When is a 'decision' an important decision in a decision tool

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Apart from a global reduction in attendances during the COVID-19 pandemic,[1] emergency departments continue to see growth in the presentations of children and young people (CYP).[2] However, there has not been a similar increase in admissions leading to the so-called 'needle in the haystack' phenomenon which describes the difficulty clinicians face in selecting CYP for investigation or intervention when the incidence of modifiable disease is so low.

CYP who present overtly unwell are always going to receive resuscitation regardless of the underlying cause of illness as restoration of adequate oxygenation, replenishment of circulating volume or support of cerebral function is a priority. These numbers, however, are small, likely no more than 1–2% of total attendances. A larger group of patients (perhaps 40% but with large regional and national variation) have a clinical appearance to healthcare professionals suggesting investigations are not necessary as they are deemed so low risk of serious illness or injury.

To treat all of those who are neither overtly unwell nor obviously well would arguably be a misuse of resources and perhaps lead departments being incapable of responding to the most critically unwell patients. The National Institute of Health and Care Excellence (NICE) Fever in illness in children guideline (NG 143) was designed to help clinicians in England decide on management options for those with a fever without a clear source. Both the face, and actual, validity of the tool has led to its widespread deployment. It is often (technically incorrectly) used as a marker of acuity for any febrile patient as opposed to a decision-making tool for a distinct group. For example, once the patient is recognised to have tonsillitis, then none of the characteristics of high risk of serious disease apply, as the evidence behind the traffic light system was derived for children without a source for their fever. Technically then, if a child presents with tonsillitis and is tachycardic and tachypnoeic, but the treating clinician does not feel they have sepsis, then the child could be discharged without further investigation. The consideration of sepsis is important as current NICE sepsis management guidance in England (NG 51) asks clinicians to think of sepsis in any patient who presents with signs or symptoms that indicate possible infection. Essentially, the same reference ranges for heart rate and respiratory rate are used to place a child into a low, moderate and high-risk sepsis group. Therefore, the critical decision point for any child presenting with any potential infection is: does this child have sepsis? This led to the concept of a sepsis screen, in which patients with potential infection of any cause and with deranged vital signs would be highlighted as needing further senior review or investigation. Having been positive in a sepsis screen (which may simply be on the basis of a heart rate), a decision to not investigate, even if the patient was felt to be subsequently stable and have a clear focus of infection, would be retrospectively criticised if the patient at any point in the future returned unwell enough to require treatment. Sepsis screening is not really screening and is very poorly specific.[3]

Martin and colleagues[4] have aimed to assist with the problem of determining who needs treatment through the continued validation of the *Feverkids* stool. This tool has been derived and validated in a large cohort of patients as part of the PERFORM Study[5] (Box 1).

It is important to note the *Feverkids* tool requires a C reactive protein; therefore, a clinician at some phase of the patient journey has felt the CYP warrants a blood test. This in essence means the *Feverkids* tool is a predictive test for children in whom clinicians are worried there may be serious bacterial infection (SBI), and there is an explicit assumption that the clinician is experienced enough to make that call.

Martin and colleagues have applied the *Feverkids* tool to a specific cohort of patients: those who are immunocompromised. This is very worthy of further evaluation as the uncertainty and increased risk of SBI mean the threshold for investigation is lowered. Their robust prospective work raises some interesting questions.

Box 1 Variables used in the *Feverkids* tool[5]

- ⇒ Age under or above 1
- ⇒ Gender
- ⇒ Temperature
- ⇒ Number of days of fever
- ⇒ Tachypnoea (as defined by Advanced Paediatric Life Support guidelines)
- ⇒ Tachycardia (as defined by Advanced Paediatric Life Support guidelines)
- ⇒ Hypoxia (oxygen saturation below 94%)
- ⇒ Capillary refill time (>3 s)
- ⇒ Work of breathing
- ⇒ Ill appearance
- ⇒ C- reactive protein

First, it is currently not easy to apply at the bedside (unlike the NICE Fever table). Box 2 shows the formulas used to calculate the *Feverkids* tool.

This does not mean a point-of-care application could not be developed, but the stratification in relation to risk of illness does require an understanding of local incidence of disease and how the risk of not treating can be explained to families and carers. This means there is a decision point prior to the deployment of the tool in which a decision is needed about whether the child has sepsis or whether investigations are needed at all.

Second, even in this 'higher' risk group, of 558 children with immune compromise, 77.5% did not have an SBI. Finally, the predictive model was only really useful for lower respiratory tract infection, probably due to the low rates of other forms of infection and the unique incidence of line infection in this group (who may have indwelling catheters when the general population do not).

How should acute and emergency healthcare professionals deploy this learning in their practice? Knowing a quarter of patients with a febrile illness in the immunocompromised group have an SBI should aid local standard operating protocol development, especially during escalation periods when waiting times for clinical review and admission may be prolonged. Also, and perhaps of greater importance, is to inform shared decision-making with families.

What remains a holy grail of paediatric practice is who determines the pre-decision tool decision. Should the application of such a tool be subject to

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Box 2 Formulas used to calculate the Feverkids tool risk score[5]

LRTI (Lower Respiratory Tract Infection)
= - 17.9 + 1.02 * age_under1 + 0.01 * age_above1 + 0.13 * gender + 0.29 * temp + 0.21 * days_fever + 0.44 * tachpnea - 0.04 * tachycardia + 1.59 * hypoxia - 0.18 * crt + 0.47 * wob + 0.16 * ill_app + 0.64 * lnCRP
SBI (Serious Bacterial Infection)
= - 4.7 + 1.73 * age_under1 + 0.11 * age_above1 + 0.70 * gender - 0.02 * temp - 0.03 * days_fever - 0.11 * tachypnea - 0.02 * techycardia - 3.29 * hypoxia + 0.30 * crt - 3.78 * wob + 0.27 * ill_app + 1.14 * lnCRP
Feverkidstool Riskscore of having a bacterial LRTI

$$= \frac{exp^{LRTI}}{1+exp^{LRTI}+exp^{SBI}}$$

its own inclusion criteria, or perhaps perversely a decision tool itself? The entry into any such prediction model risks false positives. Who then should ultimately arbitrate the risk of balancing between the benefits of detecting a case versus the harm that comes from a needless admission (especially for a cohort who are already at increased risk of hospital-acquired infection)? The PERFORM group of studies have developed an effective description of the children at risk of SBI; we now need an effective description of how best to deploy the assessment of that risk.

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