A lot to learn in a day: Using technology to support diabetes education in an inpatient setting

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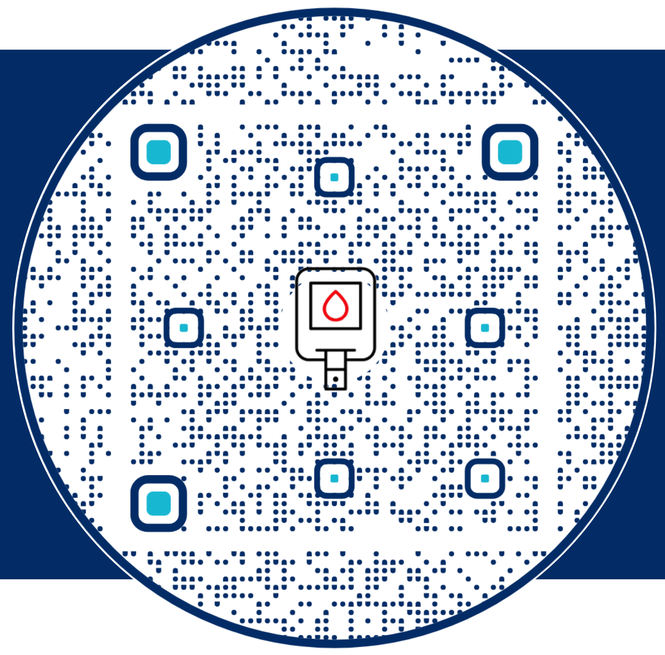
We developed **an interactive, mobile-friendly, web-based training (WBT) tool** to help teach mealtime insulin dose calculation.



Background

Type 1 diabetes (T1DM) is one of the most common chronic diseases of childhood, with an estimated 15,288 children in the United States aged 0-14 diagnosed with this condition in 2021 alone (1). Despite its relative prevalence, this diagnosis often comes as a shock to patients and families. Diabetes and all that comes with it – the monitoring, medications, injections, finger pricks, carb counting, dose calculations, and potential complications – played no part in most of their lives. Now, within a day or two of being diagnosed, they must learn enough diabetes self-management skills to be safely discharged home (2).

Effective education is key to positive outcomes for these patients (3). In a hospital setting, much of the initial education – including how to perform blood glucose checks, administer insulin, and use a sliding scale and insulin-to-carb ratio to calculate mealtime insulin doses – is provided by the bedside nurse. These nurses are an essential resource; however, their ability to teach and reinforce diabetes skills is limited by the other demands on their time as well as the relatively short stay of these patients (2). On my unit, for example, where we admit more than 100 new-onset type 1 diabetics each year, the average nurse-to-patient ratios is 4:1 and diabetic patients are typically discharge within 24-48 hours.

These obstacles to learning led us to ask the question: **How can we leverage technology to supplement the education our diabetic patients and caregivers receive?**

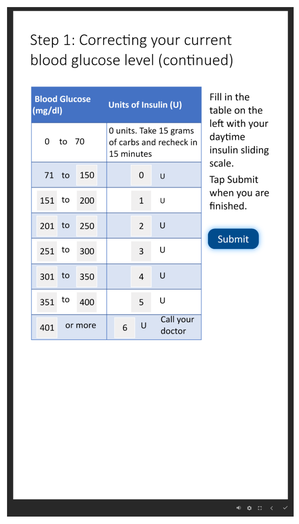
Methods

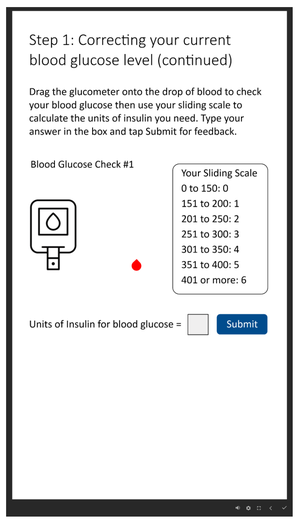
In response to the preceding question, we developed an interactive, mobile-friendly, web-based training (wbt) tool that focuses on how to calculate mealtime insulin doses. This topic was chosen for several reasons: 1) Many families find these calculations challenging and would benefit from additional practice (4); 2) Mealtime dose calculation is a self-contained task, amenable to short-duration (15-20 minutes) online learning ; and 3) Unlike finger pricks and insulin injections, these calculations can be practiced without direct RN supervision.

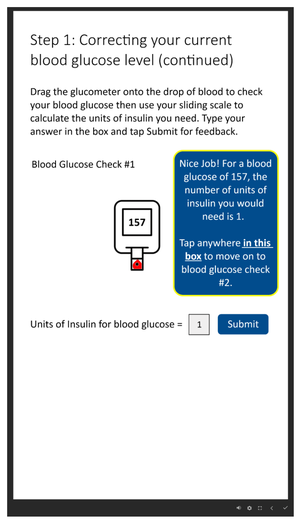
This wbt is designed to be completed independently and at the users own pace *after* they have been prescribed a sliding scale and insulin-to-carb ratio. Through this learning tool, users: 1) Walk through all the steps involved in calculating a mealtime insulin dose; 2) Input their own sliding scale and insulin-to-carb ratio to complete practice problems customized to their own insulin regimen; and 3) Receive real-time feedback on their answers to practice problems. For ease of access, this wbt is available via a simple web address using a phone, tablet, or computer; however, it is optimized for use with a tablet in a vertical orientation. On our unit, we offer patients and families the option to use one of our tablets to complete the wbt.

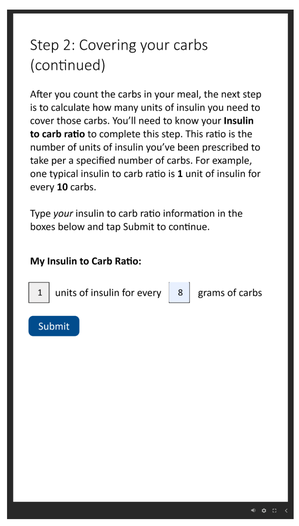
This tool was created using Storyline 360 software: an industry-standard tool for developing interactive online courses. A small amount of JavaScript was required to make the calculations work properly. Web hosting is currently through Amazon AWS with file transfer and syncing managed using CloudBerry software. A pediatric nurse with a background in instructional system design put the wbt together.

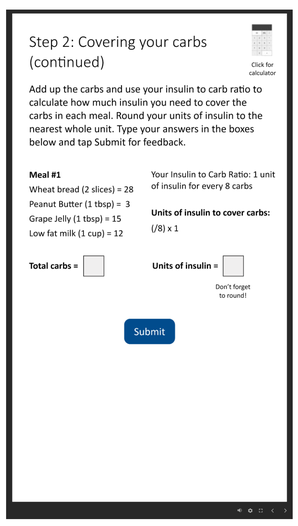
Content review was completed by our diabetes education team and members of our endocrinology team. Formal feedback from patients, families, and bedside nurses is currently being gathered through an online survey.

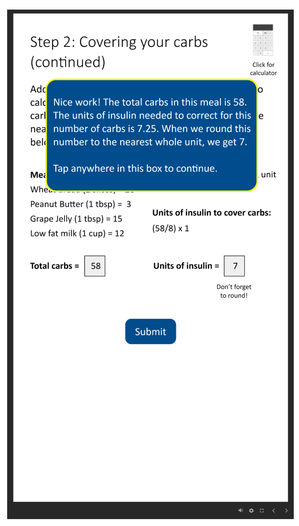


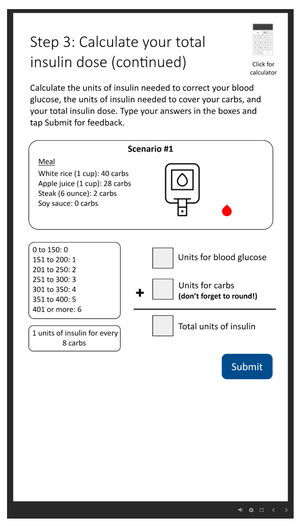


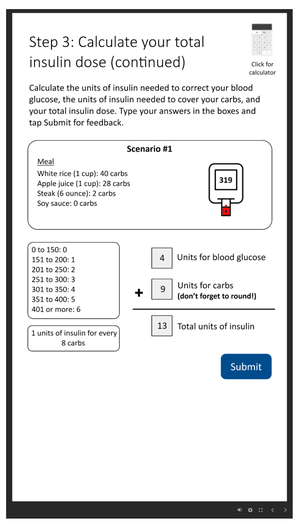


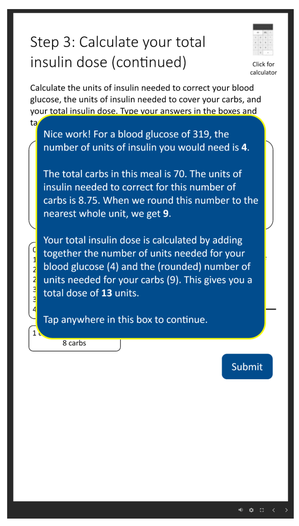












Takeaway

Early feedback from patients, families, and nurses has been generally positive; points of appreciation include having the calculation process broken down into small, digestible steps; the real-time feedback, and the interactivity. Some parents have reported plans to share the wbt with other family members as a way to help those individuals learn about diabetes management. Some families found the amount of text daunting, which may speak to widely held expectations regarding text on a mobile platform. Math illiteracy among some of our families also remains a challenge which this wbt is unable to address.

Overall use of the wbt remains inconsistent, in large part because we are conducing a soft rollout for the pilot. An overview of the wbt was provided at an all-hands meeting; however, a formal in-service for all bedside nurses has not yet been conducted. The potential of this tool is exciting; however, the pilot has demonstrated that wider adoption will depend on addressing (at least) three interrelated challenges: 1) Identification of a clear point of entry in the overall flow of diabetes education (one possibility: with the patient's first meal on an insulin regimen); 2) A bug-free, mobile-first experience; and 3) training for, and buy-in by, the bedside nursing team.

Next Steps

Planned wbt revisions:

- Begin the wbt with an animation that provides an overview of the mealtime insulin dose calculation process
- After the animation, give users two options: 1) skip straight to personalized practice problems; 2) complete the whole wbt
- Add voiceover throughout and reduce the amount of on-screen text
- Fix known limitations related to navigation, mobile platforms, and atypical sliding scales

Create Spanish language version of the wbt

Conduct in-service for bedside nurses that includes clear instructions for how to incorporate the wbt into the current flow of diabetes education

Continue collecting feedback from patients, families, and nurses.

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Acknowledgments

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