Validation of a Risk Screening Tool for Pediatric Type 1 Diabetes Patients: Predictor of Increased Acute Health Care Utilization

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Background

Diabetes mellitus (DM) affects approximately 7.6% of the population, but it is estimated that 1 in 4 health care dollars in the U.S. accounts for care of people with diabetes [2,3]. Management of Type 1 diabetes mellitus (T1DM) is complex, labor intensive, and requires extensive resources and family involvement. Diabetic Ketoacidosis (DKA) and severe hypoglycemia are significant complications of T1DM and result in acute care visits and hospitalizations. Previous research has identified various psychosocial risk factors, such as inadequate insurance, low health literacy, and lack of social support negatively affect management of diabetes [2-5]. Due to the intensive nature of diabetes management, children and families with T1DM may experience increased levels of conflict, burnout, and overall disruption of family function [1]. Therefore, it is important to assess the psychosocial background of new onset T1DM patients and families to ensure there is adequate support. Only a few validated approaches exist to identify factors among patients and families that may be predictive of poor coping or difficulty with diabetes management.
Thus, our team created a 10 factor brief screening tool comprised of evidenced-based risk factors to assist in identifying patients and families that would benefit from preventative and supportive interventions.

Purpose

To determine the utility of a risk screening tool in predicting health outcomes among patients with new T1DM. Poor health outcomes are defined as: HbA1c ≥9.5% at 18 mos., HbA1C ≥9.5% at any of the three time points within the18 month period OR acute health care utilization (HC) including: emergency department (ED), urgent care (UC), and inpatient admission.

Methods

158 patients with new T1DM were adjudicated as high risk or low/moderate risk. Data on hemoglobin A1c, which will be referred as glycemic control (GC), and number of acute health care visits (HC) were collected at 6, 12, and 18 months post diagnosis. Differences by risk status were assessed using a chi-square test and multivariable logistic regression, controlling for age and gender. Validity of high risk status for predicting favorable vs. poor outcome was assessed using area under the receiver operator characteristic curve (AUC- ROC), sensitivity and specificity.

References

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Results

TABLE 1: Comparison of Outcomes by High Risk Status

Outcome	High Risk (n=31)	Low (n=87) or Moderate (n=41) Risk	p-value
	N (%)	N (%)	
Poor GC, 18mo	10 (32)	23 (18)	0.08
Poor GC, any visit	13 (42)	34 (27)	0.1
Any HC utilization	27 (87)	3 (2)	<0.01
Any ED visits	23 (74)	3 (2)	<0.01
Any UC visits	7 (23)	1 (1)	<0.01
Any Inpatient visit	27 (87)	3 (2)	<0.01
Poor GC 18mo OR any HC utilization	28 (90)	25 (20)	<0.01

Figure 1: ROC Curves for Using High Risk Status to Predict Poor Outcome
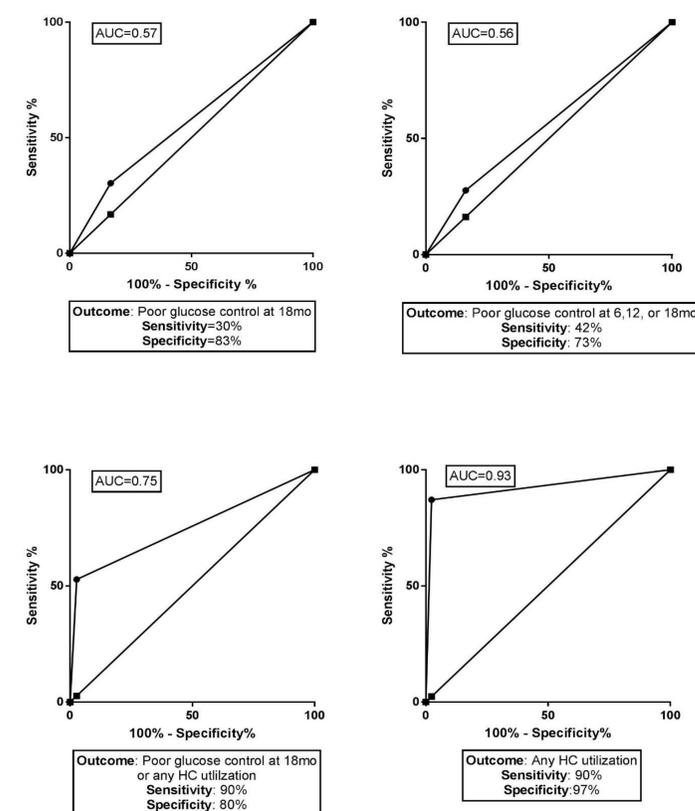
AUC of 0.5-> tool is as good as a coin flip; AUC of 1.0-> tool has perfect prediction. AUC 0.7-0.8 is good; AUC >0.8 is excellent.

- Average age was 9.6 ± 4.3 years, and 50% of patients were male. 31 patients (20%) had a high screening score and 127 (80%) had a low or moderate screening score.

- Sex was not significantly associated with any of the outcomes; younger age was significantly associated with poor GC at any visit, but not with any other outcomes.

- Patients screened as high risk were about twice as likely to be in poor GC at 18 months or have poor GC at any visit, but the association was not statistically significant.

- A high risk screen was significantly associated with the combined outcome of poor GC at 18 months or any HC utilization, and with the outcome of any HC utilization alone.

- High risk screen also had good ability to identify patients with poor GC at 18 months or any HC utilization (AUC=0.75) and excellent ability to identify patients with any HC utilization (AUC=0.93).

Discussion

- Our screening tool appears to have greatest utility at differentiating patients with vs. without any HC utilization (alone, without grouping together with poor GC), with excellent discriminatory ability (AUC=0.93), sensitivity (90%), and specificity (97%).

- Risk stratification can help target appropriate clinical interventions for prevention of HC utilization and ultimately reduce health care costs.

- Our results did not identify differences in health outcomes across sex which is inconsistent with previous research that has identified female sex as a risk factor for GC[6].

- Younger age was significantly associated with poor GC at any visit, which is consistent with previous research that has identified younger age as a risk factor[6].

- Longitudinal data collection post 18 months may further demonstrate utility to also predict poor GC.

Future Implications

- Ongoing research of a larger sample size with this tool may further demonstrate its efficacy in predicting individuals at risk for poor GC and HC.

- Overall, risk stratification can help target appropriate clinical interventions for those screened as moderate/high risk at new onset to reduce health care costs and adverse health outcomes.