

JULY 2015

Diabetes Care®

In This Issue of *Diabetes Care*

By Max Bingham, PhD

More Detailed Medical Record Documentation Linked to Faster Achievement of Glycemic Control in Patients With Diabetes

A report in this issue of *Diabetes Care* (p. 1326) indicates that very small increases in the intensity and level of detail recorded in electronic patient medical records relating to lifestyle counseling are associated with patients achieving glycemic control (according to HbA_{1c}) much faster than when documentation is less thorough. The study by Hosomura et al. retrospectively examined the medical records of just under 11,000 hyperglycemic adults with diabetes at two hospitals in Massachusetts. After extracting text from medical records relating to lifestyle counseling and calculating measures of documentation intensity (the amount of text) and heterogeneity (how different the text was over time), a clear pattern emerged. The top third of patient records with the highest scores for documentation heterogeneity and intensity had a median time to glycemic control of 26 and 24 months, respectively. In the lowest scoring third, it took 39 months to achieve control based on both measurements. Perhaps, the most surprising aspect of the study is the size of the apparent changes needed in terms of documentation. For example, an increase of just 45 characters per note was associated with a significantly increased chance of a patient hitting the HbA_{1c} target. Commenting on the wider applicability of the research, Dr. Turchin said: "This is the first study to identify a relationship between measurable characteristics of electronic documentation and patient outcomes. These findings open the door for future development of analytics that can indicate quality of care provided to the patient based on electronic health record data." The authors caution that the underlying relationship between documentation scores and patient outcomes cannot be established with this study. However, the implications for diabetes care, and particularly further research into practitioner-patient recording of care, are likely to be considerable if this approach is applied widely.

Hosomura et al. Electronic documentation of lifestyle counseling and glycemic control in patients with diabetes. *Diabetes Care* 2015;38:1326–1332

Mapping Immunity and Inflammation Markers in Over 15,000 Individuals Reveals New Targets for Diagnosis of Diabetes and Its Complications

In a notable departure from the limited trial populations that document immune and inflammatory response profiling in type 2 diabetes, Grossmann et al. (p. 1356) report a large population-representative cohort study profiling a broad range of immune and inflammatory markers that should be relevant for both clinical application and future research. The report published in this issue of *Diabetes Care* details a broad-ranging survey of both immune and inflammatory markers in a population of 15,000 individuals that included around 1,500 and 1,300 individuals with either prediabetes or type 2 diabetes, from a population perspective that far exceeds most previous studies that have looked at this area in detail. Of note, the authors identified four different patterns of response relating to various markers and disease progression from nondiabetic to prediabetic and then diabetic status. Examples of patterns included a gradual increase of various white blood cell types, IL-1RA, IL-18, and fibrinogen increasing from nondiabetic to diabetic status and separately, stable levels of lymphocytes and C-reactive protein despite progression to overt type 2 diabetes. Although the authors note some limitations of the study, the general conclusions point toward specific biomarkers being associated with the disease progression (or not) and importantly give a predictive value toward inflammation and immune marker profiling. In terms of obesity and other diseases that have a risk of diabetes but not the hallmarks necessarily on clinical presentation, these data could well prove significant. The importance of this study, apart from its sheer size, is that it uncovers a variety of markers associated with early preclinical and clinical phases of diabetes and notably what happens to them when progression occurs to the clinical stages of the disease. That could be vital for early diagnosis of diabetes. The study also provides some fundamental insights into the development of complications associated with diabetes—the area of most concern for this disease.

Grossmann et al. Profile of the immune and inflammatory response in individuals with prediabetes and type 2 diabetes. *Diabetes Care* 2015;38:1356–1364

Continuous Glucose Monitoring Reveals Patterns of Glucose Levels Associated With Large-for-Gestational-Age Infants Born to Women With Diabetes

Temporal glucose variations in diabetes can be measured by continuous glucose monitoring (CGM), and the resulting patterns can be used to monitor the development of large-for-gestational-age infants born to mothers with diabetes, according to a report in this issue of *Diabetes Care* (p. 1319). The large-for-gestational-age infant is the commonest complication in pregnancy in diabetes and is usually linked to maternal hyperglycemia, meaning glycemic control is usually targeted for treatment. However, even when glucose levels are considered controlled according to usual clinical measurements, such as HbA_{1c}, the continued prevalence of large-for-gestational-age births suggests that something else is going on. As Law et al. indicate in their report, it could be that these measurements miss temporal variations that ultimately contribute to the abnormal growth rate of the infant. To test this idea, they used CGM in combination with functional data analysis in a multicenter study of pregnant women with type 1 and type 2 diabetes based in the U.K. and Denmark. Clear temporal variations emerged in glucose levels at specific times of day and during specific trimesters that appeared to be associated with the abnormal development of infants. Importantly, they say, these variations would not routinely be picked up by standard summary clinical measurements, and it is this issue that may explain why so many births proceed abnormally even when values for glycemic control are considered controlled. Commenting on the wider clinical relevance of the study, Dr. Scott said: "Analyzing CGM has allowed us to understand where, when, and how we might better invest efforts to optimize glucose control and thus improve pregnancy outcomes. Essentially, this is like suddenly being able to view glucose through a microscope rather than the naked eye. The next stage of the research would be to use this analysis to help with the future design of the 'artificial pancreas,' the closed-loop insulin systems that are being developed to transform the care of people with type 1 diabetes who are reliant on insulin."

Law et al. Analysis of continuous glucose monitoring in pregnant women with diabetes: distinct temporal patterns of glucose associated with large-for-gestational-age infants. *Diabetes Care* 2015;38:1319–1325

Later School Grades of Children Are Affected by Glycemic Control During Pregnancy in Mothers With Type 1 Diabetes

Children born to mothers who had type 1 diabetes before and during pregnancy generally perform at school as well as matched control participants according to a report by Knorr et al. in this issue of *Diabetes Care* (p. 1238). However, offspring of mothers who had poorer glycemic control during pregnancy do appear to achieve significantly lower grades when they grow up. The report details a prospective clinical and register-based cohort study in which the school grades of just over 700 offspring of mothers who had type 1 diabetes before and during pregnancy were compared with grades of matched control participants (approximately 60,000 children). Poorer glycemic control in mothers (as measured by HbA_{1c}) before and during pregnancy does appear to be linked to lower average school grades when offspring grow up (i.e., at 15–16 years of age). The opposite also appears to be the case when there is good glycemic control in the third trimester of pregnancy—higher average school grades were obtained in comparison with the control group. Whether or not these effects are directly related to intrauterine hyperglycemia or some other (non)biological factor remains unclear, according to the authors. They explain that if there was a direct link between glucose levels in the developing brain and subsequent academic performance, they would have expected an overall difference between test and control groups. This was not the case. The finding of better overall performance in children of mothers who did have better glycemic control suggests that some sort of maternal organizational or functional skills may have had more of an effect on grades among many other factors. The result underlines the importance of glycemic control in type 1 diabetes, especially during pregnancy, and the effective management that can have consequences far beyond the patient and, particularly, in the offspring.

Knorr et al. Academic achievement in primary school in offspring born to mothers with type 1 diabetes (the EPICOM study): a register-based prospective cohort study. *Diabetes Care* 2015;38:1238–1244