Unanticipated consequences of hospital-based insulin management improvement program

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Abstract and Objective

Hypo/hyperglycemia is associated with adverse clinical outcomes in the inpatient setting. We introduced a hospital-wide inpatient glucose management program at Johns Hopkins Hospital in January 2006 to facilitate uniform glucose management policies and staff education based on current clinical practice guidelines. During that time, a spectrum of initiatives were implemented to improve hospital-wide glycemic control, including a Hypoglycemia Policy (7/06), a diabetes nursing superuser program (1/07), a Hyperglycemia Policy, and uniform computerized subcutaneous insulin orderset (11/07). After implementation of the program, the frequency of hypoglycemia significantly decreased from 1/1/07 to 12/31/08. In contrast, the frequency of hyperglycemia increased from 1/1/07 to 12/31/07 but then began to decline after 1/1/08, following implementation of a hospital-wide standardized subcutaneous insulin orderset. These data are informative in identifying unanticipated consequences of an insulin management program focused entirely on hypoglycemia. A balanced approach in implementing insulin management guidelines is warranted.

Keywords:

Hypoglycemia, Hyperglycemia, Clinical guidelines

Methods

The goal of this project was to evaluate the impact of these initiatives on hospital-wide hyperglycemia and hypoglycemia, as inpatient glucose management quality of care measures, using glucometrics.

A retrospective analysis of fingerstick glucose measures were conducted from1/1/07 to 12/31/08. We used glucose measures in our point of care testing database to generate indices of glycemic control recently introduced by the Society of Hospital Medicine Task Force in the "Practical Recommendations for Glucometrics in the Hospital." The frequency of two levels of hypoglycemia (glucose <70 mg/dL and <40 mg/dL), and hyperglycemia (glucose >=180 mg/dL and >=300 mg/dL) were calculated in the population for each month using two models. In the population model, the denominator was the total of all glucose measurements. In the patient-day model, hyperglycemia and hypoglycemia frequency were calculated as at least one incident event among each unique patient record for each calendar day. Linear regression was applied to analyze the trend of hypo/hyper-glycemia over the period of 1/1/07 to 12/31/08.

Results

The total number of fingerstick records in 2007 and 2008 were 460,696 and 382,673 respectively. The total numbers of unique patient-days were 191,904 in 2007 and 139,660 in 2008. In the population model, from1/1/07 to 12/31/08, there was a significant decrease in the percentage of glucometer readings <70 mg/dL (from 6.1% to 4.1%; p=0.007) and <40 mg/dL (from 0.6% to 0.3%; p=0.002). In the patient-day model, from1/1/07 to 12/31/08, the percentage of patients days with glucose levels <70 mg/dL decreased from 9.0% to 7.0% (p=0.01) and the percentage of patient days with glucose levels <40 mg/dL decreased from 0.9% to 0.7% (p=0.04). Following implementation of the Hyperglycemia Policy on 1/1/08, there was a slight decline in glucometer readings >=300 mg/dL (from 3.7% to 2.8% ;p=0.2) and >=180 mg/dL (from 18.6% to 17.1% ;p=0.6) using the population model. Similar patterns were observed in the patient-day model as well. From 1/1/08 to 12/31/08, following implementation of the Hyperglycemia Policy, there was a trend toward a decline in the percentage of patient days with glucose levels >=300 mg/dL (from 6.6% to 5.0%;p=0.08) in patient-day model. The percentage of patient days with glucose levels >=180 mg/dL did not significantly change during this period.

Conclusion

Introduction of a hospital-wide glucose management program had a significant impact in reducing the frequency of hospital-wide hypoglycemia. Implementation of in-hospital insulin management guidelines may be optimized by introduction of a balanced approach addressing both hypo- and hyperglycemia simultaneously.