

## Telemedicine-Based KADIS<sup>®</sup> Combined with CGMS<sup>™</sup> Has High Potential for Improving Outpatient Diabetes Care

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### Abstract

#### **Background:**

The Karlsburg Diabetes Management System (KADIS<sup>®</sup>) was developed over almost two decades by modeling physiological glucose–insulin interactions. When combined with the telemedicine-based communication system TeleDIAB<sup>®</sup> and a continuous glucose monitoring system (CGMS<sup>™</sup>), KADIS has the potential to provide effective, evidence-based support to doctors in their daily efforts to optimize glycemic control.

#### **Methods:**

To demonstrate the feasibility of improving diabetes control with the KADIS system, an experimental version of a telemedicine-based diabetes care network was established, and an international, multicenter, pilot study of 44 insulin-treated patients with type 1 and 2 diabetes was performed. Patients were recruited from five outpatient settings where they were treated by general practitioners or diabetologists. Each patient underwent CGMS monitoring under daily life conditions by a mobile monitoring team of the Karlsburg diabetes center at baseline and 3 months following participation in the KADIS advisory system and telemedicine-based diabetes care network. The current metabolic status of each patient was estimated in the form of an individualized “metabolic fingerprint.” The fingerprint characterized glycemic status by KADIS-supported visualization of relationships between the monitored glucose profile and causal endogenous and exogenous factors and enabled evidence-based identification of “weak points” in glycemic control. Using KADIS-based simulations, physician recommendations were generated in the form of patient-centered decision support that enabled elimination of weak points. The analytical outcome was provided in a KADIS report that could be accessed at any time through TeleDIAB. The outcome of KADIS-based support was evaluated by comparing glycosylated hemoglobin (HbA1c) levels and 24-hour glucose profiles before and after the intervention.

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**Abbreviations:** (BMI) body mass index, (BU) bread exchange units, (CGMS) continuous glucose monitoring system, (CHO) carbohydrate, (DIAS) Diabetes Advisory System, (DIROC) Diabetes Research and Outpatient Centre, (GPs) general practitioners, (HbA1c) glycosylated hemoglobin, (IDE) insulin dose equivalents, (IDK) Institute of Diabetes “Gerhardt Katsch” Karlsburg, (KADIS) Karlsburg Diabetes Management System, (MBG) mean blood glucose level, (OAD) oral antidiabetic drugs, (UKPDS) UK Prospective Diabetes Study

**Keywords:** advisory system, continuous glucose monitoring, decision support, HbA1c, KADIS, outpatient diabetes care, telemedicine

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**Abstract cont'd****Results:**

Application of KADIS-based decision support reduced HbA1c by 0.62% within 3 months. The reduction was strongly related to the level of baseline HbA1c, diabetes type, and outpatient treatment setting. The greatest benefit was obtained in the group with baseline HbA1c levels >9% (1.22% reduction), and the smallest benefit was obtained in the group with baseline HbA1c levels of 6–7% (0.13% reduction). KADIS was more beneficial for patients with type 1 diabetes (0.79% vs 0.48% reduction) and patients treated by general practitioners (1.02% vs 0.26% reduction). Changes in HbA1c levels were paralleled by changes in mean daily 24-hour glucose profiles and fluctuations in daily glucose.

**Conclusion:**

Application of KADIS in combination with CGMS and the telemedicine-based communication system TeleDIAB successfully improved outpatient diabetes care and management.

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