Assessing Patient Satisfaction of Providers' Adherence to Inpatient Management with Continuous Subcutaneous Insulin Infusion (CSII) Policy: A Cross-Sectional Study

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Abstract

There are unique challenges in managing patients with Continuous Subcutaneous Insulin Infusion (CSII) in the inpatient setting, but these challenges may be mitigated by institutional protocols and staff education. The purpose of our study was to determine the current level of patient satisfaction with the staff's adherence with anthe insulin pump policy and to identify areas for improvement. We hypothesize that the majority of patients will be satisfied with inpatient CSII management, as our institute's insulin pump policy had been implemented with educational sessions one year prior. We created a 20- question survey to assess patient satisfaction in regards to their inpatient CSII management which is governed by a system-wide insulin pump policy. 50 adult patients with both type 1 and type 2 diabetes managed with insulin pumps admitted to the hospital for medical care were surveyed. Fisher's exact test was used to measure the association between categorical variables and satisfaction. Of those surveyed, 78% were satisfied with CSII management in the hospital. However, only 62% of participants answered favorably to the statement which evaluated Emergency Department (ED) staff communication regarding the current insulin pump policy. Therefore, targeted education to Emergency Department (ED) staff regarding the availability of an insulin pump protocol and nursing measures to limit CSII disconnection time may further improve patient satisfaction.

Introduction

Over 21 million people in the United States have been diagnosed with diabetes while an estimated 8.1 million people remain undiagnosed [1]. In addition, greater than 40% of all health care expenditures attributed to diabetes resulted from higher rates of hospital admission and longer average lengths of stay per admission [2]. The direct and indirect costs associated with diabetes are staggering, thus appropriate inpatient management of hyperglycemia is of utmost importance. Meta-analyses have shown improved glycemic control with CSII over multiple daily injections, specifically in patients with worsening baseline hemoglobin A1C values [3]. CSII therapy has emerged as an important modality in the treatment of patients with diabetes in the outpatient setting owing to improvements in quality of life, patient autonomy, as well as modest improvements in glucose control. However, evidence to support the role of CSII therapy in the inpatient setting is not yet established as advances and complexities of pump therapy may not be fully understood by general inpatient providers.

In 2009, Sampson et al. published the first psychometrically validated Diabetes Treatment Satisfaction Questionnaire for in-patients (DTSQ-IP) in the United Kingdom [4]. To date, no equivalent studies have been done in the United States. Cook, et al. has developed specific metrics (i.e. length of stay, number of hypoglycemic events, number of hyperglycemic events) to measure effectiveness [5] but excluded measures of patient satisfaction. The utility of a validated in-patient assessment tool are several-fold as results may identify factors that result in variable glycemic control and prolong length of stay while monitoring adverse events.

The Joint Commission accredits more than 20,500 healthcare organizations nationwide. Hospitals with earned accreditation status are nationally recognized as leaders in care delivery. Such institutions are critically evaluated and held accountable to providing safe and effective care of the highest quality and value [5]. In order to maintain disease-specific accreditation, non-standardized performance measures such as patient satisfaction are established to allow programs to systematically evaluate clinical processes and/or outcomes of disease specific clinical practice guidelines. Having an insulin pump policy is also a standard, and is a requirement for certification of inpatient diabetes management by the Joint Commission [6]. Furthermore, the challenge of performance feedback and objective assessment continue to exist as there are few quantitative performance evaluation tools to measure such outcomes. In the hospital, no single laboratory test can accurately represent the overall quality of glycemic control. Standardized glucose performance metrics (or "glucometrics") in the hospital setting include multiple glucose results obtained during a variety of clinical situations including fasting and nutritional conditions [7]. Although "Glucometrics" has emerged as a marker of successful inpatient management, The National Committee of Quality Assurance for Diabetes Quality Improvement Project (DQIP) has proposed that patient satisfaction can also be an indicator to assess the quality of diabetes care in the United States [8].

As a result, a CSII policy was implemented at our institution and throughout our health system in March 2013. At that time, a mandatory

education module and/or lectures was conducted with nurses, mid-level providers, residents and attending physicians. During the six months after the policy was implemented, there were fewer recurrences of hypoglycemia as compared to the six months prior to the policy. That is, of the 30 patients in the pre-intervention group who had at least one hypoglycemic event, 56.7% [9] had a recurrent event, wheras of the 23 patients in the post-intervention period who had at least one hypoglycemic event, 52.2% [10] had a recurrent event [11]. The policy ensures that all patients admitted with CSII are assessed by the endocrinology consult team, utilize hospital insulin and glucometer systems, have three sets of infusion kits and complete a patient self-assessment with attestation forms indicating their understanding of the CSII policy. Patients are also responsible for reporting to nurses when they are changing their tubing/reservoir, suspending the pump, and the daily bolus insulin doses, as well as carbohydrates consumed. Nurses are then required to document these values and the status of the patient's insulin pump infusion skin site. A year later, a peri-operative CSII pump policy was also devised in order to make patients aware of the CSII policy prior to surgery and to ensure that they brought extra supplies, set a temporary basal rate, or prepare by transitioning to SQ insulin in the case of long or late-day procedures [10,11].

At North Shore University Hospital in Manhasset (NSUH), NY, patients with Type I (n=34), Type 1.5 (n=1) or Type 2 (n=14) diabetes utilizing outpatient CSII are permitted to stay on CSII during admission if the patient or caregiver can be responsible for management 24 hours per day. The goal of this study was to develop a patient questionnaire that would allow us to determine patient satisfaction in regards to staff's adherence to admission and post-admission protocols while also identifying areas for improvement.

Research Design and Methods

North Shore University Hospital is a 768 bed quaternary hospital with Joint Commission Certification in Diabetes. A year before receiving this certification, an insulin pump policy was created to allow patients to use CSII while admitted to our hospital. Prior to policy implementation, education was provided to nurses, mid-levels and physicians in regard to the policy in the form of on-line modules and lectures conducted by the Inpatient Diabetes Team.

A survey (Figure 1) comprised of 20 questions was given to all patients admitted to NSUH from February 2014 until October 2014 with an insulin pump who remained on their pump or initiated their pump during their inpatient stay. It was developed based on our current insulin pump policy and questions were constructed to assess adherence to current pump policy as well as the patient's satisfaction with their diabetes care as it relates to CSII management. This information would allow us to identify policy knowledge deficiencies by staff while providing opportunities to improve upon our annual educational training initiatives. Results are based on our pilot survey group of n=50.

Patients were admitted to the medical or surgical units for various diagnoses including chest pain, rule out Acute Coronary Syndrome (ACS), foot ulcers and post cardiac catheterization. Length of stay was not obtained for our study purposes, as this was a cross-sectional study. The attending endocrinologist, certified diabetes educator or a medical resident, distributed the surveys. The certified diabetes educator (A.M.H) had access to a list of all patients with insulin pump orders placed in our electronic medical record. Nurses were also encouraged to notify A.M.H. upon admission of a patient with CSII to ensure patient safety. Surveys were stored in the file cabinet of a locked office inside of a locked medical suite. In order to further ensure patient privacy, all surveys were de-identified with a link only available to study coordinators.

Inclusion criteria were adults aged 18 years or older with Type 1, 1.5

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1. The staff in the emergency room made me aware of the hospital insulin pump policy
2. The doctors on the floor understand how to handle my insulin pump
3. My doctor asked me what my bolus and basal insulin rates were
4. I came to the hospital because my pump (or its parts) were broken
5. It was easy to get insulin when I needed to change my pod or reservoir
6. My pump was not disconnected for more than 1 hour
7. My fingersticks were taken when my meals arrived
8. I completed the insulin pump self-assessment and attestation form within the first 2 days of my hospitalization
9. The nurses asked how much insulin I gave myself before meals
10. The nursing staff checked my blood sugar at least 4 times a day
11. The doctor looked at my infusion site daily
12. My pump was disconnected when I went for an Xray, MRI, CT scan
13. My blood sugars are controlled better in the hospital as compared to using insulin injections
14. I prefer to not use my insulin pump when in the hospital
15. I am generally satisfied with my diabetes management in the hospital
16. The endocrinologist was comfortable in managing my pump settings
17. I met with the diabetes educator at least once during my stay
18. If my glucose was < 70 or > 200, I let doctors or nursing staff know
19. I experienced NO adverse events related to my insulin pump
20. The nurses looked at my infusion site daily

Figure 1: Patient Satisfaction Questionnaire.

or 2 Diabetes. Exclusion criteria were patients under 18 or those who could not use their pump during the entire length of their admission due to missing CSII supplies, impaired cognition or suicidal ideation. In addition, patients were allowed to refuse to participate (n=0).

Patients were asked to rate their satisfaction of the hospital staff's management of the CSII pump based on a five-level Likert scale. Included in this survey were specific questions to ensure adherence to pump policy including infusion site assessment by both the physician and nurse providers, timing of point of care fingersticks at the time of meal arrival, frequency of blood glucose checks and appropriate recording of results based on a four times a day schedule. The order of questions posed was not randomized.

The questionnaire was distributed to 50 patients admitted to our facility. Given the descriptive nature of the study, the sample size of 50 was based on feasibility and availability of resources given the study time frame. The 20-item survey measured patient's perception of care by emergency department (ED) staff, nursing staff, physicians, diabetes educators as well as the convenience of CSII use in the hospital. The following demographic and clinical demographic parameters were obtained from patients: age, sex, diabetes type, race, HbA1c, number of hospital admissions in the past year, insulin prescriber, pump type, home insulin regimen, and associated complications from diabetes (retinopathy; neuropathy; foot ulcers; nephropathy; CAD or stroke; peripheral vascular disease) (Table 1). No participants refused to partake in the survey and 4 patients were discharged prior to completing the survey.

Statistical analysis

Frequencies and percents were tabulated for all demographic, clinical and questionnaire items. Fisher's exact test was used to measure the association between categorical or ordinal variables and patient satisfaction. Cronbach's coefficient alpha was used to determine inter-item reliability. An alpha level of less than 0.05 was used to declare significance. SAS for Windows version 3.2 (SAS Institute Inc., Cary, NC) was used to carry out the analysis.

Results

Of the 50 patients surveyed, 25 were male and 25 were female. The majority (57%) of our patients were 51-60 years old, Caucasian (59.2% Caucasian, 20% Black, 14.3% Hispanic Non-Black, 4.1% American Indian and 2% "Other"). The range of HbA1c levels was between less than 6% to greater than 12%. While 81% of patients reported HbA1c levels of between 6 and 9%. Over half (65.3%) of patients had 0 or 1 hospital admission in the past year and the remaining patients had between 2 to 7 admissions during that time. Forty-six percent of patients had been using their insulin infusion pumps for 1-5 years. Most patients used ultra-rapid acting insulin, only 6 patients (12.8%) reported using Insulin U500. Of the patients who reported experiencing complications of diabetes, neuropathy was cited as the most common (50%) complication followed by 35.4% of patients who had associated retinopathy.

As a whole, the 20-item questionnaire demonstrated acceptable internal consistency with a Cronbach's alpha of 0.73 [12,13]. Out of 50 patients surveyed, 78% responded "Agree" or "Strongly Agree" to the statement, "I am generally satisfied with my diabetes management in the hospital," 6% of patients disagreed, and the remaining 16% remained neutral in their responses. No patient "Strongly Disagreed" with the statement. When asked to respond to the statement, "I experienced

no adverse events related to my insulin pump," 90% agreed/strongly agreed, 8% disagreed/strongly disagreed, and 2% remained neutral.

Statements that were endorsed with "Strongly disagree" and/or "disagree" at a rate greater than twenty five percent were identified as potential areas for improvement. One area that was identified was in

Patient Characteristics	n (%)
Type of Diabetes (total respondents n = 49)	
Type 1	34 (69.4)
Type 1.5	1 (2.04)
Type 2	14 (28.6)
Age in years (total respondents n = 49)	
18-30	6 (12.2)
31-40	9 (18.4)
41-50	6 (12.2)
51-60	15 (30.6)
Over 61	13 (26.5)
Sex (total respondents n = 50)	
Male	25 (50.0)
Female	25 (50.0)
A1c Range (total respondents n = 42)	
Less than 6%	5 (11.9)
6-7%	10 (23.8)
7-8%	12 (28.6)
8-9%	12 (28.6)
10-12%	2 (4.76)
> 12%	1 (2.38)
Duration of Pump Use (total respondents n=50)	
< 6 months	1 (2.00)
6 months-1 year	5 (10.0)
1-5 years	23 (46.0)
6-10 years	13 (26.0)
11-15 years	5 (10.0)
> 16 years	3 (6.00)
Number of Hospital Admission in the Past Year (total respondents n = 49)	
0-1	32 (65.3)
2-4	16 (32.7)
5-7	1 (2.04)
Diabetic Retinopathy (total respondents n = 48)	
Yes	17 (35.4)
No	31 (64.6)
Diabetic Neuropathy (total respondents n = 48)	
Yes	24 (50.0)
No	24 (50.0)
Diabetic Foot Ulcers (total respondents n = 49)	
Yes	10 (20.4)
No	39 (79.6)
Diabetic Nephropathy (total respondents n = 47)	
Yes	15 (31.9)
No	32 (68.1)
Patients with CAD[1] or Stroke (total respondents n = 48)	
Yes	10 (20.8)
No	38 (79.2)
Patients with PVD[2] (total respondents n = 48)	
Yes	10 (20.8)
No	38 (79.2)
1. CAD = Coronary Artery Disease 2. PVD = Peripheral Vascular Disease	

Table 1: Patient Dempographics.

the Emergency Department (ED) where 29% of patients responded "Disagree/Strongly Disagree" to the statement "The staff in the ED made me aware of the hospital insulin pump policy" (Table 2). The second area for targeted intervention pertained to CSII disconnection time. Twenty-nine percent of patients responded "Disagree/Strongly Disagree" to the statement "My pump was not disconnected for more than 1 hour" (Table 3).

In exploring the association between patient satisfaction and various clinical characteristics, the results revealed that there is a significant association between HbA1c level and patient satisfaction (p = 0.01), however, due to the small sample size, these results should be viewed with caution.

Conclusions

Overall, the care provided by the hospital staff and use of CSII during hospital admission was rated as favorable, more often than not, on every measure of patient satisfaction. Moreover, the goal of minimizing adverse events was met given that ninety percent of the respondents reported having none. Increasing the patients' awareness of the hospital's insulin pump policy and reconnecting the patients' pump sooner while in the hospital were areas identified for improvement. All patients who participated in this survey were maintained on CSII therapy and in accordance with our current insulin pump policy, if patients preferred to not utilize CSII in the hospital, a basal/bolus insulin regimen would have been utilized (Table 4).

The areas in which patients were satisfied were: being asked about their basal and bolus rates, the ease of getting insulin for a reservoir change, getting the self-assesment and patient attestation forms, and the endocrinologist's ability to manage their pump. Areas identified as needing improvement is the emergency room awareness of the protocol and improving the transition for patients when they are going for procedures requiring pump disconnection.

The primary purpose of our study was to determine the current level of patient satisfaction with regard to the patient experience and he CSII pump utilization at our institution and to identify areas for improvement. It has also allowed us, as an inpatient diabetes team, to target our educational initiatives towards theses identified areas. We have since met with the emergency room staff and agreed that they should call an endocrine consult for patients admitted with insulin pumps that require any radiological study, surgery, diabetic keto-

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	8/16.7	6/12.5	4/8.33	17/35.4	13/27.1
2	4/8.33	7/14.6	11/23.0	17/35.4	9/19.0
3	6/13.0	2/4.26	2/4.26	14/30.0	23/49.0
4	42/88.0	2/4.20	2/4.20		2/4.20
5	4/9.52	3/7.14	8/19.1	8/19.1	19/45.2
6	11/23.0	3/6.30		12/25.0	22/46.0
7	2/4.35	4/8.70	2/4.35	16/34.8	22/47.8
8	1/2.22	1/2.22		12/26.7	31/69.0
9	3/6.40		1/2.13	20/42.6	23/49.0
10			4/8.33	15/31.3	29/60.0
11	8/16.0	4/8.00	9/18.0	17/34.0	12/24.0
12	6/16.2	2/5.41	10/27.0	8/21.6	11/30.0
13	3/6.70	3/6.70	12/27.0	11/24.0	15/36.0
14	32/64.0	1/2.00	5/10.0	2/4.00	10/20.0
15		3/6.00	8/16.0	18/36.0	21/42.0
16	1/2.00		3/6.12	10/24.0	35/71.0
17			1/2.00	12/24.5	36/73.5
18			4/8.33	13/27.1	31/65.0
19	1/2.00	3/6.00	1/2.00	12/24.0	33/66.0
20	4/8.20	6/12.2	3/6.12	11/22.5	25/51.0

Table 4: Summary table for survey question responses (Frequency/Percent).

acidosis or have an inability to manage their pump. In addition, we have met with the radiology department to ensure their familiarity with the policy. Although the relationship between patient satisfaction, health care utilization and outcomes remains poorly defined, patient satisfaction data may be used to evaluate physicians and determine incentive-based compensation. [14-18].

All patients were encouraged to answer freely and we recognized that favorable responses to the majority of questionnaire items could be attributed to selection bias of the participants as we conducted an observational cross-sectional study and many of the patients were managed by one member of the inpatient diabetes team. Future studies may benefit from anonymous submission of questionnaire answers. Perhaps if patients could take the survey multiple times during their admission or during repeat admissions, the results would have been different. Another limitation is that our current survey is written in English only. Therefore, only those patients who read and write English fluently were eligible for participation. Finally, a larger sample size would have contributed to the variability and increased precision of the findings. The number of patients using CSII is generally small as compared to those who use subcutaneous insulin. From January 2015 to mid-June 2015, there have been 71 admissions in which a patient had an insulin pump ordered in our electronic medical record.

For further studies, it will be interesting to look at patient satisfaction over a longer period of time and across different health institutions. Revisions to our questionnaire will be based on this pilot survey and will be used for our next project, as we plan to distribute the revised version to our sister institution which is also Joint Commission Certified in Inpatient Diabetes: Long Island Jewish Hospital. These efforts will allow us to assess for inter-hospital variability and determine the validity of this tool in assessing inpatient insulin pump care.

Conflicts of Interest

There were no outside funding sources. No potential conflicts of interest were reported for this article. Parts of this study were presented in abstract form at the 97th Session of the Endocrine Society Meeting 2015, San Diego, California on March 6th, 2015.

Question 1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strongly Disagree	8	16.67	8	16.7
Disagree	6	12.50	14	29.2
Neutral	4	8.30	18	37.5
Agree	17	35.42	35	72.9
Strongly Agree	33	27.08	48	100
Frequency Missing = 2				

Table 2: The staff in the ED made me aware of the hospital insulin pump policy.

Question 6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Strongly Disagree	11	22.92	11	22.9
Disagree	3	6.25	14	29.2
Agree	12	25.00	26	54.2
Strongly Agree	22	45.83	48	100
Frequency Missing = 2				

Table 3: My pump was disconnected for more than 1 hour.

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