ORIGINAL ARTICLE

Impact of 'Transition of Care Model' On Hospital Diabetic Ketoacidosis Readmission Rates: A Pilot Study

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Objective: To investigate if a 'Transition of Care' (ToC) Model at the time of hospital discharge helps in achieving a timely outpatient follow-up and reducing hospital readmission rates with diabetic ketoacidosis (DKA).

Methods: We conducted a retrospective chart review study at SUNY Upstate Medical University, Syracuse, NY. We reviewed electronic medical records (EMR) of patients $\geq$18 years old admitted with DKA between 01/01/2013 and 12/31/2013, and collected demographic, clinical, laboratory and imaging data. At our institute, the ToC program was initiated on 07/01/2013 and involved making phone calls/mailing letters to the patients within 48 hours of the hospital discharge by fellows in-training. Patients were inquired about changes in the discharge medications/insulin regimens, home blood glucose values, hypo/hyperglycemic episodes, and encouraged to follow-up at an affiliated Joslin Diabetes Center (JDC). Patients admitted between 01/01/2013 and 06/30/2013 were used as controls, and those admitted between 07/01/2013 and 12/31/2013 (post initiation of ToC) were used as cases.

Results: 89 patients with DKA fulfilled the inclusion criteria for the study, of which 54 were cases and 35 were controls. 10 out of 54 (18.5%) cases and 6 out 35 (17.1%) control group participants were readmitted >1 time within the next 6 months after a hospital discharge. Within 30 days, 48 out of 54 (88.8%) case participants and 0 out of 35 controls followed-up at JDC.

Discussion: In our experience, contacting patients within few days after discharge was an effective way to reinforce the discharge plan, clarify misunderstandings, accomplish early detection of unexpected outcomes, and remind patients about outpatient follow-up. Our study could not show statistically significant reduction in hospital readmission rates, but found a trend towards increased outpatient follow-up. The limitation of the study was the small sample size.

Conclusion: Hospital admission is the major driver in caring for diabetes, accounting for as much as 40% of total costs. Post discharge telephone contact can be explored as an effective way to improve outpatient follow-up and decrease readmission rates. However, more studies with a bigger sample size are needed to investigate the best protocol to develop an ideal ToC model.

Keywords: Diabetic ketoacidosis, diabetes, readmissions, cost, patient care.

INTRODUCTION

Hospital admissions are the primary contributors to the cost in caring for the patient's diabetes and account for about 40% of costs across all age groups.[1] According to the data from the Center for Disease Control and Prevention (CDC) Division of Health Care Statistics, from 1988 to 2009, the age–adjusted hospital discharge rate for diabetic ketoacidosis (DKA) per 10,000 population increased by 43.8% (from 3.2 to 4.6 per 10,000 population).[2]

As most hospital reimbursements are based upon diagnosis-related groups, hospitals have strong financial incentives for quicker discharges to control the length of stay and expenditures.[3] The data does demonstrate a significant decline in the length of a hospital stay in the last few decades.[4] This can limit the available time for discharge planning and compromise the patient's ability to fully understand his/ her discharge plans, including the significance for follow-up the lack of which leads to unnecessary readmissions and costs.[3] Hospital readmission rates add significantly to the cost and resource utilization of our health care delivery system.[3] The Medicare data shows that 34% of 11 Million Medicare patients were readmitted within 90 days with an estimated costs of $17.4 billion.[5] 50.2% of the readmitted patients had no bill for a follow-up clinic appointment.[5] As a result, post-discharge readmissions within 30 days are increasingly used as an indicator of quality of care during the inpatient hospital stay.[6]

With the changing economic environment and payment structures, the research into identifying potential avenues for cost saving and improving health care quality has received an increasing attention. One such area of interest is the transitional care field, which is defined as "a set of actions designed to ensure the coordination and continuity of health care as patients transfer between different locations of care."[7] 1 in 7 hospital readmissions among patients with diabetes are estimated to be due to substandard transition of care.[8]

We initiated a Transition of Care (ToC) program at our institute on 07/01/2013, which involved making phone calls/mailing letters to the patients within 48 hours of the hospital discharge. The aim was to investigate if the ToC Model at the time of hospital discharge helped in achieving a timely outpatient follow-up and in reducing the hospital readmission rates with diabetic ketoacidosis (DKA).

METHODS

A retrospective chart review study was conducted at SUNY Upstate Medical University in Syracuse, NY. The study was exempted from IRB review. We used ICD 9 codes to identify patients with a principal discharge diagnosis of DKA (250.11 and 250.13) between 01/01/2013 and 12/31/2013. We also included patients with secondary discharge diagnosis of DKA. To prevent misclassification, the diagnosis of DKA was confirmed in all the study patients. Only those patients with hyperglycemia who fulfilled the following criteria for DKA were included: an anion gap of more than 12, bicarbonate less than 18, and evidence of ketonuria or ketonemia. The Electronic Medical Records (EMR) for patients with older than 18 years that fulfilled these criteria were reviewed, and demographic, clinical, laboratory and imaging data was collected. As part of the ToC program, patients were contacted through telephone calls/letters within 48 hours of the hospital discharge by fellows-in training. Patients were inquired about changes in the discharge medications/insulin regimens, home blood glucose values, hypoglycemic/hyperglycemic episodes, and

encouraged to follow-up at an affiliated Joslin Diabetes Center (JDC). A standardized phone call template was utilized and documented in patients' EMR. For the purposes of the study, patients admitted between 01/01/2013 and 06/30/2013 were used as controls, and between 07/01/2013 and 12/31/2013 (post initiation of ToC) as cases. Patients with at least 1 follow-up appointment at JDC were accounted. Patient following at outside clinics or those with no records of follow-ups were not included.   We reviewed hospital records to identify patients who were readmitted to the hospital with a diagnosis of DKA within the next 6 months. The patient's confidentiality was protected. The collected data is de-identified in accordance with the HIPAA De-Identification Certification Form and only the aggregated patient data is presented.

Statistical Analysis

Descriptive statistics (mean $\pm$ standard deviation) were used to compare the two groups. We used the SPSS software for a detailed statistical analysis. We used student t-test and Chi-square tests to assess significance in continuous variables and categorical variables respectively. P value of < 0.05 was taken as statistically significant.

RESULTS

During the designated period from 01/01/2013-12/31/2013, 242 adult patients were discharged with ICD-9 codes for DKA. Out of those, 89 patients had at least 1 follow up visit at JDC and were included in the study, of which 54 were cases and 35 controls.   The mean age in cases was 40.8 ± 18.6 years and control group was 36.5 ± 17.8 years. Females constituted 48% of cases and 51% of controls. Among cases, 63% were Caucasians, 24% were African-Americans, and 13% were Hispanics. Amid

controls, 71% were Caucasians, 20% were African-Americans, 5.7% were Hispanics, and 2.8% were Asians. The mean body mass index (BMI) was 27.2 ± 5.7 kg/m^2 in cases and 28.2 ± 7.0 kg/m^2 in controls. The mean hemoglobin A1c (HbA1c) was $11.3\pm2.6\%$ (range 5.5-16.8) in cases and $11.6\pm2.7\%$ (range 7.6-14) in controls. The demographic data of cases and controls are compared in Table 1.

Under the ToC model, 34 cases were contacted through phone calls and additional 4 through letters. 48 out of 54 (88.8%) cases followed-up at JDC within 30 days. In the control group, 0 out of 35 followed-up at JDC within 30 days. 10 out of 54 (18.5%) in cases and 6 out of 35 (17.1%) in control groups were readmitted more than 1 time within 6 months of a hospital discharge.

Out of 10 hospital readmissions in the case group with DKA, 7 were due to non-compliance (not taking insulin, missing doses), 2 were due to gastroenteritis, and 1 was from a urinary tract infection (UTI). In controls, 6 patients had hospital readmissions for DKA, 4 were due to non-compliance (not taking insulin, missing doses), 1 was due to a UTI, and 1 was due to a foot infection.

The two groups were similar in terms of age, gender, type of diabetes, and HbA1c. Our population mainly consisted of Caucasians; hence the p value was significant for racial disparities. No phone calls were made in the control group. Post-discharge follow-up at JDC within 30 days was significantly higher in cases.

DISCUSSION

Many studies have been conducted with various tools for discharge planning like step down units, transition of care units, discharge rounds, discharge social workers, case managers, nurse home visits, telephone follow-ups, and discharge summaries sent to

Table 1. Demographic data, number of admissions, and outpatient follow-up.

	Cases (n=54)	Controls (n=35)	P value
Age (mean) in years	40.8$\pm$ 18.6	36.5$\pm$ 17.8	0.378
Gender			0.667
Male	28	17	
Female	26	18	
Race			0.028 *
Caucasian	34	25	
Afro-American	13	7	
Hispanics	7	2	
Asian	0	1	
Others	0	0	
BMI kg/m2	27.2 $\pm$ 5.7	28.2 $\pm$ 7.0	.0485
Number of admissions			0.351
1	44	29	
2	6	4	
>2	4	2	
Phone calls	34	1	0.000*
Mail letters	4	0	0.147
Post discharge follow up at JDC	48	0	0.000*
HbA1c, mean %(range %)	11.3 $\pm$ 2.6 (5.5-16.8)	11.6 $\pm$ 2.7 (7.6-14)	0.135

primary care providers, etc.[9] Post-hospital discharge phone call is an inexpensive tool to reinforce the post-discharge hospital plan, clarify misunderstandings, detect early and unexpected outcomes, remind a patient about outpatient follow-up, and gather information about patient satisfaction with outpatient services.[10,11] Studies of phone calls to patients after emergency room visits have shown beneficial effects.[12] Similarly, contacting patients via phone call after a hospital discharge for an acute myocardial infarction has shown to have superior smoking cessation rates.[13] In the majority of these studies the ancillary support staff made such phone calls. The impact of physicians making these calls has not been studied.

In our experience, contacting patients within a few days of discharge was an effective way of reviewing discharge information, checking patients' understanding of changes regarding medications/doses/insulin regimens, effect on blood glucose, early detection of hypoglycemic/hyperglycemic episodes and reinforcement of follow-up at outpatient clinics. We saw a trend towards reduced hospital readmissions, which could not reach statistical significance due to a small sample size. However, increased outpatient follow-ups were seen in our study, which holds an important clinical significance in patient care.

Mixed results were seen in a systematic meta-review analysis on interventions at the time of a hospital discharge, with most of the studies, reaching no firm conclusion., As in our study, only limited studies were able to show statistically significant effects.[9] Another systematic review of 3 studies showed an improved outpatient follow-up post phone call, but failed to demonstrate statistically significant effect on the hospital admission rate.[3] Dudas et al. showed a significant positive impact of the post-discharge phone calls on reduction of hospital readmissions within 30 days of discharge as opposed to 6 months in our study.[14]

This was a pilot study. The ToC model is still active in our institute and we plan to present more data in the future. Also, there is a lack of consensus on the most effective data script for the phone call. We used a template that we deemed as most comprehensive and efficient. Identifying a protocol for the most meaningful call can potentially increase the yield from this simple intervention and lead to more positive results. Non-compliance (not taking insulin, missing doses) and infection seems to be the major contributor to readmissions in our study. Strategies to focus on more intensive education on medication reconciliation, correct method of insulin administration, adequate supplies, and identification of early signs of infection, have been targeted as potential areas of improvement in the ToC program. Self-management education has been associated with improved readmissions in patients with congestive heart failure (CHF)[15], so more advanced individualized self-education may also be useful in the case of diabetes.

The successful programs have shown to utilize a multifactorial approach like the use of a nurse discharge advocate, pre-scheduled outpatient appointments at the time of discharge, a pharmacist based medication reconciliation, focused patient education, and communication with the primary care provider.[16] This can further guide us to improve our ToC model.

In our study fellows-in training made the phone calls. The discharge process during inpatient hospital stay involves interaction between several providers: physicians, nurses, pharmacists, case managers, discharge coordinators, physician assistants, nurse educators and other support staff. Identifying the person who can most efficiently make the post-discharge phone call can have important implications in terms of cost and maintenance of smooth workflow.

CONCLUSION

An active phone call after a hospital discharge can act as an important support system for the patients. However, in literature, there is a paucity of high quality evidence to explore the beneficial effect of this intervention on hospital readmission. Similar to our study, increased contact with outpatient providers has been demonstrated, which has important implications and is a potential area for further studies. This positive outcome should also be thought of as an opportunity to improve these outpatient encounters to include interventions, which would have the most meaningful outcomes, in terms of, preventing readmissions, medication adverse effects, quality of care, and patient satisfaction. Also given the high cost of hospital admissions, preventing even a single readmission using a very low cost tool could lead to significant savings. The ToC model used here was applied to DKA admissions, but can be essentially used to decrease hospital readmissions for any of the chronic medical conditions like CHF, chronic obstructive pulmonary disease (COPD), etc. With the changing legislations and payment structures there is an immediate need to develop effective transitional care programs.

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