Impact of a clinical decision model for febrile children at risk for serious bacterial infections at the emergency department

*a randomised controlled trial*

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Disclosure Statements

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- **Conflict of Interest Statement:** The authors declare that they have no conflicts of interest
Febrile children - Epidemiology

<table>
<thead>
<tr>
<th></th>
<th>Primary care*</th>
<th>Emergency dept#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children with fever</td>
<td>27%</td>
<td>30-50%</td>
</tr>
<tr>
<td>Serious infections</td>
<td>1%</td>
<td>10-15%</td>
</tr>
</tbody>
</table>


Within serious infections*

- Pneumonia 40-50%
- Urinary tract infection 25-48%
- Sepsis/meningitis 1-2%

Systematic review

30 studies; 20 predictors

Most important predictors:
cyanosis; tachypnoea; delayed peripheral circulation; non-blanching rash; parental concern; clinician instinct

15 781 febrile children
1140 (7%) SBI

Most important predictors:
Ill appearance, tachypnoea, tachycardia, delayed peripheral circulation, non-blanching rash (…)

Summary
Background Our aim was to identify which clinical features have value in confirming or excluding the possibility of serious infection in children presenting to ambulatory care settings in developed countries.
Clinical prediction model to aid emergency doctors managing febrile children at risk of serious bacterial infections: diagnostic study

Ruud G Nijman PhD student¹, Yvonne Vergouwe methodologist², Matthew Thompson clinical reader³, Mirjam van Veen resident¹, Alfred H J van Meurs paediatrician⁴, Johan van der Lei professor⁵, Ewout W Steyerberg professor², Henriette A Moll professor¹, Rianne Oostenbrink paediatrician¹
Decision rule for children with fever at the emergency room

This decision model aims to predict the risk of having a serious bacterial infection for febrile children aged 1 month and 16 years attending an emergency department.

This model was developed for previously healthy children only, and was not intended for children with a chronic underlying disease.
Date of birth: 10-04-2011
Date of arrival: 10-04-2013
Sex: Boy

Pneumonia:
Estimated risk percentage: 14.5%

Other SBI:
Estimated risk percentage: 8.2%

- Capillary refill peripheral: Normal (<2 sec), Prolonged (2-4 sec), Impaired (>4 sec)
- Retractions: Absent, Present
- Ill appearance: Non ill Appearance, ill appearance
- Oxygen Saturation: Normal (>94% O2), Decreased (<94% O2)
Clinical prediction model to aid emergency doctors managing febrile children at risk of serious bacterial infections: diagnostic study

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Objective

To assess the feasibility and impact of a clinical decision model for febrile children at risk for SBI attending the ED
Design and setting

- Study design
  - Randomized trial

- Study population
  - Febrile children visiting the paediatric ED
  - Aged 1 month – 16 years

- Intervention
  - Fever kids tool
## Outcomes

<table>
<thead>
<tr>
<th>Category</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic performance decision model</td>
<td>ROC-area</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Compliance</td>
</tr>
<tr>
<td>Patient outcome</td>
<td>Correct diagnosis</td>
</tr>
<tr>
<td>Process outcome</td>
<td>Length of stay ED</td>
</tr>
<tr>
<td></td>
<td>Diagnostics/ antibiotics</td>
</tr>
<tr>
<td></td>
<td>Hospitalization/ revisits</td>
</tr>
<tr>
<td>Costs</td>
<td></td>
</tr>
</tbody>
</table>
PED Triage Randomization Evaluation pediatrician Discharge PED

**INTERVENTION (I)**
- Standardized evaluation by nurse AND
- Recommendations decision model:
  - No diagnostic tests
  - Chest X-ray/ Urine culture

**USUAL CARE (UC)**
- Standardized evaluation by nurse

- (more) diagnostics/ therapeutics on judgment of pediatrician

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Diagnosis/ Therapeutics on judgment of pediatrician
Randomisation and child characteristics

- Median age: 1.8 years (IQR 0.9-4.1)
- Boys: 57% (n=251)
- SBI incidence: 12% (n=54) → pneumonia n=32; other SBI n=22
Results trial (n=444)

- **Discriminative ability**
  - AUC 0.82 (95% CI 0.74-0.90) for pneumonia (n=32)
  - AUC 0.81 (95% CI 0.72-0.90) for other SBI (n=22)

- **Feasibility**
  - Compliance to the recommendations of the decision model was high (99%)

- **Patient**
  - No differences in determination of correct diagnoses
### 1. Patient consultation time

<table>
<thead>
<tr>
<th>Time spent at the ED (hrs:min)</th>
<th>Intervention group (n=220)</th>
<th>Usual care group (n=224)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1:58 (1:24-2:38)</td>
<td>1:54 (1:21-2:42)</td>
</tr>
</tbody>
</table>

### 2. Diagnostics

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Intervention group</th>
<th>Usual care group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest-radiography</td>
<td>42 (19.1)</td>
<td>28 (12.5)</td>
</tr>
<tr>
<td>Urine dipstick</td>
<td>157* (71.4)</td>
<td>134* (59.8)</td>
</tr>
<tr>
<td>Urine culture</td>
<td>18 (8.2)</td>
<td>17 (7.6)</td>
</tr>
<tr>
<td>Full blood count*</td>
<td>31* (14.1)</td>
<td>49* (21.9)</td>
</tr>
<tr>
<td>Blood culture</td>
<td>13 (5.9)</td>
<td>20 (8.9)</td>
</tr>
<tr>
<td>Other cultures</td>
<td>21 (9.5)</td>
<td>26 (11.6)</td>
</tr>
</tbody>
</table>

### 3. Treatment

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Intervention group</th>
<th>Usual care group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics (AB) at the ED</td>
<td>9 (4.1)</td>
<td>14 (6.3)</td>
</tr>
<tr>
<td>Antibiotics at discharge</td>
<td>69 (31.4)</td>
<td>79 (35.3)</td>
</tr>
<tr>
<td>AB SBI/ SBI</td>
<td>25/27 (92.6)</td>
<td>25/27 (92.6)</td>
</tr>
<tr>
<td>AB no SBI/ no SBI</td>
<td>44/193 (22.8)</td>
<td>54/197 (27.4)</td>
</tr>
</tbody>
</table>

### 4. Follow-up

<table>
<thead>
<tr>
<th>Follow-up Type</th>
<th>Intervention group</th>
<th>Usual care group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>125 (56.8)</td>
<td>140 (62.5)</td>
</tr>
<tr>
<td>Hospitalisation</td>
<td>26 (11.8)</td>
<td>23 (10.3)</td>
</tr>
<tr>
<td>Outpatient clinic</td>
<td>22 (10.0)</td>
<td>27 (12.1)</td>
</tr>
<tr>
<td>Telephonic</td>
<td>47 (21.4)</td>
<td>34 (15.2)</td>
</tr>
</tbody>
</table>

### 5. Safety netting

<table>
<thead>
<tr>
<th>Safety netting Type</th>
<th>Intervention group</th>
<th>Usual care group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revisit</td>
<td>47 (21.4)</td>
<td>46 (20.3)</td>
</tr>
<tr>
<td>Antibiotics after revisit</td>
<td>12 (5.5)</td>
<td>8 (3.6)</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>7 (3.2)</td>
<td>5 (2.2)</td>
</tr>
</tbody>
</table>
Conclusion

1. Good discriminatory ability to detect SBI
2. Good compliance among the nurses
3. More standardized diagnostic approach towards the febrile child
4. No substantial impact on patient outcome
5. Improvement in correct diagnostic testing
Acknowledgements

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Nomogram fever kids tool

Points
age in years
sex (female)
temperature (degrees Celsius)
duration of fever (days)
tachypnea present
tachycardia present
oxygen saturation <94%
peripheral capillary refill prolonged (>3s)
chest wall retractions present
ill appearance
Total Points
risk of SBI(%)
1,769 febrile children assessed for eligibility

836 Excluded
- 569 chronic co-morbidity
- 79 revisits within 7 days
- 10 emergent triage category
- 178 only rhinitis or otitis

933 Eligible

444 CDSS registered

444 Randomized

220 Intervention group
- 16 High risk pneumonia
- 204 Low risk pneumonia
- 8 High risk other SBI
- 212 Low risk other SBI

224 Usual care group

489 Excluded
- 57 inclusion other trial
- 34 no informed consent
- 398 unknown