> <p>Reference number 23 was published in 2012. Please correct. You mention that male gender of GPs is associated with a higher misprescription of antibiotics based on paper ref. 23. However, most of the studies included in this systematic review did not find any influence of the GP's gender on antibiotic misprescription. Please correct.</p> |
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| <b>REVIEWER</b>        | Francois Angoulvant<br>Pediatric emergency department<br>Hopital Necker-Enfants Malades, APHP<br>France |
| <b>REVIEW RETURNED</b> | 02-May-2015   |

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| <b>GENERAL COMMENTS</b> | The submitted manuscript is a retrospective registry study performed in a Swedish county in 2011 and 2012. The authors have analysed antibiotic prescription patterns concerning respiratory tract infections between different physician's categories. The use of Electronic |
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|  | <p>patient records has permit to retrieve the majority of antibiotic prescription of the county. The authors showed a variation across physician's categories, younger ones seem to better comply with national guidelines. The methods used are robust, results are clearly described. Overall this manuscript showed very interesting results and I recommend it to be published.</p> <p>However, I have few comments:</p> <p>Major comments:</p> <p>1) Definition of some physician's categories remains unclear. Could the authors describe in the method section the definition of physicians categories especially resident, intern, and locum ? (I did not understand who are these locum doctors: are they old ? young ? male ? female ? from others specialty ? how have they been define ?...) Could the authors provide more informations about these categories (age, sex,...) ? may be in a table ?</p> <p>2) According to A. Teixeira Rodrigues et al. / International Journal of Antimicrobial Agents 41 (2013) 203– 212 "Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies". Antibiotic prescription pattern are related to physicians factors but also to patients factors. I feel that the authors should detailed better patients population, especially I believe they should provide more information about age of their patient: Median + interquartile and not only mean. If more informations are available about socio-economic status it could be great. This point should also be better included in the discussion.</p> <p>3) The authors have at their disposal a large amount of data. I am surprised they did not conduct a multivariate analysis. It seems difficult to argue that there are differences in prescribing practices between male and female without performing multivariate study. Indeed what is the sex ratio in each physician category? The authors should either discuss that possibility or achieve multivariate analysis.</p> <p>Minor comments:</p> <ul style="list-style-type: none"> <li>• Background: Could the authors provide a reference? "In Sweden there are national guidelines for all infections common in primary care."</li> <li>• Methods: "Due to the very large number of observations, each reported difference was highly significant (<math>p &lt; 0.001</math>) and p-values are therefore not reported" Even if a agree with the sentence, could the authors provide the name of the tests used ?</li> </ul> |
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### VERSION 1 – AUTHOR RESPONSE

Reviewer Name Carl Llor

2/The main concern of this retrospective study is the accuracy of the diagnostic codes used by GPs in your country and some of the queries I have are related to that (see below). I would like to know if you have a subgroup of high-quality medical records you can trust or have you compared the whole database with a subgroup of the best practices.

Answer:

Unfortunately we do not have any data from a sub-group of excellence to compare with. Accuracy of diagnostic codes is not a hallmark of general practice. There is a great variation in the choice of diagnostic codes. Studies have shown about 50% consistency between GPs when coding the same patients. Nevertheless, we believe that in our material quality of the records are pretty good. The observations about the frequency of various diagnoses that you have done is explained by the way primary care in Sweden is organized. See below (3).

3/ The cases of tonsillitis clearly outnumber the episodes of pharyngitis (table 2) by nearly four-fold, with antibiotics prescribed in 88.3% and 18.5% of the cases, respectively. This contrasts with the percentage of streptococcal episodes of sore throat that require antibiotics. How do you explain these figures?

Answer:

When you want to consult a GP in Sweden you have to call a nurse at the health centre to book an appointment. Nurses in primary care are as a rule specially trained and work quite independently. They give advices by telephone and they also do their own patient consultations. Most patients with a sore throat get good advice from the nurses, who often use flow charts with Centor criteria, and do not need to see a GP.

In the discussion on page 13 we have added the following text:

“In Swedish primary care, patients most often call their PHCC to get an appointment. Specialized nurses will evaluate history and symptoms and most patients with mild symptoms get telephone advice from the nurse and not a physician consultation. This triage system can explain the low prevalence of consultations per inhabitant for RTIs and especially for the diagnoses common cold, pharyngitis and acute bronchitis.”

4/The number of pneumonias is also shocking, with more cases than episodes of acute bronchitis. I imagine that Swedish GPs do not perform radiological study to confirm these cases and I reckon that some of these cases are false positives. You should clarify this finding. Curiously, older GPs tend to prescribe fewer antibiotics than their younger counterparts in cases of pneumonia. However, national guidelines recommend the use of narrow-spectrum antibiotics in such cases. How do you explain this finding?

Answer:

We find the yearly incidence of pneumonia (=20 /1000 inhabitants) in the population somewhat high but not shocking. In our data we cannot distinguish between first visit and return visits. In pneumonia return visits are fairly common. We believe that almost all patients diagnosed with acute pneumonia are given antibiotics. In this study only 73 % were treated, which could indicate that about 1/4 of all visits were return visits. This would reduce the true incidence to about 15 per 1000 inhabitants.

We added the following text in the discussion, page 13.

“,and we noted a rather high number of consultations for pneumonias in our study, 20 per 1000 inhabitants and year, of which only approximately 75% received an antibiotic prescriptions. This indicates that about 1/4 of these consultations were control visits, since antibiotics are always recommended for pneumonia.”

Concerning the low frequency of acute bronchitis:

Most patients with common colds and cough are taken care of by the nurses at the primary care health center and do not need to see a physician.

The low frequency of acute bronchitis is partly explained by this and it is also very common that GPs use the diagnosis “common cold” for those patients who have a cold even if they also have a troublesome cough.

We also added the following text in the discussion, page 13.

“In Swedish primary care, patients most often call their PHCC to get an appointment. Specialized

nurses will evaluate history and symptoms and most patients with mild symptoms receive telephone advice from the nurse and not a physician consultation. This triage system can explain the low prevalence of consultations per inhabitant for RTIs and especially for the diagnoses common cold, pharyngitis and acute bronchitis".

5/ Another curious finding is the use of 'cough' as a diagnostic code, with more cases of cough than episodes of acute bronchitis in patients aged less than 50. Obviously, the retrospective nature of the study is unable to answer the reasons why GPs select either of these two diagnoses; however, because the number of cases of cough is not negligible in this study, more information about how Swedish GPs diagnose the infections is necessary.

Answer:

The reason why GPs select either of these diagnoses is not clear in this study. To increase knowledge in this field, a quite extensive review of medical records would be needed.

We added the following text in the discussion, page 11.

"We choose also to include the symptom diagnosis cough, to make sure that all diagnoses that might represent a lower RTI was accounted for".

6/ Guidelines often use other variables not considered in your paper. For instance, other variables not taken into account, such as demographic and socioeconomic issues can also explain the variability of antibiotic prescribing across countries and in the same country, across counties, as you mention in your paper. Since this is an international journal and many readers are not aware of these aspects in Jönköping County, can you better explain if socioeconomic differences are present in this county and, if they are present, is there any bias that those from poorer areas are more likely to be visited by locum doctors?

Answer:

There are of course socioeconomic differences between the populations of the health centres in Jönköping County. In response to your comment we acquired the mean socioeconomic situation of the population of the health care centres expressed by the Care Need Index (CNI) and we found no correlation between the proportions of consultations performed by locum doctors and CNI. We have included the following text in the discussion on page 13:

"We considered that locums maybe more often served at PHCCs in areas with low socio economic status, which thus could explain a higher need for antibiotics. However, at PHCC level, locums performed the same proportion of consultations in affluent as in deprived areas."

7/ The presence of significant comorbidities is increasingly considered in guidelines on respiratory tract infections on whether antibiotic treatment should be prescribed or not. Despite being mentioned as a limitation I would like to know how you coped with this in this paper and how much did this affect the results of the study? For instance, according to the results in your manuscript older GPs visited older patients than younger GPs. Do you consider that this age difference could partly explain the results obtained?

Answer:

The age difference among the patients visiting the two mentioned groups is 1.4 years (younger GPs: 40.0 years, older GPs 41.4 years.) We don't think that this small difference affects the results to any

significant extent.

8/ Along with the previous query, the severity of the infection, that is not usually coded, can also justify the antibiotic prescribing in otherwise self-limiting infections, such as an acute bronchitis, as currently considered in many guidelines. Since the main outcome was the prescription of antibiotics and the percentage of penicillin V prescribed in various infections, an adjustment seems reasonable. Do you usually register how severe the patient is in your medical records? How did you cope with this?

Answer:

The severity of the infection might be documented in plain text in the medical record and thus could not be retrieved by us. The diagnostic code is the same irrespective of the severity of the infection. However, in this large material, we believe it is unlikely that one specific category of physicians more often met patients with a more severe infection than the other categories.

In the discussion on page 11, we now write that information about the severity could not be retrieved.

“The assessment of adherence to guidelines often requires facts that are recorded in plain text such as patient history, clinical signs, severity of infection, patient’s socioeconomic status and utilisation of rapid tests, which could not be retrieved from the database.”

9/ Nothing is mentioned in this study about the use of point-of-care tests for lower respiratory tract infections. Did you analyse its use retrospectively? Do you think that the differences of antibiotic prescribing observed among the different GP categories could also be explained by an uneven utilisation of rapid tests? You mention that locum doctors are more often stuck to stricter schedules and they have more time constraints than the other doctors, and therefore, these doctors might have used fewer rapid tests than the others. Could you discuss this issue more in depth?

Answer:

Point-of-care tests are widely used in Sweden In one of our prior studies rapid tests for streptococci were performed in 58% of all consultations for pharyngitis and tonsillitis, and CRP was analyzed in 29% of all consultations for an RTI.

Unfortunately, the utilization of rapid tests could not be extracted from the database. This is now written in the discussion, page 11.

“The assessment of adherence to guidelines often requires facts that are recorded in plain text such as patient history, clinical signs, severity of infection, patient’s socioeconomic status and utilisation of rapid tests, which could not be retrieved from the database.”

10/Table 2. Correct misspelled words

Answer:

We have corrected the word sinusitis.

11/ Reference number 23 was published in 2012. Please correct. You mention that male gender of GPs is associated with a higher misprescription of antibiotics based on paper ref. 23. However, most of the studies included in this systematic review did not find any influence of the GP's gender on antibiotic misprescription. Please correct.

Answer:

The reference number 23 and the citing of it is corrected and the text in the discussion is corrected according to the comments.

"Most of the studies included in this systematic review did not find any influence of the GP's gender in antibiotic prescription."

Reviewer Name Francois Angoulvant  
Institution and Country Pediatric emergency department  
Hopital Necker-Enfants Malades, APHP  
149 rue de Sèvres, 75015 PARIS  
FRANCE

Please state any competing interests or state 'None declared': none declared

Please leave your comments for the authors below  
bmjopen-2015-008096, entitled "Adherence to guidelines on antibiotic treatment for respiratory tract infections in various categories of physicians: a retrospective study."

The submitted manuscript is a retrospective registry study performed in a Swedish county in 2011 and 2012. The authors have analysed antibiotic prescription patterns concerning respiratory tract infections between different physician's categories. The use of Electronic patient records has permit to retrieve the majority of antibiotic prescription of the county. The authors showed a variation across physician's categories, younger ones seem to better comply with national guidelines. The methods used are robust, results are clearly described. Overall this manuscript showed very interesting results and I recommend it to be published.

However, I have few comments:

Major comments:

1) Definition of some physician's categories remains unclear. Could the authors describe in the method section the definition of physicians categories especially resident, intern, and locum ? (I did not understand who are these locum doctors: are they old ? young ? male ? female ? from others specialty ? how have they been define ?.) Could the authors provide more informations about these categories (age, sex,.) ? may be in a table ?

Answer:

In the background interns and residents now are more clearly defined. We also have completed the background with the following concerning the locums:

"Following this, the National board of Health and Welfare requires a minimum of 18 months of clinical internship (interns) before granting a medical license as a fully qualified Doctor of Medicine.15 Upon receiving a license to practice, a physician is able to apply for a post to start specialist training, (residents). "

"The main part of the locums, 71 %, were fully trained GPs and 20 % had not yet acquired any speciality"

We have supplemented table 1 with age and the proportion of females is presented on page 7.

"We were able to define the gender of 427 physicians. For those the proportion of females were among interns 58%, residents 55%, younger GPs 54 %, older GPs 30% and locums 22%."

2) According to A. Teixeira Rodrigues et al. / International Journal of Antimicrobial Agents 41 (2013) 203- 212 "Understanding physician antibiotic prescribing behaviour: a systematic review of qualitative studies".

Antibiotic prescription pattern are related to physicians factors but also to patients factors. I feel that the authors should detailed better patients population, especially I believe they should provide more information about age of their patient: Median + interquartile and not only mean. If more informations are available about socio-economic status it could be great. This point should also be better included in the discussion.

Answer:

In table 1, you now can see mean age of patients and standard deviation.

We do not have socioeconomic data on patient level.

Concerning socio-economic status, se paragraph 6 above.

3) The authors have at their disposal a large amount of data. I am surprised they did not conduct a multivariate analysis. It seems difficult to argue that there are differences in prescribing practices between male and female without performing multivariate study. Indeed what is the sex ratio in each physician category? The authors should either discuss that possibility or achieve multivariate analysis.

Answer:

Given that women were underrepresented among locums probably a multivariate analysis with regard to both gender and medical category would show larger differences between genders.

Differences between the sexes is however not the focus of this study.

Minor comments:

. Background: Could the authors provide a reference? "In Sweden there are national guidelines for all infections common in primary care."

Answer:

The references are given in this sentence in the background:

"Phenoxymethylpenicillin (PcV) is the recommended first choice antibiotic for acute otitis media<sup>11</sup>, sinusitis<sup>12</sup>, tonsillitis<sup>13</sup> and pneumonia<sup>14</sup>. No antibiotic treatment is recommended for acute bronchitis.<sup>14</sup>"

. Methods: "Due to the very large number of observations, each reported difference was highly significant ( $p < 0.001$ ) and p-values are therefore not reported" Even if a agree with the sentence, could the authors provide the name of the tests used ?

Answer:

The statistical method is now defined in the method page 6.

"Significances were tested with the Chi Square test.. "

**VERSION 2 – REVIEW**

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| <b>REVIEWER</b>        | <p>Carl Llor<br/>GP and senior researcher. Primary Health Centre Via Roma,<br/>Barcelona, Catalonia</p> <p>I report receiving research grants from the European Commission (Sixth and Seventh Programme Frameworks), Catalan Society of Family Medicine, and Instituto de Salud Carlos III (Spanish Ministry of Health).</p> |
| <b>REVIEW RETURNED</b> | 20-Jun-2015  |

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| <b>GENERAL COMMENTS</b> | <p>The authors have appropriately answered all my queries and they have included the most important in the new submission. I find it now very clear. I do not have any further queries.</p> |
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