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Brief Communications

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Using a certified electronic health record technology platform to screen, test and refer patients with prediabetes

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ABSTRACT

The objective of this study was to determine if certified electronic health record technology (CEHRT) can be used to identify and refer patients with prediabetes to lifestyle change programs (LCPs) recognized by the National Diabetes Prevention Program (DPP). This pilot utilized a prediabetes registry, patient portal, and clinical decision support to increase referrals. Data from 36 primary care providers showed 4930 patients were eligible for DPP LCP, 293 referrals were generated, compared to 20 referrals in the baseline period, and 116 patients enrolled. Referral to enrollment conversion rates were 41% in the study period and 69% in the post-study 1-year period. CEHRT functionalities can support systematic identification and management of prediabetes. The referral rate increased 7-fold compared to the baseline period, with high referral to enrollment conversion rates. CEHRT coupled with active provider engagement can serve as a tool to identify prediabetes patients and facilitate LCP referrals and enrollment.

Key words: prediabetes, health information technology, electronic health records, primary care

INTRODUCTION

Type 2 diabetes affects 34 million adults in the United States, ranking as the 7th leading cause of death in the nation. Furthermore, 88 million adults have prediabetes, a serious health condition characterized by blood glucose levels that are higher than normal, but not high enough to be diagnostic for type 2 diabetes.[1] Individuals with prediabetes are at increased risk of developing type 2 diabetes, heart disease, and stroke, and have higher health care utilization and expenditures.[2–4]

Primary care providers (PCPs) along with their care teams and healthcare organizations play critical roles in preventing type 2 diabetes, particularly among patients with prediabetes. PCPs screen their patient populations for prediabetes risk factors and identify patients using an appropriate blood test based on guidelines from the United States Preventative Services Task Force (USPSTF), American Diabetes Association (ADA), and the American Association of Clinical Endocrinologists/American College of Endocrinology (AACE/ACE).[5–7] PCPs can also provide evidence-based preventive interventions to their patients which include referrals to a lifestyle change program (LCP) recognized by the Centers for Disease Control and Prevention's (CDC) National Diabetes Prevention Program (DPP). The National DPP LCP helps patients make sustainable, healthy lifestyle changes and achieve weight loss to lower their risk of developing type 2 diabetes. In the original DPP trial, the intensive

LCP led to a 58% reduced incidence of diabetes compared to placebo at an average follow-up of 3 years and was nearly twice as effective as the diabetes medication metformin.[8]

Despite this evidence, there are several gaps in diabetes preventive care. Among adults with prediabetes, only 15% report being told by a health care professional that they have this condition.[1] Among PCPs, only 38% are aware of the National DPP LCP and only 23% make referrals to the program.[9] Although 76% of adults meet ADA screening criteria, according to one study estimate, less than half (~46%) report screening.[10] Finally, approximately 4% of American adults likely eligible for diabetes prevention programming report receiving a referral, and approximately 2% report participation.[11]

Closing these care gaps requires multiple participants, including physicians, care teams, health care organizations, and patients, to work together to identify and manage those at risk for type 2 diabetes. Processes that improve care include systematically identifying individuals with prediabetes, engaging individuals in shared decision-making regarding evidence-based treatment such as referrals to the National DPP LCP, and supporting individuals in their treatment plan by promoting self-management. These activities can often be aided by technology integration and tools within an electronic health record (EHR). This study describes the collaboration between the American Medical Association (AMA) and Henry Ford Health System (HFHS) and their work with the EHR provider Epic to pilot a prediabetes clinical program within a certified electronic health record technology (CEHRT) platform. The prediabetes clinical program was designed to include clinical decision support, patient engagement, and population health management tools. After HFHS implemented the prediabetes program, we measured changes in the proportion of eligible patients screened for prediabetes, referred and enrolled in a National DPP LCP delivered by the Henry Ford Macomb Faith Community Nursing Network. We also measured user interaction with the program and its associated functionalities. Finally, we monitored weight outcomes among patients with prediabetes who participated in the DPP LCP.

METHODS

Clinical program development and implementation

The AMA and HFHS worked with Epic to design and build the components of the prediabetes clinical program. The build included a prediabetes registry and report generation to identify and monitor patients who are eligible for diabetes prevention services. Additionally, the program provided guideline-based clinical decision support with prompts for clinicians to order appropriate lab tests, document a prediabetes diagnosis, or offer appropriate treatment, including referrals to the National DPP LCP. It also included standardized documentation and patient education materials. Patient engagement was also incorporated using a screening questionnaire in the patient portal which patients were prompted to complete before scheduled appointments. Development and validation of this questionnaire has been reported elsewhere.[12] Finally, it allowed for order sets and bulk order entry.

Furthermore, the organizations created process flow maps, an example of which is provided in Figure 1, with input from subject matter experts, clinical leads, program leads, information technology specialists, and the vendor. The maps describe systematic prediabetes screening and management from the point-of-care and care management contexts and served as the guide for the EHR build. The build was an iterative process to configure, validate, and refine the components. The clinical program went live at HFHS on March 15, 2017, and referrals began in May of 2017 after training providers and refining the platform.

Study design, data collection, and outcomes

We employed a pre-post evaluation methodology to measure the impact and usability of the prediabetes clinical program. Data were retrospectively extracted from the DPP LCP's document reporting system to establish a count of baseline referrals between July 1, 2016 and December 31, 2016. The intervention spanned between March 15, 2017 and March 31, 2018, with an additional 3-month lag to June 30, 2018 to capture enrollments that may have occurred due to the intervention. Outcome data were also collected 1-year post-intervention.

The primary outcomes of interest were (1) the number of eligible patients who were screened for prediabetes and undiagnosed diabetes, (2) the number of eligible patients with prediabetes who were referred to a DPP LCP, (3) the number of referred patients who subsequently enrolled in a DPP LCP and (4) average weight loss among participants. Screening was defined as completion of a risk questionnaire[13] and testing as the completion of a laboratory test (ie, hemoglobin A1c or fasting plasma glucose). Average weight loss was examined among patients who enrolled in a DPP LCP. Provider feedback was collected informally, and the software configuration was revised from their input.

Study population

The pilot sites were comprised of all the primary care facilities at HFHS Macomb and they included 30 primary care physicians and 6 advanced practice providers. Patients' data were included if they were attributed to these providers, were at least 18 years old, not pregnant during the time of the study, and had an encounter with their provider during the study period. Patients were excluded if they had a prior diagnosis of diabetes or prediabetes. Patients meeting inclusion criteria were considered eligible for screening and testing. Patients with an elevated body mass index and either an elevated risk score on the questionnaire[13] of 5 or higher or a laboratory test consistent with prediabetes (hemoglobin A1c 5.7–6.4%, fasting plasma glucose 100–126 mg/dl, or oral glucose tolerance test 140–200 mg/dl) were considered eligible for a DPP LCP referral.

Data analysis

HFHS compiled data from the EHR using customized reports to find patients attributed with the 36 providers and who met the inclusion criteria for this study. Separate reports were run to find data for each column of the reporting template for the protocol.

Results are reported as patient counts pre- and post-intervention, proportions are reported, and weight outcomes for the DPP LCP were calculated as means. Provider experiences were collected using a brief experience survey. The protocol was reviewed and approved for expedited review by the Institutional Review Board of Henry Ford Health System (protocol #10990). The data underlying this article are available in the Dryad digital repository, at https://doi.org/10.5061/dryad.mw6m905xq.

RESULTS

The pilot data for 36 primary care physicians and advance practice providers are illustrated in Figure 2. Among the 37 575 patients attributed to these providers, 4719 (13%) were screened for prediabe-

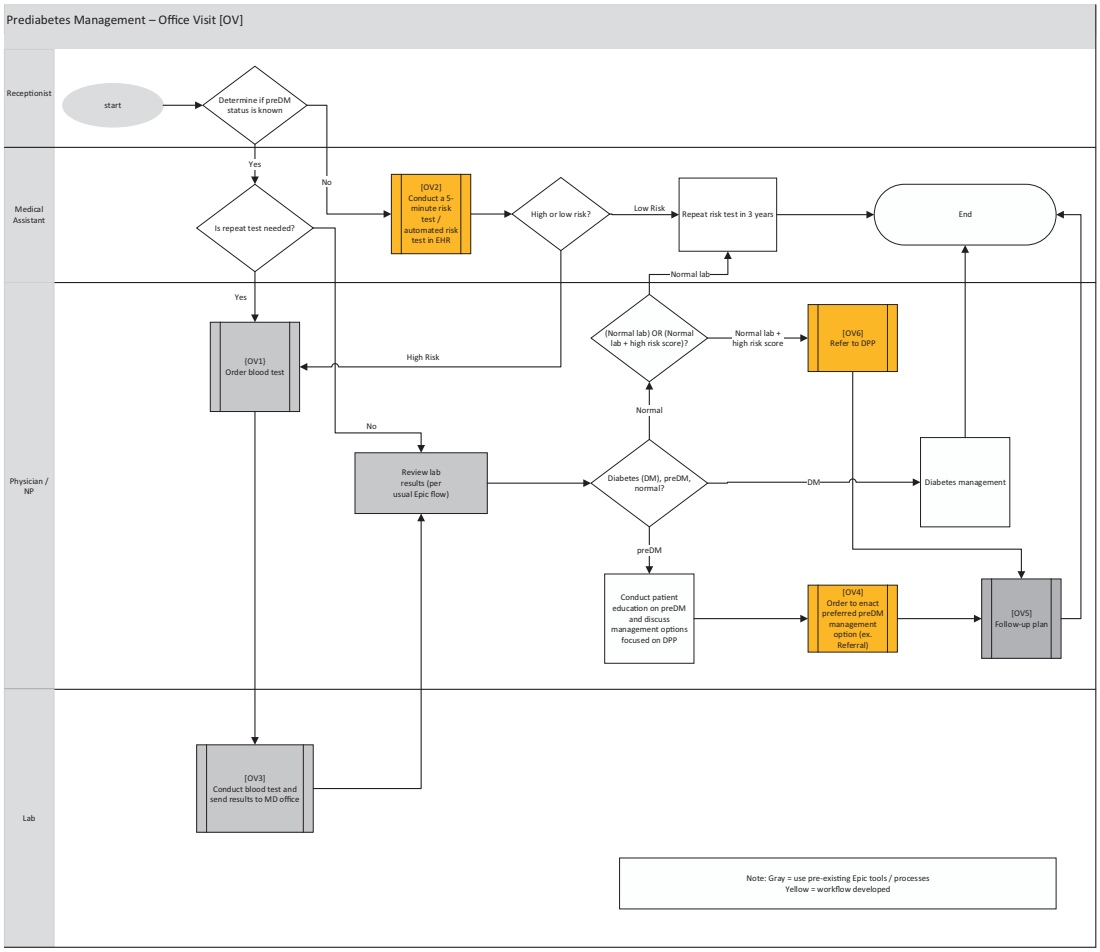

Figure 1. Example process flowmap.

tes using a patient portal diabetes risk questionnaire. Among these unique patients, 37% ($n = 1752$) were eligible for DPP LCP. Additionally, of the 8694 patients with a blood test ordered and a valid result, another 37% ($n = 3178$) were eligible for DPP LCP. Overall, the health system generated 293 DPP LCP referral orders and 116 patients enrolled in the program, yielding a referral to enrollment conversion rate of approximately 41%. The referrals increased a substantial amount from the baseline period when there were only 20 referrals. The number of patients screened and tested for prediabetes was 2.5 times higher and the number eligible for DPP LCP was 2 times higher when utilizing the CEHRT between the first and last months of the pilot. Mean weight loss of participants reported to the CDC by the National DPP LCP exceeded their goal at a mean of 5.4% between July 1, 2017 and June 30, 2018, and 5.7% between July 1, 2018 and December 31, 2018.

PCP experience successes included better documentation of patient goals that are patient-centered and attainable. After the pilot, providers were more receptive to setting goals with patients and encouraging patient engagement to achieve an overall 5% or more weight loss. The structured documentation was repeatedly noted as helpful, as they appreciated having consistent feedback from the DPP LCP coaches on patient's status. Also, the clinical decision alerts were helpful for drawing their attention to patients requiring action during the clinical encounter. One challenge included too many clicks to navigate to desired screens or fields.

DISCUSSION

This pilot of a prediabetes clinical program within CEHRT coupled with brief provider training suggests providing care teams with functionalities to support systematic identification and management of people with prediabetes was associated with an increase in screening and referrals to the National DPP LCP. By the end of the study period, the rate of DPP LCP referrals increased 7-fold, from a baseline of 20 to 293. Referral and enrollment rates among referred patients well-exceeded rates reported elsewhere,[11,14] with enrollment rates at 41% in the study period and 69% in the post-study 1-year period. Provider feedback on the program was generally positive. While the pilot included 36 providers, by 1 year after completion of the pilot, 85 providers had begun using components of the program with minimal or no training, generating a total of 515 referrals and 353 enrollments from April 1, 2018 to March 28, 2019. Adoption of the clinical program by additional HFHS providers appears to be growing organically.

The implementation of the prediabetes clinical program within CEHRT was successful in substantially increasing the referral rates to the National DPP LCP, but it is worth noting that among the 4930 eligible patients, only 293 patients (6%) were referred. This is consistent with the experiences of other organizations systematically implementing diabetes prevention strategies.[15] Leveraging clinical decision support tools and other health IT resources is one important component of the clinical integration and support needed to prevent

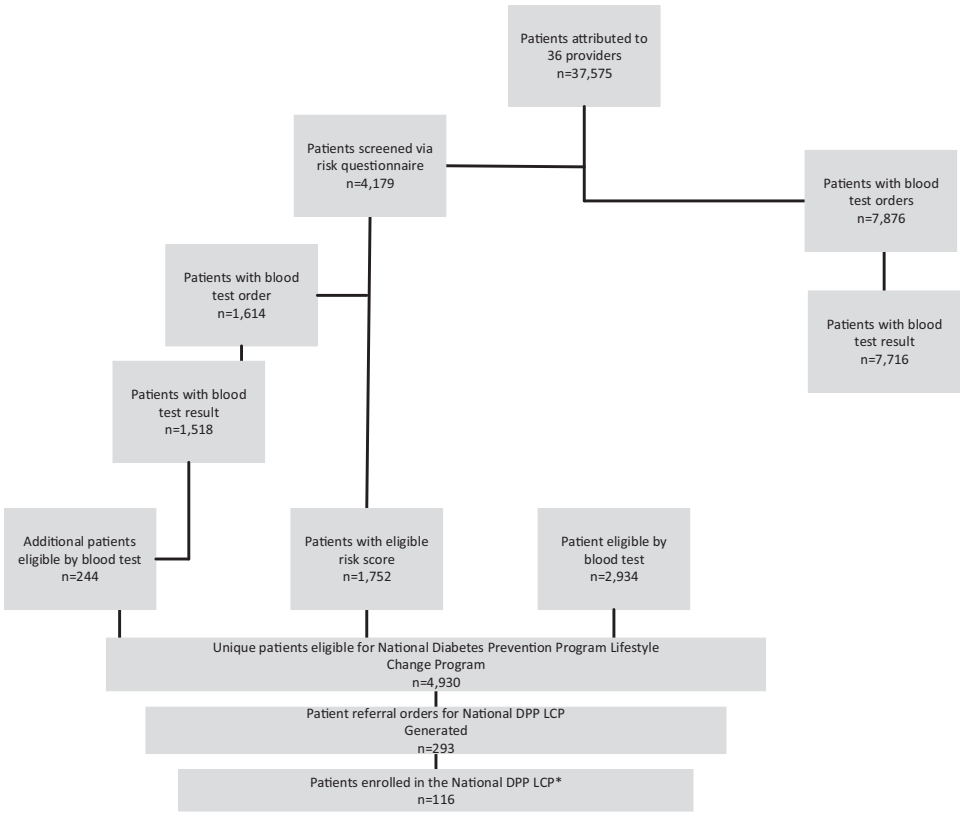

Figure 2. Patient counts of prediabetes-related screening, testing, and referrals from CEHRT. *Data Source*: EHR reporting * Measurement Period: March 15, 2017 to June 30, 2018.

type 2 diabetes. However, to sustain diabetes prevention efforts, health care organizations need to implement a multi-pronged strategy that typically requires more than 1 year to mature and scale.[15]

We encountered several challenges in executing this project. First, this work required a substantial amount of time and effort while continuing to support other departmental programs and goals. To overcome this challenge, strong leadership, and team buy-in is necessary within the health care organization. Next, it was challenging to plan for and respond to the exponential growth in DPP LCP capacity needs. To meet the increase in volume and demand of 50–60% of referrals per month, new coaches were recruited and trained, and new patient-centered strategically located classes were added. Furthermore, both in-office and care management processes were developed; however, the focus for this pilot was on in-office processes, which clearly resulted in substantial improvements in referral and enrollment rates. Finally, because the DPP LCP was offered by a community faith-based nursing network that was affiliated with HFHS but did not have access to the CEHRT platform, it was challenging to close the referral loop between the referring provider and LCP. This was overcome with the creation of the virtual department for the DPP LCP within the CEHRT platform that allowed for secure messages to close the referral loop with information about patient enrollment and progress in the DPP LCP.

Limitations

The pre-post nature of this study does not allow us to conclude that there is a causal relationship between implementing the prediabetes clinical program and improved processes and outcomes. However, it is worth noting that HFHS had a DPP LCP in place for 18 months prior to the pilot, and the baseline data that we report regarding provider referrals represents the physician referral rate for the last 6 months of 2016. No other interventions were put in place during the study period that could explain the improvements observed. Furthermore, CEHRT referral data may be an underestimate because as patients left the network they would not be included in the report.

CONCLUSION

Results from this pilot suggest that use of a prediabetes clinical program within CEHRT coupled with active provider engagement can serve as a useful tool to identify prediabetes patients and facilitate referrals and engagement in a National DPP LCP. Overall, this approach can improve efficiency of the referral process to increase DPP LCP enrollment rates and mitigate the health burdens of type 2 diabetes.

AUTHOR CONTRIBUTIONS

Conception and design of the work: KK, TK, GA, AB, SM, NC, and CO. Data acquisition, and analysis: TK and SM. Drafting of work and revisions for critically important intellectual content: KK, TK, GA, AB, and SM. Final approval of the version to be published: KK, TK, GA, AB, SM, NC, and CO. Agreement to be accountable for all aspects of the work; KK, TK, GA, AB, SM, NC, and CO

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the AMA or HFHS.

CONFLICT OF INTEREST STATEMENT

The authors have no competing interests to declare.

DATA AVAILABILITY

The data underlying this article are available in the Dryad digital repository, at https://doi.org/10.5061/dryad.mw6m905xq.

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