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Validation Of An Emr Prioritization Tool For Diabetes Population Health

Caroline Ruth Piselli
Yale University, carolinerp@prodigy.net

VALIDATION OF AN EMR PRIORITIZATION TOOL FOR DIABETES POPULATION HEALTH

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Caroline Ruth Piselli

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Allison Shorten, PhD, RN, RM MSc, FACM

May 18, 2105

Jessica Coviello, DNP, APRN, ANP-BC

May 18, 2015

Ruth McCorkle , PhD, FAAN

May 18, 2015

Signed: Caroline Ruth Piselli

May 18, 2015

Abstract

The goal of evidence based population health aligned with financial outcomes is to effectively and efficiently manage a defined population to promote wellness, prevent disease progression and manage chronic conditions and acute events. A prerequisite to this model, which is in its early stages of evolution, is an electronic trace of patient information across continuum of care (COC) providers spanning hospitals, physician offices, home health programs, skilled nursing facilities, retailers, payers and new entrants. The information captured along the information trace can be mined from a data repository to analyze cohort specific evidence based care models. A newly formed, large academic employee Accountable Care Organization (ACO) designed and implemented a chronic care program, beginning with a diabetes cohort pilot. An innovative Electronic Medical Record (EMR) prioritization tool was designed according to Design for Six Sigma principles to scope data element additions to the EMR related to weighted outcome measures such as readmission, complications, ED visit reductions and presenteeism at work. Sixteen diabetes care area data categories were prioritized to include compliance, symptoms, diabetes specific risk factors and relationship to biometric indicators. The original prioritization tool and process was further validated via a survey of national experts and a literature evaluation conducted by an expert diabetes physician. Ten of the top eleven prioritized diabetes care areas were consistent between the baseline and survey group. The literature evaluation provided additional research, further substantiating the EMR prioritization data categories

The prioritization tool and validation process can be replicated by experienced clinicians and applied to additional chronic conditions. This may be valuable for the prioritization of

additional EMR metrics that are relevant to care, business and clinical attributes. Most importantly its application to real time EMR based evidence based population health will benefit populations of patients.

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Introduction

United States healthcare spending is projected to grow beyond $3.8 trillion in 2014. (Munro, 2014). While programs continue to combat waste in the US healthcare system, a recent Institute of Medicine (IOM) report notes that technologies, a better payer model and teamwork are essential. This landmark report heralds the need for innovative use of health information technology to enable more effective use of data to care for patient populations (Blank 2012). More effective use of EMR data is needed to co-ordinate the care for the more than 75 million Americans who suffer from multiple chronic conditions (Blank, 2012).

> *"New technologies that should be more widely adopted include electronic health records, mobile technologies, and secure web interfaces, …Health professionals and patients frequently lack relevant and useful information at the point of care where decisions are made." (Blank, 2012).*

The widespread use of the EMR provides a new opportunity for evidence based care approaches to be better supported by data and technology. Even though the electronic medical record (EMR) was conceived in the 1960's, (Geoff Tennant, 2002) its recent national adoption has the potential to capture a repository of patient information with the potential ability to improve efficiency and health care delivery, reduce medical errors, provide significant cost savings, and facilitate research. (Eggleston & Klompas, 2014).

Population health is the aggregate management of a defined population to promote wellness, prevent disease progression and effectively and efficiently manage chronic conditions and acute events within a defined budget. Evolving population health 'pay for outcomes' (P4O) type models impose additional clinical outcome requirements for payment. Thus, population health must deliver the most effective evidence based clinical care. Real time analytics may equip health care providers to deliver the right care by referencing automated reports about

similar patient cohorts evidence based care. To accomplish this, a near future vision is to create an infrastructure in which patients can obtain customized 'care anywhere' supported by information technology telemedicine, telecommunications, devices, personalized medicine and other supportive systems and processes. This necessitates the capture of a relevant electronic trace of patient information across the continuum of care (COC) to include physician offices, hospitals, retailers, employers and new entrants. Chronic disease management requires a multi-faceted approach using patient centric communications, tracking of interventions throughout a patient's progression and ability to reference patient data.(Watts & Lucatorto, 2014)

Nurses in particular are well placed to leverage the EMR for notifications, patient tracking, prioritization of resources and information to continually improve care (King & Wolfe, 2009). The EMR can support care coordination by tracking patients who need extra support for chronic conditions (Carve & Jessie, 2014) as well as social support and symptom management (Omery, 2003). In addition, they can easily reference clinical practice guidelines that are embedded in the EMR and decision support systems. (Anderson, Willson, Peterson, Murphy, & Kent, 2010). However, adoption of the EMR for clinical decision support has been low, (Barca et al., 2014) and inconsistent documentation continues to be an issue as complete and accurate medical record documentation ranges from 7% to 94% (Bowles, Pham, O'Connor, & Horowitz, 2010). It is also important to establish and adhere to health information technology (HIT) policies (Denham et al., 2013) to ensure full compliance as systems are designed to support clinicians in providing evidence based care.

Literature Review

Diabetes Problem and Clinical Management Solutions

Diabetes affects approximately 382 million people worldwide and is projected to increase by 55% and affect 592 million by 2036. Diabetes is the seventh leading cause of death in the United States, affecting nearly 26 million people and costing more than $174 billion in direct healthcare expenses (Harrison & Lyerla, 2012). Most people with type II diabetes are not at goal for glycemia (Joslin Diabetes Center, 2014) presenting an incredible challenge for care coordination and population health. Adherence to evidence-based clinical guidelines using a technology generated care processes is needed (Guzek, Guzek, Murphy, Gallacher, & Lesneski, 2009). Multifactorial analysis of large data sets can potentially contribute to a reduction in avoidable risks of premature mortality and morbidity among patients with diabetes (Hennekens, Pfeffer, JNewcomer, Jellinger, Paul & and Garber, 2014) in conjunction with diabetes-focused, practice-based research (Anderson et al., 2013). For this to be achieved EMR systems must be optimized for efficient and effective data use.

EMR Development Setting

The large academic Integrated Delivery Network (IDN) employer Accountable Care Organization (ACO) was established in 2011. The ACO was comprised of 3 hospitals with 10,000 employees generating > 100 million claims per year at the time of this initiative. Expenditures were the highest for diabetic employees who had 1.6 co-morbid conditions and expenditures > $16 million. A clinical team designed a diabetes centric population health program across the Continuum of Care (COC) and the employee benefits plan provided incentives for member participation. Initially, the team adopted a traditional EMR approach and soon realized the need to capture additional information elements during each phase of care.

The aims of this project was to expand upon this foundation work to design an EMR information prioritization tool was to identify the most important additive data elements for EMR capture to support clinical, financial and operational outcome management for the ACO. `

Conceptual Framework for EMR Information Prioritization Tool Development

A Design for Six Sigma (DFSS) methodology (Chowdhury, 2002) was applied to create a value based employee ACO care process model for diabetes members and associated EMR prioritization tool. DFSS is beyond traditional Six Sigma that has the objective of improving existing processes. Design is critical to a new process as a *good design anticipates and eliminates problems early and a poor design leaves costly issues for the future (Chowdhury, 2002).* The goal was to promote optimal wellness within three months of intake, track care in the EMR and deliver positive clinical and financial outcomes.

Outcomes established by ACO executives and clinicians included reducing potentially preventable events such as readmissions and emergency room visits while promoting presenteeism; (employees present at work). The longer term goal was to create an electronic trace of patient information across the full COC, spanning hospitals, physician offices, home health programs, skilled nursing facilities, retailers, payers and new entrants. Since the ACO is responsible for the clinical and financial outcomes of its population, it was thought that this capture of information would provide a foundation for evidence based analysis of cohorts, such as members with diabetes. Success is predicated upon end to end care management to deliver the best outcomes.

The scope of this initial phase was to establish and prioritize the capture of additional diabetes care information beyond the scope of a traditional medical record. Some examples of additional data attributes included compliance to the patient's customized plan, diabetes risk

factors, social or family situations and agreed upon action plans. As information is captured over time, evidence based care models can be based on that captured data and derived according to cohorts with similar attributes. The process steps are outlined below.

Step 1: Identification of Care Inputs and Outputs

A panel of expert clinicians was formed to identify critical areas of diabetes care which would contribute to meeting the desired short-term outcomes. The panel included 3 nurses with greater than 25 years' experience each in the Fall of 2013. They were chosen because of their collective inpatient and outpatient experiences including those relevant to population health such as chronic disease care coordination, case management and health promotion. Using the DFSS approach, the expert group applied the formula for value to guide identification of critical areas of diabetes care: *Value = Σ(Quality Components) – Price. (Chowdhury, 2002).* Value components included identification of new patient data or specific diabetes care elements. The price included human resource utilization to input, track and report those elements within the EMR and database. Quality can also be expressed within a formula in which *Quality = Σ(Product dimensions) + Σ(Service dimensions) (Chowdhury, 2002).* In this case, quality is defined as the outcomes of the employee ACO such as compliance to prescribed medications, clinician visits, risk factor reduction, care coordination pathways and their relationship to results such as hospital, urgent care and emergency room utilization, complications and readmissions. Product dimensions included the EHR informational elements, process flow, ease of use and reporting capability for clinicians at the time of care to serve as a reference.

The ACO population health service dimensions include contact points with clinicians, patients and significant others as depicted in Figure I. process flow. The plan was for three

phases of care, customized throughout the patient experience with information captured within the EMR during each patient-clinician encounter.

Step 2: Care and Data Capture Process

Phase I *Assessment*: the first phase of care includes a nursing intake visit during which a thorough assessment is completed to fully understand the patient's current status, risk factors, compliance and other diabetes related information. Results are documented within the EMR and include follow up instructions for the patient and clinician. Phase II *Goal Setting*: begins an iterative process step during which the nurse provides advice to the patient about risk factor reduction and care management. The patient then decides upon two to three attainable goals he or she will accomplish within three months, supported by the nurse. Phase III *Goal Tracking*: begins the phase during which the patient and nurse track progress and continually evolve and improve upon the plan. Goals are limited to two or three to ensure they can be accomplished within a three month timeframe. Phase IV *Optimal Wellness*: Optimal Wellness and maintenance is the last phase during which goals are maintained. At this point, the plan can incorporate additional new goals and repeat Phase II to achieve them.

Information capture is critical during each of these process steps or phases of care. Critical success factors for information elements are that each is simple to access at the right time, for the right care and that the information is relevant and enables care decisions. A methodic approach was followed to identify and prioritize these key potential information elements. The clinicians referred to information currently captured on paper sources and brainstormed further about key diabetes care metrics for potential inclusion, identifying more than eighty categorical and multi-dimensional areas. Therefore, it was imperative to systematically prioritize diabetes care step capture within the EMR to those associated with desired outcomes. The EMR prioritization tool

was designed to transform this qualitative data to a quantitative and weighted format to further prioritize information capture.

The baseline prioritization tool is illustrated in Figure II to graphically depict the four process steps applied to prioritize diabetes care areas for the employee ACO program

A. **Clinical and Business Goals:** These were identified by the senior executives and clinicians of the ACO in alignment with pay for outcomes contracts. ACO type contracts provide financial incentives to providers for achieving pre-identified quality scores and healthcare waste reduction. Goals included less readmissions, potentially preventable admissions, ED visits, complications and improved presenteeism at work.
B. **Clinical and Business Goal Weights:** Each was weighted in terms of importance to business and clinical outcomes within a mutually exclusive 1-10 scale; 1 being least important and 10, most important by the ACO leadership.
C. **Diabetes Care Areas:** Care areas identified by the ACO clinical team were then scored within an importance framework as they relate to achieving each of the business/clinical objectives. A scale of 1, 3 and 9 were used whereas 1= minimal importance, 3= moderate importance and 9= most important. *For example, following the 'obtaining medical history' row, it was scored as a 1= minimal importance to achieving less readmissions, as a 3 = moderate importance to achieving less preventable admissions, as a 9 = highest importance to achieving less ED visits and the process continues across this row and those remaining.*
D. **Overall Weighted Scoring:** Upon completion of scoring for each care area, final weighted scores are computed by multiplying the score of each cell within each row by the weight associated with each business/ clinical objective in each respective

column. The sums of each row cell weighting are then added together to create an overall score for each row.

Validation Design and Methods: EMR Information Prioritization Tool and Process

The prioritization tool for diabetes care was based upon the clinician's experiential and intuitive knowledge. Since the goal was to replicate this process to prioritize EMR information capture for other chronic conditions and eventually utilize the data for evidence cohort driven population health, it was essential to validate the process and results. Validation approaches included: I.) Survey of national diabetes experts replicating the prioritization tool, II.) Literature review gap analysis and III.) Review of all results by the original design team for further refinement.

Ethical Considerations:

Internal Review Board approval was not required. Patient data and/or medical records were not a part of this project.

I. Survey of national diabetes experts replicating the EMR prioritization tool

US and global diabetes experts were selected to represent providers actively practicing and navigating healthcare transformation with diverse credentials. The goal of recruiting 5 experts was exceeded as 7 credentialed experts provided input (Figure III); one physician, one registered dietician and five nurses with combinations varying levels of academic preparation.

Experts were actively practicing within a large northeast based, academic diabetes center, large academic global diabetes center of excellence, a multibillion dollar northeast visiting nurse agency participating in Medicare and Medicaid Accountable Care Organization Shared Savings and a new innovative diabetes center of excellence in the South innovating predictive diabetes simulation and modeling.

The survey tool was designed to replicate the DFSS scoring and weighting process within the information prioritization tool, evaluating diabetes care priorities and their respective relationship to business goals such as improved outcomes, reduced cost and reduced waste noted at the top of the prioritization tool. Survey questions included Likert scales for each process step to simulate baseline tool calculations as illustrated in Figure IV step C.

II. Literature review gap analysis

The original literature review systematically assessed, evaluated and interpreted diabetes trends and care, population health transformation as well as the evolution of EMR data capture and database integration. Since EMR information capture, integration with databases and mining is in early stages of evolution, the literature was limited and is probably one to two years behind publication. Therefore, an expert validator was chosen; a physician with extensive experience in diabetes, EMR and analytics, to determine if there were gaps and recommendations for additional literature support for those. The aim of the validation process was to confirm that the original prioritization of diabetes care areas and overall business/clinical objectives were supported by the literature cited. A matrix was created to determine which of the 27 articles cited addressed each of the key areas in the prioritization tool. The matrix listed the cited articles on the left side and the diabetes care areas and outcome measures across the top. The expert reviewed each article and determined whether it addressed the diabetes care area or outcome measure and checked it accordingly. The number of articles that addressed each area were then summed. In addition, the expert reviewed the most recent literature within the last year to understand advancements in EMR and database applications for population health.

III Review of validation process with the original design team for further refinement

The results of the validation process were communicated to the original design team who continue to care for the diabetes population. Expert opinions and review of the literature validated the original design. Thus, no additional changes were incorporated into the prioritization tool.

Results:

Expert Survey

Overall, the expert validation survey group yielded consistent prioritization of clinical and business metrics when compared to the baseline group. The following results are described systematically following the baseline prioritization tool process illustrated in Figure VI.

A.,B. Clinical and Business Goals and Weights

The experts' results were in agreement with the original clinical and business goal metrics: less readmissions, preventable admissions, ED visits, complications, improved presenteeism and did not recommend alternate or additional metrics. The difference between the baseline group and those surveyed is that the baseline group applied mutually exclusive weights to each clinical/ business goal metric, differentiating the importance of each metric and the establishment of clear prioritization weights. The survey group applied duplicative weight scores to four of the metrics, applying a weight of 10 to less readmissions, preventable admissions, ED visits and complications. Increasing weights to multiple metrics rather than applying priorities inflated the results and limited differentiation of each when applied to the computation model.

The survey question was designed to be non-prescriptive about scoring within a mutually exclusive or duplicative framework to support the intent of determining if experts differentiated one over the other. Some follow up discussions with the experts surveyed indicated that they

believed the clinical/business goals are interrelated and non-mutually exclusive to diabetes care aspects. They communicated that some of the diabetes care areas can positively affect multiple clinical and business outcomes. For example, compliance can prevent readmissions and ED visits. However, they were in full agreement with capturing these as separate metrics.

C., D. Diabetes Care Areas and Overall Weighted and Scores:

Each expert survey was considered a replication of the baseline process with scoring based upon each expert's individual point of view. Therefore, seven distinct replications of the tool were completed with seven expert points of view for each cell of the prioritization tool. To compute a score representative of all experts, all scores were added for each cell and divided by the number of respondents as represented in a detailed sample in Figure V. This constitutes the weighted average score (WAS) of the survey respondents.

Once the WAS was computed for each cell of the EMR information prioritization cell, each WAS was manually entered into the EMR prioritization tool. Replication was accomplished by computing the overall scores identical to the original step D of Figure III. The re-computed results using the WAS are described as follows.

The expert group results provided validation of ten of eleven of the prioritized diabetes care areas that the baseline group had identified. Furthermore, the expert group did not identify any gaps or recommendations for additional diabetes care areas. Validated areas include symptom identification, risk assessment for diabetes, self-care, compliance to both clinician visits and medications, PCP/ specialist history, A1C, vital signs and medical history. Figure VI. illustrates results within a table format respectively; with the primary sort being on the survey group from high to low. Note that that while the survey results are inflated due to higher survey weights applied to the computation model, the overall results are consistent. Thus, the

prioritization tool framework piloted for a diabetes population produced consistent results between the baseline and validation survey groups.

Results: Expert Survey: Review of Literature Gap Analysis

The review of literature gap analysis was performed following the framework construction order of the prioritization tool. As noted above, a matrix was created with the list of references to the left of the matrix and diabetes care and business/clinical outcome areas across the top. The expert mapped the original twenty seven sources within the review of literature to each of these areas to examine for gaps. All areas were supported by literature as graphed in Figure VII.

Traditional care areas such as medication management, obtaining a medical history, diet, exercise and prevention of readmissions and emergency room visits were documented in eleven to twenty two of the twenty seven references. Conversely, presenteeism, stress, smoking and sleep were not mentioned as frequently. The review of the literature was updated with nine recent journal articles within the last 2 years that validate advances in EMR capture and application of the information to care. EMR data was demonstrated to effectively identify target populations and practice patterns in diabetes (Kamal, Chopra, Elliott, & Mattei, 2014), population based care quality measures (Hirsch & Scheck McAlearney, 2013) and automated education programs (Hazlehurst et al., 2014). Additional sources documented challenges such as incident diabetes being treated only half of the time with a recommendation to improve diabetes identification systems in the EMR (Chung et al., 2015). Unfortunately, gains associated with evidence-based targets are small initially, as documented delivery of care improves.(Schmittdiel et al., 2014) One trial did not find chronic disease management programs to positively affect presenteeism or diabetes related disability losses (Adepoju et al., 2014) and another was unable to validate the efficacy of rich communication programs (Chrimes, Kitos, Kushniruk, & Mann,

2014). More analysis is required to verify if the rich communication actions found in Phase II complement clinical workflows. Thus, continual learning will require the integration of clinical practice, data and eventual evidence. ” (Roth, Foraker, Lopetegui, Kelley, & Payne, 2014)

Limitations

The validation of the prioritization tool was important to verify to determine if the team of clinical experts within the baseline group, had captured the most important elements for the tool and whether there were any key elements missed. However, the validation process did not identify any additional gaps either within the care categories or the literature. There was strong agreement amongst those surveyed, so the conclusion is that they key elements had been identified. Further evaluation once the tool is fully operationalized may reveal other key elements were missed. The review of the literature also did not rank the level of evidence for each study identified and therefore did not fully capture the quality of the literature and strength of evidence used to support key diabetes care categories and target outcomes. In addition, the application of the EMR to mining data for evidence based practice is still in an early stage of evolution. Therefore, the lag of applicable research is at least one to two years behind and new aspects of care may be needed in the future.

Discussion

There are a number of practical considerations to achieving the overall goal of validating a tool that is designed to prioritize information regarding diabetes care within the (EMR). Future considerations can be categorized in the context of healthcare and evolving requirements, people, process, technology and change management.

Evolving healthcare requirements associated with outcomes for payment are essential for sustainable results. As healthcare is transforming at a rapid pace aligning outcomes to payment,

requires an evidence based population health model that is reliant on real time information. The constraint is that the sense of urgency may preclude organizations from creating an overall integrated clinical/ business and EMR strategy with clear data requirements. Instead, some may simply add to existing EMR infrastructures in the absence of prioritizing information.

People, process and technology are integral to each other. People must be fully engaged and possess new competencies as identified by the National Association of Healthcare Quality (NAHQ), "Emerging Competencies for Population Health & Care Transitions". (Parisi, 2014). Clinicians must become familiar with the use of informatics to fully understand evidence based care, well beyond competencies established in 2002 (Hart, 2008) Population health clinicians must also design the future infrastructure to enable the understanding of patient cohorts and care process transitions.

> *"…the amount of knowledge clinicians must acquire and maintain just to succeed in their basic work is staggering…." (Carver,M.C., Jessie, A., 2014) …'nurse of tomorrow will integrate the latest available knowledge, will coordinate care in a multidisciplinary manner and will partner with the patient in managing his or her health care journey" (Swick, Doulaveris, & Christensen, 2012) and must be well trained in the process and information elements (Swick et al., 2012).*

Lastly, if stakeholder engagement and continual change management is not adopted by all involved, limitations and/or failure will ensure. If clinical teams do not value or understand why information elements must be prioritized and/or they feel they are too busy, EMR information prioritization will not occur.

Implications for Clinical Practice Change and Future Tool Replication

This baseline prioritization tool was designed to support the first of a number of chronic care areas, care, processes and infrastructure for an employee ACO. Over time, additional information elements can be added to the EMR based upon replication of this prioritization tool

and process for other clinical conditions. The integration of EMR data into the large data repositories that include biometric data as well as data from devices, telecommunications, process and outcomes measures such as A1C, glucose, blood pressure, compliance to medical visits, diet, exercise and presenteeism can be mined and analyzed to support cohort based evidence based care. As each sector of data elements are captured within the database, the predictive power of cohort analysis will be continually improved.

This initial practice change was scoped to the diabetic employee population for further replication to aforementioned disease states. A consistent coordinated and collaborative approach to capturing and surfacing data within an EMR can provide the right data at the right time for the right decisions about populations and cohorts of patients.

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