# Important New Evidence Service

In Partnership with The Centre for Medicines Optimisation at Keele University

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# Antibiotic Prescribing: Development and internal validation of a practical tool for primary care antimicrobial stewardship in children (STARWAVe)

A simple clinical rule (STARWAVe) has been proposed that stratifies children presenting to primary care with a respiratory tract infection (RTI) and cough into one of three groups for risk of future hospital admission. Whilst further validation is desirable, prescribers may be interested in this new tool that has the potential to help guide decisions on use of antibiotics and reduce unnecessary prescribing.

**Reference:** Hay AD, Redmond NM, Turnbull S *et al*. Development and internal validation of a clinical rule to improve antibiotic use in children presenting to primary care with acute respiratory tract infection and cough: a prognostic cohort study. Lancet Respir Med. Published Online: 01 September 2016.

## What do we know already?

- Most antibiotics are prescribed within primary care - the majority for RTIs. We know that there is variation in prescribing between GP practices.
- Reducing the unnecessary prescribing of antibiotics is one of the several measures being undertaken to help tackle antimicrobial resistance. For example, in England, the Quality Premium scheme for 2016/17 financially rewards CCGs that reduce antibiotic prescribing rates and limit use of broad spectrum agents.
- NICE has also produced several key guidelines in relation to antibiotic prescribing: RTIs – antibiotic prescribing in July 2008, the NICE clinical pathway for self-limiting RTIs, and more recently NICE Guideline (NG15) Antimicrobial stewardship: systems and processes for effective antimicrobial medicine use.
- Faced with clinical uncertainty and anxious patients and parents, there are few evidence-based practical tools available to help guide appropriate antimicrobial prescribing for children presenting to primary care with acute RTIs. The result is often 'defensive' prescribing of antibiotics for 'just-in-case' scenarios.

## What does this evidence add?

- This study investigates whether simple, routinely-collected clinical characteristics could be used to help stratify children presenting to primary care with an RTI and cough for their risk of a future hospital admission for RTI.
- Using data from over 8,000 children visiting GP practices in England, the authors identified seven simple predictors of future hospitalisation (STARWAVe, see table). By assigning one point to each of these characteristics, children could be stratified into one of three 30-day hospital admission risk groups: very low, normal and high risk of hospital admission.
- The authors suggest different antibiotic strategies for groups: a 'no antibiotics' strategy in the very low risk group, a 'no' or 'delayed' antibiotics strategy in the normal risk group (*which is as per NICE guidance on RTIs*), and immediate antibiotics, with close monitoring for signs of deterioration and follow-up within 24 hours, for the high-risk group. They also predict impact on antibiotic usage, suggesting if antibiotic prescribing in the very low risk group halved, remained the same in the normal risk group and increased to 90% in the high risk group, this would result in a 10% overall reduction in antibiotic prescribing for RTIs.

**Predictors of future hospitalisation:**

**S**hort illness duration (≤ 3 days)
**T**emperature >37.8°C or parent reported severe fever in the last 24 hours
**A**sthma
**R**ecession (inter and subcoastal)
**W**heeze
**A**ge (< 2 years)
**V**omiting (moderate-to-severe vomiting in last 24 hours)

**STARWAVe** assigns 1 point to each characteristic to assess a child's risk of hospitalisation in next 30 days.
**Score of 0-1: very low risk** (0.3% risk); n.b. most (67%) children who presented to GPs in this study were in this category
**Score of 2-3: normal risk** (1.5% risk; similar to the overall population)
**Score of 4 or more: high risk** (11.8% risk)

- The authors acknowledge that further research is needed to externally validate the rule (*which was not possible due to the low numbers of admissions in the study [n = 78]*) and to investigate effects on antibiotic prescriptions and clinical outcomes. They also stress that STARWAVe should be considered a useful supplement to clinical judgment, rather than replacing it.
- Whilst noting several limitations, the authors of accompanying commentary suggest STARWAVe offers an evidence-based practical tool to help guide antibiotic prescription decisions, and combining this tool with point-of-care C-reactive protein (CRP) testing, or to triage for CRP testing, might help to target antibiotic use further.

## Study details

**Participants:**

- A prognostic, prospective cohort study of children aged between 3 months and 16 years presenting to 247 participating GP practices across England with the main symptom of acute (< 28 days) cough with other RTI symptoms (such as fever and coryza). Children with an infected exacerbation of asthma and those who were severely unwell (e.g. requiring same day hospital assessment or admission) were included.
- 519 GPs and prescribing nurse practitioners (clinicians) offered invitations for study recruitment to 9,043 children, of whom 8,879 (98%) accepted, with 8,394 (95%) receiving valid parental consent. Children's median age was 3 years and 52% were boys. 3,121 (37.2%) children in this cohort were prescribed an antibiotic.
- Exclusions included children who presented with non-infective exacerbations of asthma, those at high risk of serious infection (immunocompromised) and those that required a throat swab for clinical management.

**Intervention and comparison:**

- Clinicians completed a structured online (or paper) case report form that recorded eight sociodemographic items, four medical history items, 33 parent-reported symptoms, 14 physical examination signs (including vital signs and global illness severity) and the prescription of antibiotics (or not).
- The clinicians also recorded reasons for not inviting potentially eligible children to participate and reported a global illness severity (scored from zero to 10) for those children that were invited into the study but declined.

**Outcomes and results:**

- The primary outcome was hospital admission (excluding emergency department attendance only) for any RTI in the 30 days after recruitment.
- Hospital admissions were uncommon, with only 78 (0.9%) children subsequently admitted with an RTI. Reasons for admissions, as provided in discharge diagnoses notes, included: lower RTI, bronchiolitis, viral wheeze, upper RTI, croup, infected exacerbation of asthma, tonsillitis, viral illness, febrile illness and pneumonia. 26.9% of all discharge diagnoses suggested a possible bacterial cause, for which antibiotics might have been needed.
- The median time to hospital admission following recruitment was 2 days. 15 children (19%) were admitted to hospital on the day of recruitment, 33 (42%) admitted between 2 and 7 days, 11 (14%) admitted between 8 and 14 days and 19 (24%) admitted between 15 and 30.
- There was no evidence of association between risk of hospital admission and the prescription of antibiotics at the recruitment consultation. There was also no difference in global illness severity scores between the children who declined participation and the final sample that were recruited.
- Based on the analysis of case report forms, seven characteristics were found to be independently associated ($p<0.01$) with hospital admission: age <2 years, current asthma, illness duration of 3 days or less, parent-reported moderate or severe vomiting in the previous 24 h, parent-reported severe fever in the previous 24 h or a body temperature of 37.8 $^{o}$C or more at presentation, clinician-reported intercostal or subcostal recession, and clinician-reported wheeze on auscultation.
- The ability of the model to discriminate between hospitalised and non-hospitalised children was measured using the area under the receiver operating characteristic (AUROC) curve (*n.b.an AUROC of 1 indicates the model is perfect at discriminating*). Applying a simple one point score for each of the above characteristics, the AUROC value for the STARWAVe clinical rule was 0.81 (95% Confidence Interval [CI]: 0.76–0.85). The authors describe this AUROC as *"useful, but not perfect, meaning that the rule should supplement, not supplant, clinical judgment*".
- The clinical rule distinguished three hospital admission risk groups:
    - very low risk (0.3% risk of hospital admission [95%CI: 0.2 to 0.4%), 1 point or less
    - normal risk (1.5% [95%CI: 1.0 to 1.9%]), 2 or 3 points
    - high risk (11.8% [95%:7.3 to16.2%), 4 points or more.
- The majority of the study's participants (67%, n = 5,593) were categorised using STARWAVe to be at very low risk of a subsequent admission. 33% of this 'very low risk' group had received antibiotics. The authors suggest that STARWAVe may help reduce clinical uncertainty, and thereby antibiotic use in this very low risk category.

**Level of evidence:**

Level 2 (limited quality patient –oriented evidence) according to the SORT criteria.

**Study funding:**

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