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Effectiveness of Flow Sheet Implementation on Diabetes Progression Screening at a Student-Run Free Clinic

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ABSTRACT

Introduction. Diabetes mellitus (DM) disproportionately affects people with low socioeconomic status (SES). Student-run free clinics (SRFC) aim to care for low SES populations and experience high clinician turnover. Flow sheets have been used to improve care for those with diabetes, yet no research has assessed the use of such a flow sheet in a SRFC. The aim of this project was to determine if use of a flow sheet improved care for people with DM in an SRFC.

Methods. Charts from all patients receiving care for DM at one SRFC in the year before (n = 53) and after (n = 56) implementation of the flow sheet were reviewed. Pre- and post-group comparisons and post subgroup comparisons were made for glycosylated-hemoglobin (HgbA1c), microalbumin, and foot and eye exams.

Results. During a one-year period, a larger proportion of patients who received care post flow sheet introduction received at least two HgbA1c tests (53%), a microalbumin test (46%), and a foot-exam (46%) compared to those receiving care before the flow sheet (28%, 2%, and 25%, respectively). There was no difference in proportions of patients undergoing eye exams. In post subgroup analysis, flow sheets were used for 50% of patients, and patients who received care with the flow sheet were more likely to receive at least two HgbA1c tests and a foot exam per year.

Conclusion. Flow sheets may improve the process of care for patients with diabetes in a SRFC, but the effect must be studied further. Regardless, a systematic integration of the flow sheet is being implemented in the SRFC evaluated in this study. ***Kans J Med 2020;13:285-289***

INTRODUCTION

Type-2 diabetes mellitus (T2DM) is a growing epidemic in the U.S., with an estimated 28.9 million people diagnosed in 2014.[1] The sequelae of this disease can cause serious and deadly complications; T2DM is the seventh-leading cause of death in the U.S., with a mortality rate of 60.3 deaths per 100,000.[2] A low socioeconomic status (SES) is associated with an increased incidence of T2DM.[3,4]

Having a low SES and being uninsured are associated with poor provider adherence to American Diabetes Association (ADA) guidelines.[5] The ADA guidelines address the importance of preventing progression of T2DM by recommending routine testing for markers of disease progression.[6] These measures of progression include annual testing of microalbumin, low-density lipoprotein (LDL), and foot and eye exams, as well as at least semi-annual testing of glycosylated-hemoglobin (HgbA1c). Thus, not only are those with low SES more likely to have T2DM, they are less likely to receive T2DM progression screening. One mechanism to improve these health disparities is student-run free clinics (SRFC).[7,8]

SRFCs are teaching clinics associated with medical schools that often aim to serve people with low SES or who lack health insurance. SRFCs can provide excellent diabetic care, frequently surpassing national benchmarks for insured patients.[9-12] However, an initial assessment of adherence to ADA guidelines at the SRFC in this study revealed diabetic care below national benchmarks (data provided as "pre" group in this study).

To improve the quality of care, a flow sheet for comprehensive diabetic care was initiated. Flow sheets can be an effective method to improve adherence to ADA guidelines.[13-16] However, studies have not shown SRFCs performing below national benchmarks for diabetic care or if the implementation of a flow sheet can improve SRFC adherence to ADA guidelines. Therefore, the aim of this study was to determine whether the use of a flow sheet improved adherence to ADA guidelines in an SRFC.

METHODS

Participants. This was a pre/post quasi-experimental study comparing diabetes progression screening (according to ADA guidelines) before and after the introduction of a diabetic care flow sheet (see Appendix) at one SRFC. To receive care at this SRFC, patients must be at least 18 years old and uninsured. Participants were all patients with a diagnosis of diabetes mellitus who received care in the year before (March 1, 2017 - February 28, 2018; hereafter referred to as "pre") or after (March 1, 2018 - February 28, 2019; hereafter referred to as "post") the introduction of a diabetic care flow sheet.

Procedures. A data specialist employed by the SRFC filtered all patients seen by the SRFC to those meeting the inclusion criteria and provided this list of patients with identifying information to a group of medical students to abstract data. Data were abstracted manually from patients' charts, both paper charts and electronic health records (EHR). The form included the annual frequency of HgbA1c, microalbumin testing, and retinal and foot exams. These disease-progression testing measures were considered completed if there were lab results, notes from an outside facility, or the note from the provider at the SRFC reported physical exam results or, in the case of retinal exams, the patient reported an eye exam within the last year. After the first year, the form was expanded to include questions concerning race, ethnicity, lipid testing, and presence and use of the flow sheet.

Analysis. Data were de-identified and exported to Excel®. The data analysis for this study was generated using SAS (Version 9.4) software (SAS Int. Inc., Carry, NC). Age was expressed as means ± standard deviation and comparisons were made with Student's t-test. Gender and race/ethnicity were expressed as percentage (n). Comparisons of gender were made with Pearson's chi-square test.

Comparison of ethnicity was completed as group composition using Likelihood-ratio chi-square test. Between the pre- and post-groups and the post subgroups with (postw) or without (postwo) a flow sheet in the chart, comparisons for HgbA1c, microalbumin, LDL, and foot and eye exams were made by Pearson's chi-square test or Fisher's Exact test (if expected result was < 5). Statistical significance was determined at the $p \leq 0.05$ level.

RESULTS

A total of 109 patients' charts were reviewed (53 pre, 56 post; postw: 28, postwo: 28; Table 1). The average age of patients across all groups was 53 ± 11.0 years. There was no difference in age between pre and post ($p = 0.097$) or postw and postwo. The percentage of female participants was not different between pre and post or postw and postwo. There were no statistically significant differences amongst race/ethnicity between postw and postwo ($p = 0.055$).

Comparisons Between Pre and Post. Compared to the pre-group, the post-group had a significantly higher proportion of patients receive at least two HgbA1c tests (28.30%, n = 15 versus 52.73%, n = 29, respectively; $p = 0.010$), one microalbumin test (1.89%, n = 1 versus 46.43%, n = 26; $p < 0.001$), and one foot-exam (24.53%, n = 13 versus 46.43%, n = 26; $p = 0.018$) during the year reviewed (Figure 1). There was no difference in the percent of patients with documented eye exams from pre (5.36%, n = 3) to post (9.43%, n = 5).

Table 1. Demographic comparison of pre, post, postw, and postwo groups.*

Variable	Pre	Post	Postw	Postwo
Frequency	53	56	28	28
Age (years ± SD)	55.5 ± 10.0	52.0 ± 11.6	50.1 ± 10.8	53.9 ± 12.3
Gender (as % (n) female)	49.1 (26)	50.0 (28)	53.6 (15)	46.4 (13)
Race/Ethnicity (as % (n))	13.6 (2.6)	13.7 (2.5)	-0.08	0.935
White	---	48.2 (27)	57.1 (16)	39.3 (11)
Hispanic	---	46.4 (26)	32.1 (9)	60.1 (17)
Black	---	3.6 (2)	7.1 (2)	0 (0)
Asian/Pacific Islander	---	1.8 (1)	3.6 (1)	0 (0)

*No significant differences between any groups for age or gender as determined by Chi-Square Test. There were no significant differences between postw and postwo for group race/ethnicity as determined by Likelihood-Ratio Chi-Square test.

Comparisons Between Postw and Postwo. After its implementation, the flow sheet was found in 50% of patients' charts. Compared to the postwo group, the postw group had a higher proportion of patients receive at least two HgbA1c tests (21.43% versus 75.00%, respectively; $p < 0.001$) and one foot-exam (25.00% versus 67.86%; $p = 0.001$) during the year reviewed (Figure 2). There was no difference between postw and postwo in proportions of patients with documented microalbumin tests or eye exams.

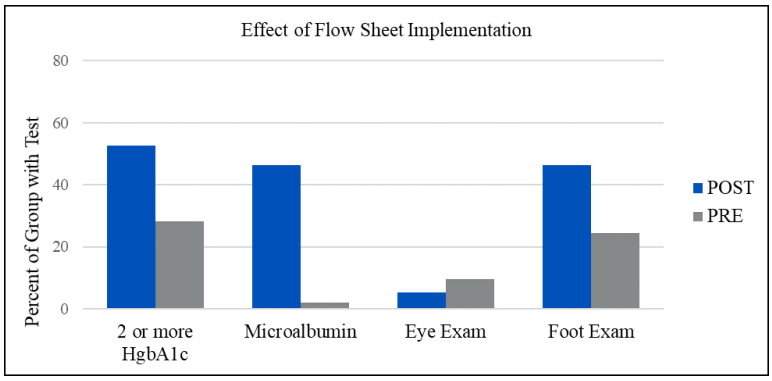

Figure 1. Effect of flow sheet implementation on T2DM progression screening. * Significant difference ($p < 0.05$) between pre and post, as determined by chi-square test for A1c and Foot Exam and Fisher's exact test for MicroAlb and Eye Exam.

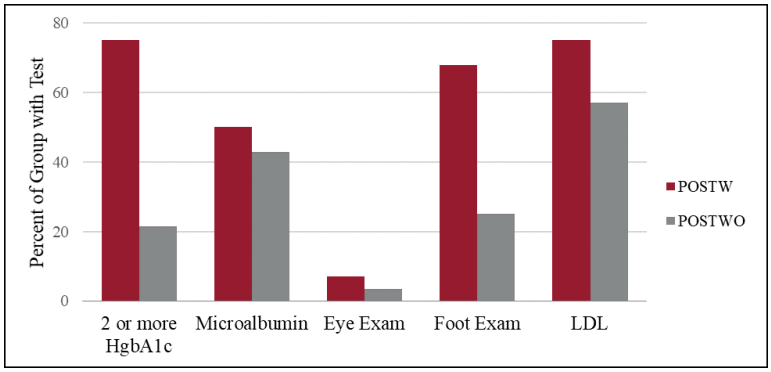

Figure 2. Effect of flow sheet utilization on T2DM progression screening. *Significant difference ($p < 0.05$) between postw and postwo as determined by chi-square test for HbA1c, LDL, Microalbumin and Foot Exam, and Fisher's exact test for Eye Exam.

DISCUSSION

This study suggested that the introduction of a flow sheet may be associated with increased SRFC compliance with guidelines for T2DM disease-progression screening. In the year after implementation of the flow sheet, the proportion of patients meeting ADA guidelines for HgbA1c, microalbumin, and foot exams improved. The proportion meeting ADA guidelines for eye exams did not increase. These changes may not be due entirely to the flow sheet, as subgroup comparisons suggest that although HgbA1c and foot-exam testing improved, microalbumin testing compliance did not improve when the flow sheet was included in the patient's chart.

HgbA1c. Frequency of HgbA1c testing increased after the introduction of the flow sheet. This result is consistent with some,[15,16] but not all,[17] previous studies. In the study by Schmidt et al.,[17] the percent of patients having HgbA1c checks at baseline was 83%, leaving little room for improvement. Additionally, Schmidt et al.[17] required only one HgbA1c per year. A study by Ludwig and colleagues involving point-of-care reminders (as part of a multi-component quality improvement initiative) similarly showed no improvement in the percent of patients with at least one HgbA1c test per year.[18] However, there was an increase in frequency of HgbA1c tests for patients who received at least one test. A similar outcome was found in the current study, as there was no difference between pre- and post-groups for proportion

of patients receiving at least one HgbA1c test per year (88.7% (47), 87.5% (49), respectively). ADA guidelines require at least two HgbA1c checks per year for every person with diabetes,[6] and the current study's increase in frequency of testing, but not percent of patients tested, could show a move toward ADA adherence with a flowsheet.

Foot Exam. The improvement in foot exams in this study was consistent with previous studies.[14,15,17] The Hempel study reported expected reasons for this improvement to be more complete documentation and new clinic protocols.[14] One major difference between those studies and the current study was that the current study reviewed practices at an SRFC, whereas the others were for practicing physicians. Although there is physician oversight at this SRFC, it stands to reason that if the flow sheet helps practicing physicians be more thorough and consistent with documentation, it should help students as well. Although anecdotal, this seems to be a feasible association for the increase in exams.

Microalbumin. Although microalbumin testing frequency improved after the introduction of the flow sheet, it did not appear to be due to the use of the flow sheet. There was no difference in the proportions of patients receiving annual microalbumin testing between those who did and did not have a flow sheet in their charts. Confounding variables may need to be considered. The SRFC of the current study was coordinated by continuously changing personnel and a significant portion of its patient population were either transient or homeless. As with all SRFCs, there was necessary change to the student-volunteer pool due to graduating and matriculating classes. However, all students were from the same medical school and experienced similar training. There were no differences in the mean ages or proportions of gender between pre- and post-groups. Ethnicity data were unavailable for the pre-group, but there was no statistically significant difference between postw and postwo groups. Through these subtle variations in personnel, collection methods and knowledge of tests performed could have changed, suggesting some collection bias.

Eye Exam. In the current study, the proportion of patients with documented eye exams was low and did not appear to be affected by the implementation of the flow sheet. Poor adherence (50 - 70%) with ADA guidelines for eye exams is a common issue for the broader population with diabetes.[19-21] People with low SES have an even lower likelihood of being adherent to ADA guidelines for eye exams.[19,22] Some, but not all,[17] studies have shown improved eye exam rates after flow sheet use.[14,15] The eye exam recommended in ADA guidelines requires a dilated retinal exam,[6] which is within the scope of practice for primary care providers. However, provider self-confidence in this exam is low,[23,24] and fewer primary care providers perform the exam.[25] This causes more eye exams to be referred to outside specialists, which is a barrier for the SRFC in this study as only one ophthalmologist or optometrist volunteered appointments at a low/no-fee schedule during this timeframe. These data suggested that the flowsheet implementation may have been affected by availability of eye exams to patients.

Limitations. There were multiple limitations which prevented a more robust evaluation of the quality of care for patients with diabetes and the effect of a flow sheet. First, the clinic is coordinated by a continuously changing pool of volunteer physicians and medical students with a member of the board of directors present to oversee operations. Therefore, most providers were unfamiliar with the clinic, patients, protocols, and the EHR. Each clinic day, the director familiarized the providers with each of the above, but irregularities occurred. Additionally, differences in the way data were collected between pre- and post-groups could be affected by the ever-changing groups of students working in the clinic.

Second, patient charts were split between paper and EHR. To appease and maintain the physician volunteers, use of the EHR was optional. For every encounter, all paper notes (including the flow sheet) were scanned into the EHR. However, due to the complexity of the EHR, the scanned documents were not readily accessible. This allowed for errors not only for providers at the time of service, but in abstraction of the data. To accommodate these difficulties, the groups abstracting data examined both paper charts and EHR using a standard form from each year. Additionally, the data documentation form changed over the study time period, and the change in time itself could present a temporal factor that limits the study's effects.

Third, the two datasets (pre and post) were gathered by two separate groups of medical students on two different forms. The form purposefully was altered in the second year to change the focus of the review of practices. Although different, the data were appropriate to compare, but still presented an area of irregularity.

Fourth, there was a possible clinically significant difference in the proportions of ethnicities between postw and postwo. Regression analysis demonstrated no statistical significance of race/ethnicity on the amount of HbA1c tests, microalbumin tests, foot, or eye exams. However, due to sample size, this validity may be compromised, leading us to believe there may be a clinically relevant difference in our study. A flow sheet was used in 3/5 charts for white patients and only 1/3 charts for Hispanic patients (Table 1). No measure of English literacy or availability of interpreters was present on either data collection form. Studies have shown both Latino heritage[26] and limited English proficiency,[27-29] are associated with lower rates of receiving preventive services. Having a language-concordant physician or professional interpreters can attenuate these effects.[29] However, these resources were unavailable for the vast majority of encounters at this SRFC. This information could have a confounding effect in the results of our study.

Future research should seek to limit these biases further to provide stronger conclusions. English literacy and interpreter availability should be considered in data collection and analysis to evaluate ethnic factors. Larger sample sizes could help to evaluate for more nuanced differences between groups. A randomized controlled trial with patients assigned to groups either with or without flowsheet implementation could improve limitations such as collection and temporal bias.

CONCLUSION

This study suggested that the incorporation of a flow sheet for care of T2DM could be associated with improved usage of disease progression screening tests at an SRFC. However, the improvement in outcomes of patients whose charts did not include the flow sheet suggested that the flow sheet itself was not the sole factor at work. It appeared that incorporating flow sheets for the care of diabetes is one factor that could help improve outcomes. Nonetheless, future studies should elucidate further the differing impacts of the usage of flow sheets in SRFCs.

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Keywords: diabetes mellitus, student run clinic, clinic activities

APPENDIX

PATIENT_____ Year placed on chart_____

Date of Birth_____ Chart #_____

Hemoglobin A1C if not done in last 3 months, perform Point of Care testing and record result here and in EMR.

Value 5.7 - 6.4% indicates prediabetes. Value 6.5% or higher indicates diabetes.

Date						
Results						

Blood pressure to be done each appointment. Goal less than 130/80.

Date												
Results												

Urine microalbumin/creatinine ratio if patient already has a diagnosis of diabetic nephropathy, no test needed.

To be done yearly. Value over 30 - 300 mg/dl may indicate early kidney disease.

Date			
Results			

Lipids to be done yearly. LDL goal is < 100. Is the patient on a statin?_____

Date			
Chol:			
Trig:			
HDL:			
LDL:			

Retinal eye exam to be done yearly. Fill out referral form for optometrist. Dr. _____

Date			

Foot exam to be done yearly. Has the patient been referred to podiatrist? _____

Date		
Neuropathy?		
Pulses?		
Nail fungus?		
Skin condition?		

+**Please provide patient with diabetic education materials as available.**