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ORIGINAL ARTICLE

Data Entry Errors and Design for Model-Based Tight Glycemic Control in Critical Care

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Abstract

Introduction:

Tight glycemic control (TGC) has shown benefits but has been difficult to achieve consistently. Model-based methods and computerized protocols offer the opportunity to improve TGC quality but require human data entry, particularly of blood glucose (BG) values, which can be significantly prone to error. This study presents the design and optimization of data entry methods to minimize error for a computerized and model-based TGC method prior to pilot clinical trials.

Method:

To minimize data entry error, two tests were carried out to optimize a method with errors less than the 5%-plus reported in other studies. Four initial methods were tested on 40 subjects in random order, and the best two were tested more rigorously on 34 subjects. The tests measured entry speed and accuracy. Errors were reported as corrected and uncorrected errors, with the sum comprising a total error rate. The first set of tests used randomly selected values, while the second set used the same values for all subjects to allow comparisons across users and direct assessment of the magnitude of errors. These research tests were approved by the University of Canterbury Ethics Committee.

Results:

The final data entry method tested reduced errors to less than 1–2%, a 60–80% reduction from reported values. The magnitude of errors was clinically significant and was typically by 10.0 mmol/liter or an order of magnitude but only for extreme values of BG < 2.0 mmol/liter or BG > 15.0–20.0 mmol/liter, both of which could be easily corrected with automated checking of extreme values for safety.

Conclusions:

The data entry method selected significantly reduced data entry errors in the limited design tests presented, and is in use on a clinical pilot TGC study. The overall approach and testing methods are easily performed and generalizable to other applications and protocols.

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Abbreviations: (BG) blood glucose, (IQR) interquartile range, (STAR) stochastic targeted, (TGC) tight glycemic control

Keywords: critical care, data entry, error, glycemic control, human factors, ICU, intensive care, intensive insulin therapy, STAR, TGC, user interface

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