Main Submission

Using new technologies to improve individualized self-management of diabetes

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Obesity, a major public health concern worldwide, has reached epidemic proportions in North America. This has resulted in exorbitant healthcare costs, accounting for 2-7% of total healthcare costs.[1] A number of health complications have been linked to obesity, including: psychosocial difficulties, cancers, cardiovascular problems, and type 2 diabetes.[2] In diabetic patients, closely observing blood glucose (BG) response to food consumption and physical activity over time has been shown to be an effective way of exploring BG change. For instance, examining BG response using blood-testing strips has shown that BG increased rapidly after meals and was positively correlated with fat mass percentage.[3] Furthermore, collecting dietary, physical activity and BG data in real-time has demonstrated an opportunity to allow for *individualized* feedback that could be used by a diabetic patient to enhance their self-management of diabetes.[4] This commentary explores advancing research and new technologies for improved diabetic patient self-management.

Real-time self-monitoring of blood glucose (SMBG) affords an opportunity to identify the patterns of daily insulin secretion via complex datasets comprised of activity, physiological and nutritional data. SMBG serves as an important adjunct to hemoglobin A1c (HbA1c) testing and can differentiate between fasting and hyperglycemia; detect glycemic episodes; recognize and monitor resolution of hypoglycemia; in addition to providing instantaneous feedback to patients about their food choices, physical activity, and medications. Pattern analysis is an organized approach to recognize glycemic patterns within SMBG data, allowing for the appropriate action to be taken based upon those results. Pattern analysis involves: [1] glucose targets [2] obtaining data regarding BG levels, carbohydrate intake, medication, activity levels and emotional/physical stress [3] analyzing data to recognize patterns of adverse glycemic episodes, assess any influencing factors, and apply appropriate action(s) and [4] performing ongoing SMBG to measure the impact of any treatment changes made.

Employing a novel data collection methodology, Doherty[4] designed a pilot study that consisted of a set of wearable sensors connected to a BlackBerry Smartphone with a continuously running software program. The Smartphone and sensors in this study included: a GPS receiver; 3-axis accelerometer and ECG and heart rate monitor; and a continuous BG monitor. Data was compressed, encrypted to ensure patient privacy, and transmitted to a central server for storage, processing, display, and further interaction with patients. An electronic food diary was recorded and made available the amount of sugar, carbohydrates, calories and medication consumed, while automated activity diary software was able to calculate how long patients were engaged in specific activities.

Findings from the Doherty pilot study demonstrate the potential for accurately predicting patient-specific BG levels. Not surprisingly, findings from this pilot study suggest that diet and physical activity are closely related to BG fluctuation. However, and more importantly, the study demonstrates the ability to predict *when* a change in BG is likely to occur. This information is of clinical importance in efforts to prevent hypoglycemic episodes and avoid unnecessary trips to traditional healthcare facilities. The pattern analysis techniques employed by Doherty provides an opportunity for clinicians and patients to learn what would trigger adverse fluctuations in a patient's BG. Additionally, this approach to understanding SMBG data facilitates appropriate therapeutic modification, leading some researchers to suggest that pattern analysis of SMBG can be of equal or greater value than traditional measurements of HbA1c levels.[5] This notion is complimented with further evidence indicating SMBG-based structured pharmacological and educational programs are able to empower patients to achieve physical activity and nutritional goals, and encourage patients and physicians to utilize SMBG to optimize therapy.[6] Nevertheless, a challenge remains that involves the knowledge translation and exchange components of new data collection techniques afforded with SMBG. For instance, the manner in which data from the Doherty pilot study is presented to patient and care provider needs further refinement. Despite the controversy of the perhaps premature criticisms regarding the cost-effectiveness and clinical benefits of SMBG, it is suggested that further research is necessary to identify subgroups for whom SMBG might be useful.

While findings from Doherty[7] provide promise, a challenge remains in updating policy, mainstream healthcare strategies, and patient education to enhance and empower diabetic patients. New technologies provide an opportunity for diabetic patients to better understand the idiosyncratic nature of their health complications and how to better self-manage their disease.

References

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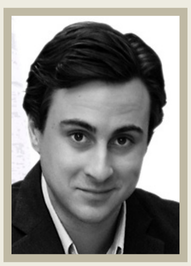

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