Impact of acute otitis media clinical practice guidelines on antibiotic and analgesic prescriptions: a systematic review

Yelin Deniz, Rick T van Uum, Marieke LA de Hoog, Anne GM Schilder, Roger A M J Damoiseaux, Roderick P Venekamp

ABSTRACT

Background Clinical practice guidelines focusing on judicious use of antibiotics for childhood acute otitis media (AOM) have been introduced in many countries around the world.

Objective To systematically review the effects of these guidelines on the prescription of antibiotics and analgesics for children with AOM.

Methods Systematic searches of PubMed, Embase and Cochrane Library from inception to 6 June 2017 using broad search terms. Studies specifically aimed at evaluating the effects of introduction of national AOM practice guidelines on type of antibiotic and/or analgesic prescriptions were included, irrespective of design, setting or language. The Risk Of Bias In Non-randomized Studies of Interventions tool was used to assess risk of bias.

Results Of 411 unique records retrieved, seven studies conducted in six different countries (France, Italy, Spain, Sweden, UK and USA (twice)) compared data before and after guideline introduction. All studies had an observational design, using longitudinal data of children aged under 15 years (n=200–4.6 million) from either routine care, insurance databases or electronic surveys. Risk of bias of all studies was judged serious to critical. Of the five studies reporting on antibiotic prescription rates, three showed a decline of 5%–12% up to 3 years after guideline introduction and two found no or negligible effect. In one US study, the initial 9% decline decreased to 5% after 4–6 years. The recommended first choice antibiotic was prescribed more frequently (9%–58% increase) after guideline introduction in four out of five studies reporting on this outcome. Analgesic prescription rates for AOM were more frequently (9%–58% increase) after guideline introduction in four out of five studies reporting on this outcome. Analgesic prescription rates for AOM were more frequently (9%–58% increase) after guideline introduction.

Conclusion Based upon what is published, the effects of introduction of national clinical practice guidelines on antibiotic and analgesic prescribing for children with AOM seem modest at the most.

INTRODUCTION

With emerging antimicrobial resistance posing a serious threat to global public health, promoting judicious use of antibiotics has become a top priority for governments worldwide. As a consequence, clinical practice guidelines for common infectious diseases, including acute otitis media (AOM), have been introduced and updated in many countries over the past decades. Although AOM guidelines vary regarding specific recommendations across countries, they generally emphasise the importance of accurate diagnosis and adequate analgesia as well as advocating selective antibiotic prescribing.

It has been suggested that guideline adherence for AOM may be suboptimal due to a variety of factors, such as fear of serious complications and parental pressure to prescribe antibiotics. In daily practice, antibiotics are commonly prescribed to children with AOM, ranging from around 50% in the Netherlands to 80% in the USA, whereas analgesics are only recommended in a minority of cases.

However, the true impact of introducing AOM guidelines on prescription of antibiotics and analgesics for children with AOM in daily practice has not been reviewed systematically. We aim to do so and provide an overview of current available studies that compare prescription data before and after national AOM clinical practice guideline introduction.

METHODS

Search strategy and study selection

We performed systematic searches of the PubMed, Embase and Cochrane Library databases from inception to 6 June 2017 using database-specific syntaxes of keywords relevant to ‘acute otitis media’ and ‘guidelines’ (see online supplementary for full search strategies). After removing duplicates (RefWorks), two reviewers (YD and RTU) independently screened titles and abstracts for inclusion. Discussion with a third and fourth reviewer (MLAdH and RPV) resolved any discrepancies. We screened reference lists of included studies for additional studies.

We included all original studies, irrespective of design, setting or language, evaluating the effects of the introduction of national clinical practice guidelines on prescription of antibiotics (rate and type) and/or analgesics for children (up to the age of 16 years) with AOM by comparing data before and after guideline introduction. We only included studies in which the time between data collection before and after guideline introduction was less than 5 years; this was to minimise the impact of other factors that may affect AOM epidemiology and subsequent prescription rates, for example, the introduction of pneumococcal conjugate vaccines and anti-smoking campaigns.
**RESULTS**

Search results and study characteristics

Figure 1 shows the search results. Of the 411 unique records identified, 20 were considered potentially relevant. Of these, seven studies were included in this review. The characteristics of the included studies are summarized in Table 1. The method of dissemination varied considerably (Table 3). The method of dissemination varied considerably (Table 3).

**Table 1.** Baseline characteristics of included studies

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Country</th>
<th>Sample size</th>
<th>Setting</th>
<th>Age</th>
<th>Data source</th>
<th>Guideline introduction</th>
<th>Outcomes reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyrstrup et al</td>
<td>Sweden</td>
<td>N=1,245,599</td>
<td>PC</td>
<td>1-12 Y</td>
<td>Routine care</td>
<td>2010</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Palma et al</td>
<td>Italy</td>
<td>N=4559</td>
<td>SC</td>
<td>0-14 Y</td>
<td>Routine care</td>
<td>2010</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Levy et al</td>
<td>France</td>
<td>N=4661</td>
<td>SC</td>
<td>6 M-2 Y</td>
<td>Routine care</td>
<td>2011</td>
<td>Type of antibiotic</td>
</tr>
<tr>
<td>McGrath et al</td>
<td>USA</td>
<td>N=3,039.460</td>
<td>SC</td>
<td>3 M-12 Y</td>
<td>Insurance databases</td>
<td>2004</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Coco et al</td>
<td>USA</td>
<td>N=1114</td>
<td>PC+SC</td>
<td>6 M-12 Y</td>
<td>Electronic surveys</td>
<td>2004</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Ríos et al</td>
<td>Spain</td>
<td>N=230</td>
<td>PC</td>
<td>2-15 Y</td>
<td>Routine care</td>
<td>2001</td>
<td>Type of antibiotic</td>
</tr>
</tbody>
</table>

*Number of patient years.

**Table 2.** Summary of the primary outcomes of interest reported for each study.

- Tystrup et al
- Palma et al
- Levy et al
- McGrath et al
- Coco et al
- Thompson et al
- Ríos et al

**METHODS**

Data extraction and synthesis

The primary outcome was the overall antibiotic prescription rate for AOM. Secondary outcomes included type of antibiotic prescribed and analgesic prescription rate.

The method of dissemination varied considerably (Table 3). The method of dissemination varied considerably (Table 3).

**Table 3.** Method of dissemination strategies.

<table>
<thead>
<tr>
<th>Study ID</th>
<th>Method of dissemination</th>
<th>Country</th>
<th>Sample size</th>
<th>Setting</th>
<th>Age</th>
<th>Data source</th>
<th>Guideline introduction</th>
<th>Outcomes reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tyrstrup et al</td>
<td>Routine care</td>
<td>Sweden</td>
<td>N=1,245,599</td>
<td>PC</td>
<td>1-12 Y</td>
<td>Routine care</td>
<td>2010</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Palma et al</td>
<td>Routine care</td>
<td>Italy</td>
<td>N=4559</td>
<td>SC</td>
<td>0-14 Y</td>
<td>Routine care</td>
<td>2010</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Levy et al</td>
<td>Routine care</td>
<td>France</td>
<td>N=4661</td>
<td>SC</td>
<td>6 M-2 Y</td>
<td>Routine care</td>
<td>2011</td>
<td>Type of antibiotic</td>
</tr>
<tr>
<td>McGrath et al</td>
<td>Insurance databases</td>
<td>USA</td>
<td>N=3,039.460</td>
<td>SC</td>
<td>3 M-12 Y</td>
<td>Insurance databases</td>
<td>2004</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Coco et al</td>
<td>Electronic surveys</td>
<td>USA</td>
<td>N=1114</td>
<td>PC+SC</td>
<td>6 M-12 Y</td>
<td>Electronic surveys</td>
<td>2004</td>
<td>Antibiotic prescription rate</td>
</tr>
<tr>
<td>Ríos et al</td>
<td>Routine care</td>
<td>Spain</td>
<td>N=230</td>
<td>PC</td>
<td>2-15 Y</td>
<td>Routine care</td>
<td>2001</td>
<td>Type of antibiotic</td>
</tr>
</tbody>
</table>
across countries, ranging from passive dissemination through online publication or paper copies targeted at individual physicians only to extensive (public) media attention, interactive workshops and joint antibiotic stewardship campaigns.

**Risk of bias assessment and study findings**

Risk of bias was judged serious in six studies and critical in one; reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about physicians find it easier to substitute rather than refrain from antibiotic prescribing.

**DISCUSSION**

The introduction of national AOM clinical practice guidelines seems to have at least a modest impact on antibiotic and analgesic prescribing; antibiotic prescription rates decrease by a maximum of 12% and analgesic rates increase by 10%. Its effect on the type of antibiotic is more substantial with an increase of up to 58% for the recommended first choice antibiotic.

In line with available literature, results from the study of Tyrstrup et al suggest that tailored guideline dissemination may have a larger impact on antibiotic prescription rates than passive dissemination only. Our findings also indicate that physicians find it easier to substitute rather than refrain from antibiotic prescribing. Reasons include their concerns about the risk of the child falling seriously ill when not prescribing antibiotics, or missing a diagnosis which would have been adequately treated with antibiotics. This is especially the case when dealing with young children, or in consultations in which physicians perceive parental pressure to prescribe antibiotics. Apparently, many physicians are either not convinced of, or unfamiliar with, the literature that refutes the risks of restrictive prescribing and parental expectations of antibiotics.
Our findings should be interpreted with some caution. Despite our efforts to minimise the impact of external factors affecting childhood AOM epidemiology and prescribing patterns, such as anti-smoking campaigns, pneumococcal conjugate vaccination and strategies to promote breastfeeding,20 21 we cannot rule out this has influenced our results. Also, we were not able to account for ongoing prescribing trends prior to the introduction of the guideline; none of the studies applied interrupted time-series analysis.22 Importantly, dissemination of the guideline to the general audience suggesting that parents can manage milder cases of AOM themselves can lead to fewer overall AOM consultations and subsequent antibiotic prescriptions.23 Nevertheless, only two out of the seven studies reported on annual fluctuations in AOM consultation rates and none of them accounted for this in their analyses.13 14 Besides, when parents do self-manage these milder cases of AOM, physicians may be faced with more severe AOM and thus prescribe antibiotics more frequently (leading to a relative increase over time). These aforementioned trends are not captured in the studies. Neither are the phenomena that, with explicit diagnostic guidance, physicians may diagnose AOM more accurately,
leading to fewer overall diagnoses and antibiotic prescriptions, but at the same time a higher prescription rate per diagnosis.

Finally, the vast majority of analgesics for AOM are obtained over-the-counter rather than prescribed. This implies that our results regarding analgesic prescriptions for AOM are incomplete and preclude strong conclusions.

CONCLUSION

Based on what is published, the introduction of national AOM clinical practice guidelines seems to have at best a modest impact on antibiotics and analgesics prescription rates for childhood AOM. Future studies evaluating the impact of clinical guidelines using longitudinal observational data should use a quasi-experimental approach, and take fluctuations in AOM consultation rates into account, to provide more meaningful estimates on the impact on antibiotic and analgesic prescribing.

Acknowledgements  We are grateful to our colleagues P Little (UK), P Marchisio (Italy), R Rosenfeld (USA) and M Tyrstrup (Sweden) for providing information on guideline dissemination in their respective countries.

Contributors  YD, RTvU and RPV collected and reviewed primary data. YD and RTvU drafted the first version of the manuscript. All authors revised the manuscript and accepted the final manuscript for publication.

Funding  This review was supported by a grant from the Netherlands Organisation for Health Research and Development (ZonMw)—HGOG subprogramme.

Competing interests  None declared.

Provenance and peer review  Not commissioned; externally peer reviewed.

Open Access  This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

© Article author(s) (or their employer(s) unless otherwise stated in the text of the article) 2018. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

Original article


