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BabySTEPS: A Sugar Tracking Electronic Portal System for Gestational Diabetes

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Abstract and Objective

Gestational diabetes is a condition occurring in up to 18% [1] of pregnant women that results in an increase in blood glucose levels due to the body's inability to produce sufficient insulin given the additional needs of the baby, and/or hormonal changes that lower the body's sensitivity to insulin. If left untreated, the growing baby may become too large, increasing the risk of injury to the mother and baby during delivery. Controlling blood glucose can be a challenging task, especially for women with no previous experience and who may have unhealthy diets. An opportunity exists to further encourage compliance by providing patients electronic access to data generated during their pregnancy. Previous studies have shown the potential of portals for managing general diabetes [2], but no work has targeted glucose control in pregnant women. We present BabySTEPS (Sugar Tracking Electronic Portal System), a patient portal focused on engaging women with gestational diabetes that provides personalized feedback with the goal of reducing complications at birth and subsequent medical problems resulting from poor glucose control.

Keywords:

Patient portal, Diabetic pregnancy, Glucose monitoring.

Methods

BabySTEPS (Sugar Tracking Electronic Portal System) was developed as a web-based application with components for data collection, data exchange, and data visualization. In the pilot version of the system we aimed to present the user with: 1) a graphical representation of their blood glucose history, 2) ultrasound images, 3) fetal growth charts, 4) automated messages to highlight poor glucose control and to encourage good control, and 5) educational information. Patient data collection is performed by clinic staff using REDCap, a widely-used web-based system for collecting medical information [3]. For each patient, case report forms are completed that are then used to populate the portal view. These include forms for demographic information, lab values (e.g., HbA1c), and ultrasound images with corresponding measurements (e.g., crown to rump length). A glucose report form is completed weekly for each patient, capturing four blood glucose readings a day for seven days. BabySTEPS uses J2EE technologies and was built with the Grails modeling framework. Grails supports a model-view-controller (MVC) design paradigm that isolates the presentation layer from application logic and data modeling. To enable data exchange between REDCap and BabySTEPS, the REDCap web application programming interface (API) was used. This required the integration of a customized XML parser, as the REDCap entity-attribute-value (EAV) data model does not fit naturally with Grails' object relational mapping (ORM) system. Additional Grails plugins were used for security, image manipulation, and HTML styling. Upon presentation to the user, BabySTEPS compares glucose readings and fetal measurements to predefined normal ranges, and formats the information into a variety of interactive graphical elements with personalized alerts. These alerts may be multi-tiered, combining information from several data points. For example, a fetal abdominal circumference measurement beyond the maximum range is linked to corresponding poor glucose control measurements, as well as guidelines on healthy eating and educational material on the possible dangers of delivering oversized babies. Alerts and their driving data interactions were specified by the clinical investigators, who were also responsible for culling educational information from a variety of resources. Ultrasound images are displayed in a temporal view, with links allowing users to share images via email. Finally, growth charts are presented on top of normal ranges, giving the user visual feedback relating their baby's measurements to an ideal range.

Discussion

BabySTEPS is currently being evaluated as a tool to support glucose control in a randomized controlled study at our institution, with comparison to standard of care. Outcome measures of the study include glucose compliance, fetal weight, relevant complications at birth, and monthly patient questionnaires regarding glucose control. In addition, the application provides the platform to introduce future technologies for glucose control support, including wireless glucose monitoring, EMR integration, SMS alerts to cell phones, and social network integration.

References

[1] National Diabetes Statistics, National Diabetes Information Clearinghouse (NDIC), 2011: Available from: http://diabetes.niddk.nih.gov/dm/pubs/statistics.

[2] Catherine HY, Bahniwal R, Laupacis A, Leung E, Orr MS, Straus SE. Systematic review and evaluation of web-accessible tools for management of diabetes and related cardiovascular risk factors by patients and healthcare providers. Journal of the American Medical Informatics Association. 2012;19(4):514-22.

[3] Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)-A metadata-driven methodology and workflow process for providing translational research informatics support. Journal of Biomedical Informatics. 2009;42(2):377.