Challenges of detecting childhood diabetes in primary care

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Type 1 diabetes is a rare autoimmune condition with a prevalence in the UK of 0·2% in children and young people.[1] Children with type 1 diabetes frequently present severely unwell and a quarter present with life-threatening diabetic ketoacidosis requiring urgent insulin treatment. This number has sadly remained largely unchanged for 25 years.[2,3] Although many of these children have increased interaction with clinical services in the months before diagnosis, they frequently have non-specific symptoms not fitting a textbook diabetes presentation.[4,5] A well known axiom in clinical medicine is "common things are common", so how can we improve identification of rare conditions such as type 1 diabetes when they present with non-specific symptoms encountered by clinicians on an almost daily basis?[6]

In *The Lancet Digital Health*, Rhian Daniel and colleagues provide a potential solution by developing a novel prediction model using an ensemble machine learner to assist with earlier detection of type 1 diabetes in children using routinely available UK primary care data.[7] Developed in more than 952 402 children in Wales, UK, the model, if deployed, could alert clinicians during primary care visits to the possibility that children have as-yet-undiagnosed type 1 diabetes. In external validation in England, UK, the authors show the potential clinical utility of the model in nearly 1·5 million children. Setting the algorithm to give an alert in 10% of contacts with primary care detects seven in ten children who are developing type 1 diabetes, potentially expediting diagnosis by an average of 9 days. Crucially, this alert threshold captured around half of children who went on to present critically unwell with diabetic ketoacidosis.

Importantly, the authors show that the model is superior in sensitivity to a simple approach of flagging suspected type 1 diabetes on the basis of typical symptoms: thirst, tiredness, weight loss, and increased urination. The algorithm therefore potentially provides clinicians with an important new tool to help identify this rare but life-threatening condition earlier when children present with non-specific symptoms. In terms of clinically acting on flagged cases, raised glucose in children is highly specific for type 1 diabetes, and can easily and cheaply be measured by readily available capillary testing.

Despite this promise, implementing the model in clinical care is likely to be challenging. Further research is needed to carefully evaluate real-world impact in terms of both patient benefit and cost. To examine the benefit, both the proportion of children with type 1 diabetes flagged by the algorithm at different onset ages, and the reduction in severity of presentations (particularly diabetic ketoacidosis rates) resulting from earlier diagnosis, should be assessed. Assessment of benefit by age is especially important as the model appeared to be less sensitive for younger children and those going on to present with diabetic ketoacidosis. In terms of cost, the threshold used in the study of flagging 10% of primary care contacts would mean glucose testing around 4000 contacts to find a single type 1 diabetes case early, and testing about 22 000 contacts to avoid one diabetic ketoacidosis presentation (assuming each alert results in a glucose test). With such a high proportion of visits to primary care being flagged, there is a real risk of a so-called alert burden, with clinicians becoming overwhelmed and disempowered by broad-ranging technological advice.[8] In addition, the effect on the children without type 1 diabetes and their parents of receiving such alerts must be assessed. Setting a lower alert threshold will reduce burden and impact on clinicians, children, and their parents, but also reduce case detection.

Finally, the algorithm is UK specific and unlikely to be generalisable, at least without substantial modification, to other populations and settings. Direct application of the model in other health systems will be limited by the broad and probably UK-specific definitions used for predictor variables and frequency of other conditions presenting with similar symptoms. The model was developed and validated predominantly in children, and performance different ethnic groups in the UK was not evaluated. Nonetheless, conceptually the principle of using routine clinical data to identify early type 1 diabetes and reduce severity of presentation is highly attractive and provides a model for future work in other countries.

This study shows exciting potential for technology to assist with clinical practice by allowing earlier detection of type 1 diabetes before children becoming life-threateningly unwell with diabetic ketoacidosis.

As a next step, prospective evidence is needed to show that the proposed alerts are acceptable to health professionals, children, and their parents. Crucially it will need to be shown that alerts can support appropriate clinical action that improves the outcomes of childhood type 1 diabetes presentation, thereby convincing clinicians that the benefits of the model outweigh the costs.

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