## Enhanced 911/Global Position System Wizard: A Telemedicine Application for the Prevention of Severe Hypoglycemia—Monitor, Alert, and Locate

Eyal Dassau, Ph.D.,<sup>1–3</sup> Lois Jovanovič, M.D.,<sup>1–3</sup> Francis J. Doyle III, Ph.D.,<sup>1–3</sup> and Howard C. Zisser, M.D.<sup>1,3</sup>

## Abstract

Intensive insulin therapy has an inherent risk of hypoglycemia that can lead to loss of consciousness, cardiac arrhythmia, seizure, and death ("dead-in-bed syndrome"). This risk of hypoglycemia is a major concern for patients, families, and physicians. The need for an automated system that can alert in the event of severe hypoglycemia is evident. In engineering systems, where there is a risk of malfunction of the primary control system, alert and safety mechanisms are implemented in layers of protection. This concept has been adopted in the proposed system that integrates a hypoglycemia prediction algorithm with a global position system (GPS) locator and short message service such that the current glucose value with the rate of change (ROC) and the location of the subject can be communicated to a predefined list. Furthermore, if the system is linked to the insulin pump, it can suspend the pump or decrease the basal insulin infusion rate to prevent the pending event. The system was evaluated on clinical datasets of glucose tracings from the DexCom Seven® system. Glucose tracings were analyzed for hypoglycemia events and then a text message was broadcast to a predefined list of people who were notified with the glucose value, ROC, GPS coordinates, and a Google map of the location. In addition to providing a safety layer to a future artificial pancreas, this system also can be easily implemented in current continuous glucose monitors to help provide information and alerts to people with diabetes.

J Diabetes Sci Technol 2009;3(6):1501-1506

Author Affiliations: <sup>1</sup>Department of Chemical Engineering, University of California at Santa Barbara, Santa Barbara, California; <sup>2</sup>Biomolecular Science and Engineering Program, University of California Santa Barbara, Santa Barbara, California; and <sup>3</sup>Sansum Diabetes Research Institute, Santa Barbara, California

Abbreviations: (AP) artificial pancreas, (APS) artificial pancreas software, (CGM) continuous glucose monitoring, (CSII) continuous subcutaneous insulin infusion, (GPS) global positioning system, (ROC) rate of change, (SMS) short message service, (T1DM) type 1 diabetes mellitus

Keywords: artificial pancreas, hypoglycemia, telemedicine, type 1 diabetes mellitus

**Corresponding Author:** Eyal Dassau, Ph.D., Department of Chemical Engineering, University of California, Santa Barbara, Santa Barbara, CA 93106-5080; email address <u>dassau@engineering.ucsb.edu</u>