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Editorial:
From Knowledge Generation to Synthesis to Translation

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Conflict of interest

Nil

Author contribution

Franz Babl, Emma Tavender and Stuart Dalziel drafted the manuscript, contributed to the content of the work, critically reviewed the drafts and approved of the final version submitted.

PREDICT, the Paediatric Research in Emergency Departments International Collaborative, is an Australian and New Zealand network of EDs with a mission to generate new knowledge and improve emergency care for children and adolescents through rigorous research. However generation of new knowledge is only half the battle to improve care of the children presenting to the EDs. To address this, PREDICT has gradually moved from knowledge generation via cohort studies and multi-centre randomised controlled trials to knowledge synthesis and knowledge translation (**Figure 1**). The evidence for what works in emergency medicine to improve the uptake of research knowledge into everyday clinical practice, however, is limited (1,2).

Taking a broader perspective knowledge translation includes adaption of knowledge to local context via guidelines, an understanding of current practice and the factors influencing practice variation, the development and evaluation of tailored implementation strategies, and research on ways to sustain knowledge use (3). There is an urgent need to improve implementation research in emergency medicine, particularly in our unique practice setting, and PREDICT has set out a goal to advance the field by exploring whether successful implementation is influenced by the type of condition (high vs. low volume), the type of ED, the direction of practice (adopting new practices vs. ceasing practices of low value) and the complexity of behavioural change needed. We also want to identify organisational and other predictors of research uptake and factors that influence the sustainability of effective interventions.

As part of this program of work the PREDICT Australian and New Zealand Guideline for Mild to Moderate Head Injuries in Children has recently been released (4, 5). The guideline builds on several multi-centre PREDICT projects and 30 related PREDICT publications to understand the optimal clinical decision rule for head CT imaging in our setting, the management of head injury in children with underlying medical conditions and variation in current practice (6,7). We were particularly keen to understand practice outside tertiary paediatric hospitals, where the majority of children in Australia and New Zealand with head injuries present and where the widest variation in head CT rates had been reported in other counties. Data from a study of 31 Australian and New Zealand EDs show that head CT imaging rates are lower, approximately 10%, than reported in North America, with similar rates regardless of type of ED (tertiary, suburban, regional or rural) when adjusted for head injury severity (7). However, importantly CT rates and length of stay showed a five-fold variation across types of EDs and that patients with head injuries and more complex underlying problems, such as children with ventricular shunts, present to all types of EDs, not just to tertiary hospitals (7).

Why not simply implement an established high-quality clinical decision rule? In our setting the Pediatric Emergency Care Applied Research Network (PECARN) clinical decision rule for CT imaging (8) is the most effective and accurate tool to stratify children for the risk of clinically important traumatic brain injuries (6) and forms the core of the imaging recommendations of our guideline (4). While the PECARN clinical decision rule has been successfully implemented in several countries with a safe decrease in CT rates, our CT rates are lower than those seen in North America and it's primary purpose (and high sensitivity) is to identify which children presenting with head injuries can be safely discharged from the ED without a CT scan. Thus the PECARN clinical decision rule needed to be incorporated into a guideline providing clinicians with clear guidance regarding observation, a management strategy clinicians in Australia and New Zealand are successfully using as an additional tool to risk stratify patients (9,10). Further, the decision to obtain a CT scan or not is only one part of the management of children presenting with head injuries, with also a strong need for guidance in pre-hospital triage, discharge advice and follow-up.

Why not use existing high-quality international guidelines? There was no guideline that addresses the management of paediatric head injuries in the Australian and New Zealand setting. For those guidelines from other countries we selected (11-14), no single guideline addressed all the questions and conditions ED clinicians had identified as important and there was a for an update of the evidence used (5). To be efficient and not "reinvent the wheel," we drew on the evidence and recommendations from these guidelines using existing adaption frameworks, e.g. GRADE-ADOLOPMENT, which provided the scientific underpinning for adopting, adapting or creating new recommendations (5). Still, over half of the recommendations were created *de novo* as no suitable existing recommendations could be found (4).

Simply creating a new guidelines, even high quality ones, is not enough to improve practice. For implementation key questions are the 'dose' (i.e. intensity) and type of implementation strategy needed for a particular condition in a particular setting. We are striving to develop evidence for what works in our ED setting. One of the major research priorities for the network has been bronchiolitis; following years of primary research and guideline development within PREDICT (15-17) we have now assessed the effectiveness of tailored implementation strategies to improve care through a cluster randomised controlled trial across 26 hospitals (18). We are also assessing if bi-national paradigm shifts can be effected by evidence-based point changes to established treatment patterns— such as the inclusion of levetiracetam in the second line management of status epilepticus in children (19,20) —via changes to treatment algorithms of Advanced Paediatric Life Support (APLS) and regional children's hospital guidelines.

For the PREDICT Head Injury Guideline our implementation strategy includes formal endorsement by key colleges and partnering with well-regarded educational bodies such as APLS and *Don't Forget the Bubbles*. We are also developing tailored training materials to address key scenarios that clinicians have identified as challenging and co-designed materials to support shared decision making and discharge communication based on clinician and patient consumer input.

By developing a longitudinal research program with a focus on knowledge translation, alongside an established program of new knowledge generation, PREDICT will go a long way to achieving it's mission of improving emergency care of children presenting to EDs throughout Australia and New Zealand.

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Figure: PREDICT program: From Knowledge Generation to Synthesis to Translation (Adapted from PREDICT, with permission)

