

Intelligent Decision Support for Type 1 Diabetics on Insulin Pump Therapy

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Abstract

The purpose of this project was to develop software to help patients with diabetes attain better glucose control. Using case-based reasoning, the software analyzes patient lifestyle information, correlates it with self-glucose monitoring data, compares it to previously learned case scenarios, and then offers solutions that have proven successful in past.

A pilot 6-week study of 20 patients with type 1 diabetes on insulin pumps was conducted. Each subject provided extensive daily logs via the internet, tracking self-glucose monitoring data, insulin dosages, work schedules, sleep patterns, exercise, meals, stress, illness, menstrual cycles, infusion set changes, pump problems, hypoglycemic episodes, and other events thought to impact glucose levels. Each subject wore the Medtronic Minimed® continuous glucose monitoring system for three, separate 72-hour intervals during the study. All data was presented graphically to participating physicians, who interpreted the data, then educated the knowledge engineers building the software about observed glucose patterns and rationales for changes in management.

As a result of this pilot study, 38 clinical problem/solution cases have been compiled in this artificial intelligence system. Software has been built to detect nocturnal hypoglycemia, morning hyper or hypoglycemia, over-correction for hyper or hypoglycemia, pre-meal or post-meal hyper or hypoglycemia, over-bolusing at meals, exercise-induced hypoglycemia, and insulin pump malfunction/infusion set problems. Software to provide problem-specific advice based on these cases is under construction and cases are being developed as more patients participate in this study. Patients participating in the study believed that receiving advice from a computerized system would be beneficial.

Conclusions from this pilot study are that 1) the graphic presentation of integrated lifestyle and glucose data developed for this program allows participating physicians to identify trends more readily and adjust therapy more effectively, resulting in improved glucose control and 2) it is possible to develop a computerized system which recognizes common clinical problems and offers automated advice for patients. As envisioned, this software will initially provide recommendations to physicians for review. Eventually, it could be incorporated in a patient's insulin pump or glucose monitor system for daily decision-making help.