Evaluating the Automated Blood Glucose Pattern Detection and Case-Retrieval Modules of the 4 Diabetes Support System™

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Abstract

Background:

We have developed a prototypical case-based reasoning system to enhance management of patients with type 1 diabetes mellitus (T1DM). The system is capable of automatically analyzing large volumes of life events, self-monitoring of blood glucose readings, continuous glucose monitoring system results, and insulin pump data to detect clinical problems. In a preliminary study, manual entry of large volumes of life-event and other data was too burdensome for patients. In this study, life-event and pump data collection were automated, and then the system was reevaluated.

Methods:

Twenty-three adult T1DM patients on insulin pumps completed the five-week study. A usual daily schedule was entered into the database, and patients were only required to upload their insulin pump data to Medtronic's CareLink® Web site weekly. Situation assessment routines were run weekly for each participant to detect possible problems, and once the trial was completed, the case-retrieval module was tested.

Results:

Using the situation assessment routines previously developed, the system found 295 possible problems. The enhanced system detected only 2.6 problems per patient per week compared to 4.9 problems per patient per week in the preliminary study ($p = .017$). Problems detected by the system were correctly identified in 97.9% of the cases, and 96.1% of these were clinically useful.

Conclusions:

With less life-event data, the system is unable to detect certain clinical problems and detects fewer problems overall. Additional work is needed to provide device/software interfaces that allow patients to provide this data quickly and conveniently.

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Abbreviations: (A1C) glycosylated hemoglobin, (CBR) case-based reasoning, (CGMS) continuous glucose monitoring system, (SMBG) self-monitoring of blood glucose, (T1DM) type 1 diabetes mellitus

Keywords: artificial intelligence, case-based reasoning, decision-support software, insulin pump therapy, type 1 diabetes mellitus

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