

Intelligent Decision Support System for Diabetes Management

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Introduction:

Continuous glucose monitoring in patients with type 1 diabetes provides voluminous patient glucose data; however, these data are not yet maximally used to improve outcomes. A major barrier is the time required to analyze and translate data into clinical solutions that improve blood glucose control. A prototypical intelligent decision support system has been built to automatically analyze both patient glucose and lifestyle data, detect abnormal patterns in blood glucose control, and then recommend solutions to individual problems.

Methods:

Twenty patients with type 1 diabetes on insulin pump therapy participated in a 6-week pilot study. Each patient provided electronic daily logs, including self-glucose monitoring data, insulin dosages, work schedules, sleep patterns, exercise, meals, stress, illness, infusion set changes, pump problems, and hypoglycemic episodes. Each patient also provided Medtronic MiniMed continuous glucose monitoring data for three separate 72-hour intervals. Physicians interpreted data, identifying problems and recommending therapy adjustments to solve them. Knowledge engineers recorded problems, solutions, and physician rationales.

Results:

Fifty problem/solution cases from this pilot study were built into a prototypical case-based reasoning system. Software detected nocturnal hypoglycemia, morning hyper- or hypoglycemia, overcorrection for hyper- or hypoglycemia, pre- or postmeal hyper- or hypoglycemia, over-bolusing at meals, exercise-induced hypoglycemia, and insulin pump malfunction/infusion set problems. Newly detected problems were compared to previously encountered problems to identify potential therapeutic changes. Recommendations were provided for physician review, but might eventually be incorporated into patient devices.

Conclusions:

Integrating glucose and lifestyle data facilitates provider recognition and development of solutions for common problems encountered by patients on insulin pump therapy. Patients accept the concept of an automated advice, and additional research could lead to a practical tool for patients.