

**Electronic Health Record Template Improves Quality and Delivery of Healthcare for
Patients with Type 2 Diabetes**

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Abstract

Background: The goal of this project was to determine if a primary care-based quality improvement project could enhance provider documentation reflecting national guidelines of care through the use of a charting template and improve quality of care through identification of appropriate community resources for patients with Type 2 Diabetes Mellitus (T2DM).

Objective: The primary outcome measure was increased documentation of key aspects of T2DM care management using the charting template. The secondary outcome measure was the utilization of community resources to aid in patient care management.

Methods: This project was a 3-month prospective, mixed-method, quality improvement study that provided a charting template to increase charting of care management for patients with Type 2 Diabetes Mellitus.

Results: Participants in the study demonstrated significant improvement in documentation of necessary national standards of care management for patients with Type 2 Diabetes with the use of the charting template during the 3-month implementation period.

Conclusions: Full utilization of the electronic health record to streamline care and increase provider compliance with charting is possible through the creation of charting templates for patients with T2DM.

Implications for Nursing: Gaps in care of patients with T2DM can be filled through provider utilization of templates within EHR formulated based on national standards of care.

Keywords: diabetes, EHR template, quality improvement, electronic documentation, diabetes management.

Electronic Health Record Template Improves Quality and Delivery of Healthcare for Patients with Type 2 Diabetes

The concept to use template driven care within electronic health records to improve patient outcomes was developed in the early 1990s (O'Connor, 2010). To this day, the full potential for electronic health records (EHR) to provide quality improvement has yet to be fully realized, especially with the care of adults with Type 2 Diabetes Mellitus (T2DM) (O'Connor, 2010). The epidemiological impact of this chronic disease serves as a catalyst for optimizing the EHR to improve patient outcomes (CDC, 2019). T2DM is estimated to be responsible for 1.5 million deaths worldwide in the year 2019 (WHO, 2021). Treatment of diabetes includes the adoption of effective measures to screen, prevent, and control diabetes through individualized comprehensive patient care management (WHO, 2021). The quality of healthcare provided to patients with T2DM can be analyzed through two different lenses: the individual receiving care and the clinician providing care (Perez-Cuevas, 2012). The patient's aim when seeking healthcare is to obtain an optimal outcome (Perez-Cuevas, 2012). The goal for the clinician is to provide high-quality, culturally appropriate, and evidence-based treatment to the patient (Perez-Cuevas, 2012).

Electronic health record utilization serves to overcome barriers when considering the insufficient knowledge surrounding implementation of decision support help during clinical encounters (Benhamou, 2011). There is evidence that computerized decision support systems integrated within the electronic health record utilizing a charting template can improve the quality of patient care and facilitate the identification of opportunities for provider intervention (Benhamou, 2011; Perez-Cuevas, 2012; Hosomura et al., 2015; Cahn et al., 2018; Mann et al., 2018).

The American Reinvestment and Recovery Act (ARRA) of 2009 set aside an additional \$22 billion for efforts to encourage healthcare information technology adoption and meaningful use in the United States (Veinot et al., 2010). Meaningful use is described by the Office of the National Coordinator for Health Information Technology as a requirement for incentive payments from the Centers for Medicare and Medicaid Services (Health IT, 2013). Those providing healthcare are expected to collect data in a clear and uniform manner in order to improve the quality and safety of healthcare delivery. (Veinot et al., 2010). The United States government has called upon providers to improve patient-centric preventable care and support the development of robust standardized data changes (Veinot et al., 2010). If a provider uses a charting template within the EHR to guide patient interaction and screen for lack of access to care, the provider will meet care management initiatives and meaningful use requirements (Veinot et al., 2010).

Review of Literature

Diabetes Management in Primary Care

More than 34 million Americans have diabetes, with Type 2 diabetes accounting for 90-95 percent of the total (CDC, 2019). The American Diabetes Association recommends that primary care providers use tools to improve the health across populations and individualize diabetes care for each patient (ADA, 2021). The ADA guidelines include screening components for past medical and family history, lifestyle factors (eating patterns, weight history, and physical activity), medications and vaccinations, technology use (access to apps, glucometer, insulin pump if applicable), and behavioral and self-management skills (ADA, 2021).

The creation of innovative methods for monitoring and reporting patient lifestyle data, such as diet, exercise, and medication adherence, is one guideline for preventive care for patients

with diabetes using the EHR (Veinot et al., 2010). Template usage within the EHR which incorporates medication reconciliation and patient history can serve to accomplish this goal (Veinot et al., 2010). Providers are also advised to incorporate methods of recording information about the patient's health care activities, such as a yearly dilated eye exam and comprehensive foot exam (Veinot et al., 2010). The ability of clinicians to classify and follow up on patients at high risk would be enhanced by conducting a community needs assessment and assessing the patient's ability to access transportation to and from appointments, obtain adequate nutrition to support the diabetic diet, and afford medications prescribed (Veinot et al., 2010).

Comprehensive Diabetic Foot Exam in Primary Care

Complications of T2DM include diabetic peripheral neuropathy and peripheral arterial disease (Murphy Buschkoetter et al., 2019). Both of these disease processes are directly related to diabetic foot ulceration leading to infections and lower limb amputation (Murphy Buschkoetter et al., 2019). Implementing comprehensive foot exams during every patient encounter will help identify patients who have sensation loss and decreased blood flow in their lower extremities and demonstrate improved provider adherence to nationally established guidelines (Murphy Buschkoetter et al., 2019).

Providers using a checklist approach to charting foot exams often have the most complete foot exams (Pocuis et al., 2017). Including a prompt in the electronic health record within a charting template that includes critical components of the diabetic foot assessment will help with meeting national guidelines of care management for patients with T2DM (Pocuis et al., 2017).

Screening for Yearly Dilated Eye Exam in Primary Care

Diabetic retinopathy puts patients with T2DM at risk for vision loss and is the most common cause of blindness for patients with T2DM (Lundeen, 2019). For this reason, proper

assessment of annual dilated eye exams is recommended to diagnose retinopathy and permanent vision loss early and manage it effectively (Lundeen, 2019). In an assessment of the prevalence of eye exams in 2017 by Medicare of their beneficiaries with T2DM, it was discovered that 54.1% had eye exams that year (Lundeen, 2019). Suboptimal care management and referral, a lack of perceived need for care, and poor health awareness are all barriers to accessing care (Lundeen, 2019). Optimizing care systems to incorporate eye care referrals and reminders within the charting templates of the electronic health record can address these barriers (Lundeen, 2019).

Medication Reconciliation and Past Medical History within Patient Encounter

Performing a comprehensive medication review and reconciliation at each patient visit is important due to the progressive nature of T2DM and the fact that treatments to reduce blood glucose levels will almost always need to be titrated over time. (Diggle, 2015). Evidence suggests that clinicians often favor an approach to suboptimal glucose control which fails to increase the intensity of medicines in a reasonable timeframe (Diggle, 2015). Performing a medication reconciliation which includes a thorough review of the patient's medications and assessing the patient's understanding of the medications can decrease the number of medication related problems that may arise (Diggle, 2015). A reminder placed within an electronic health record template will prompt the clinician to perform a medication reconciliation and optimize treatment outcomes with the proper use and education of important diabetic medications (Diggle, 2015). Medication reconciliation can also screen for potential side effects leading to medication non-adherence before negative outcomes occur for the patient (Diggle, 2015).

Eighty percent of all diagnoses may be made during the process of obtaining a thorough history (Clifton, 2017). History taking during the patient encounter allows the healthcare provider to assess the patient's co-morbid conditions, obtain the patient's familial history, and

use culturally appropriate strategies to tailor the care provided (ADA, 2016). Given that a patient's family history is a sensitive marker for T2DM, assessing this part of the patient's history is critical in order to implement appropriate T2DM management strategies for those who have been classified as being at higher risk (Birt et al., 2014). Knowing more of the patient's history can help answer some of the questions that providers may have regarding individualized treatment during clinical encounters (Clifton, 2017). Ensuring EHRs include the patient's history accompanied by the updated history from the patient's record will aid clinicians in the treatment plan and permits the EHR to tell the patient's complete story (Clifton, 2017).

Screening for Community Resource Need in Patients with Diabetes

The “diabetes belt” is a large geographic region that extends along the Appalachian Mountain Range and has high rates of patients with T2DM (Johnson & Denham, 2015, p. 3). It is home to many patients living in rural areas (Johnson & Denham, 2015). Those living within these areas often have limited access to physicians, specialized diabetes support, and community resources which may help to ease the burden of living with T2DM (Johnson & Denham, 2015). Primary care providers practicing in these rural locations are tasked with addressing the T2DM patient's lack of ability to obtain resources necessary to treat and manage T2DM (Johnson & Denham, 2015). Proper nutrition, medication acquisition, and transportation to and from appointments are the minimum requirements to successful outcomes for these patients (Johnson & Denham, 2015). Optimizing patient care delivery to include screening patients for community need deficits will enable the primary care provider to identify these important concerns for patients who may benefit (Johnson & Denham, 2015).

Enabling the Provider to Adhere to National Standards of Diabetes Care Management

The proportion of United States adults with T2DM receiving recommended care based on national guidelines has increased from 25% in 2005-2006 to 34.1% in 2016-2018 (Shin et al., 2021). Efforts to increase usage of national guidelines to provide recommended care and improve healthcare delivery for these patients is still needed (Shin et al., 2021). These efforts will require a system level approach to ensure patients with T2DM receive recommended care based on national guidelines (ADA, 2021).

Guideline non-adherence in the management of chronic disease, specifically T2DM, is due in large part to the provider not providing or initiating the treatment (Fürthauer et al., 2013). This could be a result of the provider's lack of awareness of the particular guideline or choice not to include the guideline in the patient's treatment plan (Fürthauer et al., 2013). Organizational culture can affect adherence to the diabetic guidelines, specifically patterns of behaviors that a given group have utilized to cope with internal integration (Radwan et al., 2017) Healthcare providers may conform to the culture of the organization but must also strive to change the culture and establish an environment conducive to adherence of guidelines (Radwan et al., 2017).

The creation of a template within the electronic health record allows for the successful insertion of prompts for providers regarding the patient's yearly eye exam, foot exam, past medical history, medication reconciliation and assessment of community needs that could improve patient compliance of treatment plan goals. Utilization of a template within the EHR can improve provider counseling for behavior change and effectively screen each patient for opportunities where community resources can benefit their outcomes (ADA, 2021). A charting template is a perfect example of a system level approach that meets the needs of primary care providers attempting to provide sustainable and impactful changes in care management for their patients with T2DM (Mann et al., 2018).

Method

This project was a 3-month prospective, mixed-method, quality improvement study that implemented a charting template within an EHR to document patient encounters for patients with newly diagnosed T2DM and those seeking follow-up care for T2DM.

Participants

Three primary care nurse practitioners providing care for patients with T2DM participated in this QI initiative. Eligibility and inclusion criteria for this study required that the provider utilize a charting system for documentation capable of template creation within the EHR and manage care for patients with T2DM.

Measures

Documentation of Foot Examination and Yearly Dilate Eye Examination

Data regarding foot examinations and yearly dilated eye examinations was collected during prospective chart reviews when the provider successfully documented a foot examination in the physical assessment portion of the patient encounter or when the provider successfully documented the patient's eye exam status within history of present illness portion of the patient's chart.

Assessing Past Medical History and Performing Medication Reconciliation

The patient's past medical history and medication reconciliation was assessed during the period of implementation and was achieved if the provider documented these aspects within the patient encounter. Again, data was collected to see if these components were documented simply because the provider used the charting template.

Retrospective Chart Review

All data components (foot examination, yearly dilated eye examination, past medical history, medication reconciliation, and community needs assessment) were also collected from retrospective chart reviews during the three-month period prior to implementation. This data was obtained in order to compare prospective data to determine the provider's baseline charting before the template was used and to determine the efficacy of the template. A retrospective chart review was conducted on 248 documented patient encounters for providers who fit the sample criteria to compare documentation of national guidelines of care management for patients with T2DM during the period of implementation for this study.

Community Needs Assessment

According to the American Diabetes Association, a key component of diabetes care management is using community services and public policies that promote healthier lifestyles (ADA, 2021). The number of times that each provider utilized a community needs assessment within the patient encounter was recorded in the same manner as the previously measured standards. The secondary outcome for this study was the inclusion of a community needs assessment for each T2DM patient encounter with the use of the charting template.

Procedures

The intervention within this study was a charting template created within the EHR that required proper patient assessment and clinical documentation by nurse practitioners. The template gave providers clinical decision support and prompted them to address important aspects of diabetes management at each and every visit. The template was formulated using the components of the American Diabetes Association (ADA) Comprehensive Diabetes Medical Evaluation at Initial, Follow-up, and Annual Visits guidelines (ADA, 2019). Templates were entered into the EHR under easily discoverable names: "Initial_T2DM" and "Follow-

up_T2DM.” Community resources for Burke County, NC were listed visibly in the patient rooms so they could be referenced quickly following the community needs assessments during patient encounters.

A chart review was conducted on 278 patient encounters during the period of implementation that were found to fit the inclusion criteria (T2DM). The frequency of how many times the provider assessed each measure was collected using a pre-formulated data collection table on a piece of paper. In order to count each item as being completed within the encounter, the provider had to include the item within the note. If the provider included the standard of care management, the data collector simply placed a yes in the column for that encounter during data collection. If the provider did not include them, the data collector placed a no in the column for that encounter. The principal investigator and data collector were the same person in this study.

The study was approved by the Institutional Review Board at Lenoir Rhyne University, Hickory, North Carolina. Informed consent was not necessary, and all participants were willing to be included.

Data Analysis

Documentation of Foot Examination and Yearly Dilated Eye Exam

The Chi Square Test of Independence was conducted to analyze the relationship between documented foot examination numbers in the period before implementation and the period during implementation as well as the relationship between documented yearly dilated eye examination numbers in the period before implementation and the period during implementation. The goal was to determine if the template improved the provider’s documentation compliance when it comes to completing and documenting foot exams and yearly eye exams for patients with T2DM.

Assessing Past Medical History and Performing Medication Reconciliation

Past medical history and medication reconciliation were variables collected that were completed almost 100% of the time before and during implementation. For this reason, descriptive statistical analysis was performed analyze the data because Chi Square analysis was not appropriate for this data.

Community Needs Assessment

Data analysis for this variable was performed through descriptive analysis. There were zero community needs assessments performed in the period before implementation because this was a new component introduced to the documentation when the provider utilized the charting template.

Provider Perception of Charting Template

Qualitative data analysis was completed via an anonymous survey emailed to the participants following the period of implementation. The survey included open ended questions pertaining to the use of the charting template and allowed for the collection of provider opinion surrounding the template usage. The questions were as follows:

1. Please share your experience using the EHR template designed using ADA guidelines to chart patient encounters during the initial diagnostic phase for patients with type 2 diabetes mellitus.
2. Please share your experience using the EHR template designed using ADA guidelines to chart patient encounters during the follow-up phase for patients with type 2 diabetes mellitus.

3. Share your experience using the provision of resources to remedy deficits for patients obtaining medications, nutrition, or transportation for patients with type 2 diabetes mellitus.

Results

The Chi Square Test of Independence was performed to determine template usage effect before and after implementation on provider documentation of foot exam and assessment of yearly dilated eye exam. Results of the data analysis showed an increase in the amount of eye exams and foot exams with the use of the charting template in the period of implementation. The results of the Chi-square test for the eye exam were significant based on a p value of $< .001$. Out of the 248 encounters during pre-implementation (no template usage), the assessment of a yearly dilated eye exam was documented 4 times (1.6%). During the implementation phase (278 encounters), assessment of a yearly dilated eye exam was documented 104 times (37.4%). See Table 1 for presentation of data.

The results of the Chi-square test for the foot exams were significant based on a p value of $< .001$. Out of the 248 encounters during pre-implementation (no template usage), a foot exam was documented 55 times (22.2 %). During the implementation phase (278 encounters), a foot exam was documented 143 times (57.6%). See Table 2 for presentation of data.

During the implementation phase, providers used the charting template approximately 40% of the time. See Table 3 for presentation of data.

It is important to note that for the variables past medical history, and medication reconciliation, there is a 100% usage rate during the pre-implementation period and implementation period. See Table 4 and Table 5 for presentation of data.

The 100% usage rate can be attributed to the fact that the electronic health record system used by this particular primary care office pulls the medical history and medications from the patient's most previous encounter prior to the current encounter. This is beneficial because the provider can review the past medical history and medications and edit them as they see fit within the current encounter. This does minimize the impact of the charting template for these variables because the charting system already ensures the providers address this at each and every visit.

Within the period of implementation where the template was used, the providers assessed for community needs 95 times (34% of the time). The secondary outcome was achieved because the charting template effectively enabled providers to assess patients for deficits of care management. See Table 6 for presentation of data.

Content analysis was performed on qualitative data to discover themes during the post-implementation phase of the project, to provide a more robust analysis of the template usage and impact, and to understand provider perception of template usage throughout the study. Out of the three providers practicing at this particular office, two providers completed the anonymous post-implementation surveys. It is important to note that due to the relatively small sample size, qualitative data and analysis is limited. The data includes experiences of the providers using the charting template and the answers to an open-ended survey. The providers noted their opinions with use of the charting template for initial visits, follow-up visits, and usage of the community needs assessment.

Qualitative data analysis was performed by coding the data from open-ended surveys given post implementation (See Appendix A). The coding scheme includes three categories: Helpful/Benefit, Consistency, and Improving Compliance. These categories help to define the following themes surrounding provider perception of template usage:

Helpful

The results reveal that the providers felt that the template was helpful in documenting important aspects of patient care management.

“The template was helpful in ensuring that essential elements of the chart were completed and consistent.”

Consistency

Those completing the survey felt that the template provided an opportunity to chart consistently for each patient encounter.

“It was helpful in providing consistent documentation that complies with guidelines.”

Improving Compliance

The entire purpose of the intervention was to improve provider compliance with charting key aspects of diabetes care according to evidence based guidelines. According to the survey results, this was accomplished.

“The fact that the charting template integrates national guidelines of care is beneficial to reminding and prompting to chart important aspects of Type 2 Diabetes care.”

Throughout the coding of the data set, a single person coded the data which promotes consistency across survey analysis (Polit & Beck, 2017). Within this content analysis, an overall theme emerged: The providers found the template to be helpful and beneficial to patients and ensuring essential aspects of the chart were completed, the template allowed for consistency, and the charting template has the capability to improve charting compliance for T2DM patient encounters.

Discussion

With the use of the charting template designed using ADA guidelines, charting compliance for important aspects of diabetes care management significantly increased. Managing chronic diseases such as T2DM can be difficult (Perez-Cuevas et al., 2012). Close follow-up and management are paramount to the continued success and amelioration of permanent end-organ damage and negative lifestyle factors (Perez-Cuevas et al., 2012). Formal template creation within the electronic health record can effectively streamline care for patients with T2DM and allow primary healthcare providers to provide the patient with high quality, culturally appropriate, and evidence-based care (Perez-Cuevas et al., 2012).

The successes of this QI initiative can be demonstrated through the direct relationship between the intervention and outcome. The charting template allowed the providers to successfully incorporate appropriate screening for deficits in care and prompted them to fulfill necessary aspects of care management. The introduction of a charting template including key aspects of diabetes care management positively impacts patients with T2DM and provides a system level change within the electronic health record at the site of implementation. This quality improvement initiative shows that when a template is correctly used and formatted to target patients with chronic disease (T2DM), charting key components of care based on American Diabetes Association guidelines increases (Veinot et al., 2010).

Providers viewed the template as helpful, able to provide an opportunity for consistent documentation, and allowed for the improvement in charting compliance. Implementing a charting template that serves to prompt providers to complete proper assessments and thoroughly document these assessments will become the catalyst for improvement in patient outcomes. Using charting templates to the advantage of the provider coincidentally is advantageous to

patients who in turn receive appropriate screening and risk amelioration during every patient encounter. (See Appendix A).

Limitations

It is important to note this QI included a nonblinded review of medical records. The principal investigator served as the data collector and performed the data extraction process. Efforts to minimize limitations included use of a data abstraction sheet, careful selection of patients using inclusion criteria and searching through each clinical day and each provider schedule to collect data. A further limitation of the study was the small sample size. The sample size included three providers.

Conclusion

Evidence supports that quality improvement of diabetic care is possible with use of an EHR template to screen patients during initial and follow up patient encounters (O'Connor, 2010; Veinot et al., 2010; Benhamou, 2011; Perez-Cuevas, 2012; Hosomura et al., 2015; Cahn et al., 2018; Mann et al., 2018). Charting templates within the electronic health record enable the clinician to increase completion of diabetic foot examinations, assessment of yearly dilated eye examinations, medication reconciliation, past medical history and perform a community needs assessment for patients with T2DM. Primary outcomes include quality improvement of care given to patients with T2DM by identifying existing gaps in care within the primary care setting and creating a charting template within the EHR to identify patient needs and facilitate documentation of diabetes care management resources. A secondary outcome includes improved accessibility to resources in the community to facilitate successful patient care management (Penn et al., 2015). Completion of foot exams can minimize the advancement of foot ulcers, allow for proper assessment of neuropathy, and prevention of costly complications (Boulton et

al., 2008). Yearly dilated eye exams monitor for the progression of diabetic retinopathy which could lead to blindness. Ensuring these key aspects of care are properly performed and documented will ensure a reduction in complication risk and allow for timely intervention (O'Connor, 2010).

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Appendix A

Content Analysis for Qualitative Data Collection Survey Results

Category 1: Helpful/Benefit
<ul style="list-style-type: none"> • “The template was helpful in ensuring that essential elements of the chart were completed and consistent.” • “This resource was helpful in giving patients extra options for their T2DM treatment.”
Category 2: Consistency
<ul style="list-style-type: none"> • “I will be able to use this in the future for assisting with patient care.” • “Charting was made easy and efficient with the template.” • “It was helpful in providing consistent documentation that complies with guidelines.”
Category 3: Improving Compliance
<ul style="list-style-type: none"> • “The fact that the charting template integrates national guidelines of care is beneficial to reminding and prompting to chart important aspects of Type 2 Diabetes care.” • “The charting template is helpful in improving compliance and prompting charting of components of guidelines of care for patients with Type 2 Diabetes.”

Table 1*Observed and Expected Frequencies for Eye Exam*

Group	No	Yes	χ^2	<i>df</i>	<i>p</i>
Pre	244	4	102.94	1	<.001
Post	174	104			

Table 2*Observed and Expected Frequencies for Foot Exams*

Group	No	Yes	χ^2	<i>df</i>	<i>p</i>
Pre	55	193	47.82	1	<.001
Post	143	135			

Table 3*Frequency Table for Template Usage*

Template Used	Pre	Post
No	248 (100%)	168 (60%)
Yes	0 (0%)	110 (40%)

Table 4*Observed and Expected Frequencies for Past Medical History*

Past Medical History	Pre	Post
Yes	248 (100%)	278 (100%)
No	0 (0%)	0 (0%)

Table 5*Observed and Expected Frequencies for Medication Reconciliation*

Medication Reconciliation	Pre	Post
Yes	247 (100%)	277 (100%)
No	1 (0%)	1 (0%)

Table 6

Observed and Expected Frequencies for Community Needs Assessment

Community Needs Assessment	Pre	Post
Yes	0 (0%)	95 (34%)
No	248 (100%)	183 (66%)