

Diabetes and Hypertension Quality Measurement in Four Safety-Net Sites

Lessons Learned after Implementation of the Same Commercial Electronic Health Record

R. Benkert¹; P. Dennehy²; J. White³; A. Hamilton⁴; C. Tanner³; J.M. Pohl⁵

¹Wayne State University, Nursing, Detroit, Michigan, United States; ²GLIDE, San Francisco, California, United States; ³Michigan Public Health Institute, Center for Data Management and Translational Research, Okemos, Michigan, United States; ⁴Alliance of Chicago Community Health Services, Clinical Informatics, Chicago, Illinois, United States; ⁵The University of Michigan, School of Nursing, Ann Arbor, Michigan, United States

Keywords

Electronic health records and systems, safety net clinic, patient with chronic illness or special needs, performance improvement

Summary

Background: In this new era after the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, the literature on lessons learned with electronic health record (EHR) implementation needs to be revisited.

Objectives: Our objective was to describe what implementation of a commercially available EHR with built-in quality query algorithms showed us about our care for diabetes and hypertension populations in four safety net clinics, specifically feasibility of data retrieval, measurements over time, quality of data, and how our teams used this data.

Methods: A cross-sectional study was conducted from October 2008 to October 2012 in four safety-net clinics located in the Midwest and Western United States. A data warehouse that stores data from across the U.S was utilized for data extraction from patients with diabetes or hypertension diagnoses and at least two office visits per year. Standard quality measures were collected over a period of two to four years. All sites were engaged in a partnership model with the IT staff and a shared learning process to enhance the use of the quality metrics.

Results: While use of the algorithms was feasible across sites, challenges occurred when attempting to use the query results for research purposes. There was wide variation of both process and outcome results by individual centers. Composite calculations balanced out the differences seen in the individual measures. Despite using consistent quality definitions, the differences across centers had an impact on numerators and denominators. All sites agreed to a partnership model of EHR implementation, and each center utilized the available resources of the partnership for Center-specific quality initiatives.

Conclusions: Utilizing a shared EHR, a Regional Extension Center-like partnership model, and similar quality query algorithms allowed safety-net clinics to benchmark and improve the quality of care across differing patient populations and health care delivery models.

Correspondence to:

Joanne M. Pohl, PhD, ANP-BC, FAAN, FAANP
The University of Michigan
School of Nursing
Ann Arbor, Michigan, United States
jpohl@umich.edu

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1. Background

Millions of adults in the United States have hypertension (67 million; 31%) [1] and diabetes (25.6 million; 11.3%) [2], and of these adults, seven million use a community health center (CHC) as their usual source of care [3]. CHCs are one type of health care safety net sites in the US, which are public and private sites “that deliver care in a variety of settings to patients, who are otherwise unable to afford or access care” [4]. These primary care safety net sites (CHCs) largely serve racial and ethnic minority and under resourced populations [3].

Despite the availability of affordable care, both CHCs and national data report significant continuing chronic health disparities among minority patients and those with low socioeconomic status [5]. Recent reviews argue that quality measurement paired with health information technology (HIT) is essential for diminishing disparities [6]. Quality of care for hypertension and diabetes in CHCs became required reporting in 2008 using the Uniform Data System (UDS); the following year, the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 called for Regional Extension Centers (RECs) and “meaningful use” of electronic health records (EHRs). Thus, HIT, especially EHRs, holds enormous promise as a solution (MU) to improving outcomes of care and reducing health disparities.

Yet there is mixed evidence that EHR use as a single solution by primary care providers will improve quality outcomes. Several studies found process measures (eg, blood pressure [BP] obtained; HbA_{1c} testing performed) are more easily improved through quality improvement (QI) strategies with EHRs than outcome measures (eg, BP and HbA_{1c} control), especially for low income and underinsured populations [7–10]. Other studies found improvements in processes of care and outcomes (albeit smaller) [11] or no improvement in processes of care and outcomes with EHR implementation [12]. These results held true even when controlling for primary care practice site (safety net vs. other), patient demographics and insurance status; yet patients on Medicaid or the uninsured consistently had the lowest rates of improvements.

Reports from the New York Department of Health and Mental Hygiene’s Primary Care Information Project [8, 13, 14] indicated that delivery of clinical preventive services can increase in small primary care practices that implement an EHR system when it includes comprehensive QI support. But even in the post-HITECH era, access to the full cadre of QI strategies for safety net sites varies by site type, HIT resources, and implementation processes. The quality retrieval mechanisms in EHRs are only as good as their ability to obtain consistent quality measures across sites [15], and implementing technology alone will not improve processes of care without significant operational change (eg, using data for rapid cycle change) [13].

A large project jointly conducted by the Institute for Nursing Centers at the Michigan Public Health Institute and the Alliance of Chicago centered on EHR implementation, clinician use, and quality of care. The project was a practical evaluation to determine if the partnership model can improve clinician use of the EHR and if the model is successful at improving quality across multiple sites not physically co-located. Participating health centers provided primary care services to populations in Illinois and California, but all utilized the GE Centricity® EHR product implemented by the Alliance in accordance with the partnership model [16]. Clinical performance data evaluation was one aspect of the project. With select facilities from the project, this paper explores the way data from the same EHR system presented across multiple sites.

2. Objective

Our objective is to describe what implementation of a commercially available EHR and organizational level quality query algorithms showed us about our care for diabetes and hypertension populations in four safety net clinics. Specifically we will describe:

1. the feasibility of data retrieval across sites;
2. the measurements over time,
3. the quality of data, and
4. how our teams used this data to improve quality of care over time.

3. Methods

3.1 Setting and Participants

The participating safety net clinics are all Federally Qualified Health Centers (FQHCs), including three CHCs affiliated with the Alliance (Centers A/B/C) and a nurse-managed health center (NMHC) affiliated with the Institute for Nursing Centers (Center D). The three Alliance centers had fully implemented the EHR system, and Center D completed the implementation process during the study. The original project intentionally used Centers A-C because they were established EHR users and could serve as a comparison to the project's four newly implementing NMHC sites. Center D is the only NMHC whose data are presented here. A brief description of each center is presented in ►Table 1.

3.2 Human subjects' protection

The research protocol of this study was reviewed and approved by the Michigan Public Health Institute with Federal Wide Assurance and the research ethics governing bodies at the respective study sites.

3.3 Methods Overview

A cross-sectional study was conducted from October 2008 to October 2012 in four safety-net centers. We conducted standardized quality metric calculations from the Centers, at the organizational level, three and four years post EHR implementation, as the project began more than one year post implementation for Centers A-C. Center D had Year 1 post implementation data, and provided data for Years 3 and 4 in order to have time points comparable to the other Centers. A nationwide data warehouse was utilized for data extraction. Data were limited to billable providers (physicians, nurse practitioners, physician assistants) who had been assigned as responsible providers for primary care office visits.

3.4 Data Collection and Quality Metrics

On an annual basis, we examined both process and outcomes measures among patients with diabetes and/or hypertension, using national measure sets existing at the beginning of the project (pre-meaningful use). Measures were based on conditions and services (chronic disease care for adults) provided across all sites and the set of required measures for FQHCs [3, 17]. The selected measures are described in ►Table 2, including the numerators and denominators. Most diabetes measures were derived from Health Resources and Services Administration's (HRSA) Health Disparities Collaborative (HDC) [18], with the exception of one outcome measure (last HbA_{1c} <7.0) from the American Diabetes Association [19]. The hypertension measures are a subset of measures from the Centers for Medicare and Medicaid Services (CMS) and housed on the Doctors Office Quality-Information Technology (DOQ-IT) website [20].

We then exported the data from the warehouse for Years 1 (Center D only), 3, and 4 and graphically examined the differences in quality measures across Centers. The data warehouse's query tool is external to the Health Record (HR) and was used to conduct the complex calculations needed for queries. Metrics for time periods after EHR implementation were generated by algorithms programmed as part of GE Healthcare's Medical Quality Improvement Consortium (MQIC) [21]. MQIC, a participating registry vendor for the CMS Physician Quality Reporting System (PQRS), is a community of providers that utilize GE Centricity® EHR or Practice Solution, and also elect to contribute data that is standardized and stored in a centralized repository for use in QI, benchmarking, and research.

MQIC provides a query interface so that participating sites can generate quality data at the practice, provider, and even patient level. Researchers and practice staff utilized MQIC to pull numerator and denominator data points for each metric. All metrics were initially examined individually (►Table 2); next, the research team calculated composite scores based on the "Opportunity Model"

employed by the CMS [22]. A composite score of a group of measures was calculated by dividing the sum of numerators of all measures in the group by the corresponding sum of denominators. Composite scores were not calculated for Center C because it had undergone organizational restructuring that made key data unavailable.

3.5 Training and Organizational Change Processes

One goal of the project was to have Centers develop an engaging relationship with the technology team as a continuous quality improvement process, as opposed to a one-time software installation effort. Initially, staff received three 4 hour training sessions prior to go-live (system overview; clinical template training; and workflow training). Staff also had on-site, dedicated go-live support available at each clinical setting for two weeks beginning from the go-live date. The research team capitalized on the existing literature [23] and also created a shared learning process; sites shared with each other and discussed lessons learned from actual process and outcome measures. The project used a change management framework which supported administrative and clinical leadership to drive the change. The need for data was included in the training sessions, and administrators and researchers provided reports to clinicians with data at a population level to compare performance overtime. An annual EHR user conference, including clinicians, super users and the quality and research staff, offered technical assistance to the centers and discussed Center-specific data for identified measures. Centers also implemented PDSA cycles to track the specific process level measures (e.g. foot exams) and had champions for each cycle.

4. Results/Lessons Learned

Results and lessons learned are described according to our study objectives:

1. the feasibility of data retrieval across sites,
2. the measurements over time,
3. the quality of data, and
4. how our teams used this data to improve quality of care over time.

4.1 Feasibility of Using the Same Quality Query Algorithms across the Four Sites

While use of the algorithms was feasible across sites, challenges occurred when attempting to use the query for research purposes. The MQIC reporting mechanism is designed for centers to create dashboards as a tool for internal QI, with measures generally reported as basic percentages. Further, centers obtain data dashboards in an easy-to-use format that would otherwise use complex calculations for queries. However, utilizing the data for research purposes required significant editing and reorganizing. In order for data to be accessible, users also must chart using discrete data fields. While the research team and site administrators worked to train users on an ongoing basis, the data collection was not always timed to capture specific PDCA cycles and local FQHC training.

The process of contractual agreements for participation in MQIC took longer than anticipated, delaying or limiting the research team's access to data and requiring more involved procedures for querying historical data. Three of the four NMHCs were unable to provide data due to significant contractual delays with MQIC, limiting our present analysis to four instead of the anticipated seven sites. Center C's organizational restructuring also resulted in a loss of data.

4.2 Measurements over Time

There was wide variation in diabetes process results by individual centers and across all centers Years 3 and 4 post-implementation (►Table 3), and modest variations of hypertension process and diabetes and hypertension outcome measures. Self-management goal setting ranged from 7% (Center B) to 60% (Center D) in year 3, and depression assessments ranged from 27% (Center A) to 99%

(Center D) in year 4 (see italicized text in ►Table 3). Flu vaccine rates were the most variable across all sites, increasing slightly and then decreasing across all sites. The hypertension process measure and the hypertension and diabetes outcome rates were less dramatic; hypertension process rates, in particular, were relatively high at Year 3 and changed little afterward. Center A had the highest hypertension process and outcome scores, approximately 90% and 60%, respectively. Center B had the lowest hypertension scores, but raised both process and outcome 9 percentage points from Year 3 to 4 (75%–84%, 56%–65%, respectively). Across all Centers, the hypertension outcome rates at Year 4 were consistent; however, diabetes outcome metrics (e.g. blood pressure goal and the HbA_{1c}) were variable.

Calculation of the composite scores balanced out the dramatic differences seen in some individual measures but highlighted differences by center. Center B's diabetes process scores increased significantly from Year 3 to 4 (►Figure 1), matching the diabetes outcome score for both time points. Center A's scores remained relatively flat for both diabetes process and outcome. Center D's diabetes process scores were consistently higher than the outcome scores (►Figure 1), and it saw a jump in diabetes process scores from Year 1 to 3 with a slight decrease at Year 4. Meanwhile, Center D's diabetes outcome measure remained flat with a similar drop at Year 4. Centers A and B had increases in hypertension process and outcome from Year 3 to 4 (►Figure 2), but Center D showed a subtle decline from Year 3 to 4 for both hypertension scores.

4.3 Quality of Data

We used consistent definitions, numerators and denominators to ensure data quality. Still, the differences across centers (►Table 1) had an impact on numerators and denominators (eg, Centers A and D had more stable primary care practices than Centers C and B). Center D was an FQHC and NMHC serving a transient population, possibly affecting care processes. Center D also experienced connectivity issues that interfered with proper documentation and delayed lab interfaces. With few exceptions, for nearly all measures at all sites, the denominator values increased from one year to the next.

For the most part, numerators increased at a pace that met or exceeded the rate of increase in their denominators. For some measures at certain centers, numerators did not keep pace with their denominators' growth from Year 3 to 4; most of these lagging numerators were seen at Centers C and D. For 6 of the 15 measures, Center D saw numerators rise faster than the denominators from Year 1 to 3, then fall behind Year 3 to 4.

One positive factor that contributed to our data quality was the consistency of EHR versions across sites and the study period. Centers A-C began with the GE Centricity® product in 2006 using version 5.6 (most current available). In 2007, the three Centers upgraded to version 2006. Center D started on that same version (EHR 2006) in 2012. Subsequently, all sites were upgraded to the same EHR versions at the same time, as available.

4.4 How Our Teams Used This Data to Improve Quality of Care over Time

As a part of the larger project, all sites agreed to a partnership model of EHR implementation [16]. Each Center utilized the available resources for internal quality initiatives and changed course when appropriate or possible. Center B had low performance in the goal setting measure and utilized an external grant to shift focus to another diabetes process measure, allowing them to address smoking issues in their population. Center B saw significant improvements from Years 3 to 4 in smoking status and advice (process measures), critical cardiovascular disease prevention strategies for diabetic patients [24]. Center D used process data to assess compliance with standards, combining this quality work with innovations in practice, including adding a pharmacist to the team and conducting an active medication reconciliation process. Center D also formed an integrated primary care-public health model using a community based focus, new team members and students working with the patient population.

5. Discussion

This paper adds to the literature on lessons learned post HITECH, RECs and MU. Consistent with earlier research [7, 9, 25–27], we found more improvement in process measures than outcome measures the first four years after implementing an EHR. We learned important lessons on individual measures, even as composite scores balanced dramatic differences among centers. We also learned about the feasibility of data retrieval, the quality of our measures and how our partnership helped us to achieve policy recommendations by Berenson and colleagues [28].

Our study achieved three of these policy recommendations [28]: collect data at the organizational level, use a select set of nationally approved measures, and promote a rapid-learning health care system. All data was collected at the clinic level using standardized measures from national organizations. In addition to CMS, the measures are used by the National Committee on Quality Assurance (NCQA) and the American Medical Association Physician Consortium for Performance Improvement (AMA/PCPI). The site and staff training, the user conferences and the relationship with the technology team as a QI process also allowed us to evaluate selected measures for use with our Centers' populations. Flu vaccinations, for example, were exceptionally variable across all years. Through shared learning, the teams better understood the complex reasons (eg, patient vaccine refusal, widespread availability of the vaccine). The rapid feedback cycles uncovered that this particular diabetes quality measure is more complex than simple data retrieval, which may not reflect actual practice and requires multi-level system changes to achieve a consistent score.

Two other quality recommendations [28] merit discussion. The first was moving from measuring processes to outcomes. Although we agree that process measures do not predict outcomes – as our data support – we found that by focusing on individual process measures and emphasizing these data, centers could improve processes that allowed later attention to outcomes. All centers focused on standardization of EHR documentation the first two years post implementation. These focused processes required a lot of time on the part of clinicians. While often seen as clinically irrelevant, especially in a high need population where they may need more face to face time, these strategies resulted in nearly all measures at all sites improving over time. We cannot definitively prove that our partnership model or these QI processes to improve documentation caused these changes. Yet to achieve consistent reductions in health disparities among safety net sites, Regional Extension Centers, combined with an organizational change process will be required. Center D uniquely did not get “stuck” in the success of process measures; they also achieved improvements in hypertension outcomes (Year 3), evident in ►Figure 2. They did this by focusing on ongoing training of the staff regarding documentation and using the partnership model to its full capacity and used all staff to their full capacity.

Another recommendation from Berenson and colleagues [28] was using quality measures strategically and implementing other approaches if measures prove inadequate. One slow performing measure in three centers was setting self-management goals with diabetic patients. Center B was able to implement new approaches and move strategically to achieve positive outcomes, but required grant support. Although literature supports that patient engagement using goal setting does impact outcomes [29], we suspect that until payment for these services occurs it may be difficult to move the mark on this process measure. Moreover, compensating for the performance of health counseling in primary care does not necessarily lead to improved counseling or outcomes [30, 31]. Coleman [30] found that financial incentives intended to increase smoking cessation counselling by general practitioners merely increased EHR documentation without resulting in significant process changes. More research is needed to determine which factors actually incentivize providers and in which types of settings.

Upgrades to the EHR over time positively affected our results. Smoking cessation advice was one measure that improved across all sites appreciably. This was likely due to the use of clinical decision support (CDS) tools implemented in April 2012. The use of the new CDS tool may have positively affected the process of care data for the individual diabetes measures [32].

Although one project focus was improving use of the EHR, Center D reported being somewhat fatigued by additional MU reporting. The MU program did not result in significant practice changes as Center D was already using a registry prior to EHR implementation. In addition, the use of a pa-

tient portal for MU processes was seen (by Center D) as another new program with undue expense and questionable value to the population.

Comparing our composite and outcome data to the research literature and UDS data remains challenging. Our centers had a BP control rate comparable to other CHCs in the same measurement years [33], but our diabetes outcomes measure ($\text{HbA}_{1c} < 7\%$) differed from the UDS measure ($\text{HbA}_{1c} < 9\%$). It was also difficult to compare our composite data to existing studies, as they used study specific composite scores [7, 12]. While we used a standard CMS composite measurement scheme and standard measure sets, the inconsistencies in metrics across published studies makes it difficult to make reliable comparisons, lending support the quality measurement recommendations by Berenon and colleagues. [28]. Future quality research will need to utilize standardized measures across sites and studies to address this gap.

5.1 Limitations

Our study had four limitations. First, we did not measure factors beyond the EHR that can affect poor outcomes in safety net clinics. Processes can be affected by system use (extent to which providers use/adopt a system) and workflow (extent to which the system was implemented in the context of overall work) [34, 35]. Likewise both processes and outcomes can be affected by the social determinants of health (health literacy, patient access to resources, etc.) and interventions that address these issues [36–38]. Factors that may have affected our results include time spent with patients, day-to-day functioning of each center, telehealth, use of community health workers, grant funding for quality projects, use of REC resources, etc. Both CHCs and NMHCs report equivalent outcome data related to chronic conditions [27], yet the depression screening data for Center D may highlight a cultural distinction of NMHCs [39] that often embed the social determinants of health into daily practice. Future research will need to capture these data to better differentiate center specific improvements from EHR and QI initiatives.

Two data quality limitations require comment. First, the timing of MU mandates may have affected data quality. As noted, Center D was fatigued by additional mandate. Each center in the study was at a different “year” in the MU program, confounding its impact on our data. Second, three of the four centers had no pre-load data and one had a limited pre-load process. Subsequently we could not adequately compare data from Years 3 and 4 to a center’s benchmark level. Future research will need to capture and control for the contextual drivers of EHR implementation to fully understand its impact on chronic disease quality measures.

Finally, while we used standardized composite measures, process measures may have a time-lag, so composite scores should take timing into consideration. We did not account for time lags or staggered time points. Future research would need to take these into consideration.

5.2 Conclusions and Implications

The individual quality measures among patients with diabetes and/or hypertension highlight the gaps in processes of care that may be amenable to workflow improvements. In contrast, standardized composite measures can enhance comparisons of data across multiple safety net practices. Yet our commitment to a strong partnership model with flexibility at the site and technology level impacted our results. While our findings predate the development of RECs, our partnership model suggests that “REC-like” activities can occur across multiple sites in different states. Future research or QI activities to evaluate EHR implementation should utilize standardized quality query algorithms with closer attention to the context of care, including the quality of any regional partnerships.

Clinical Relevance Statement

Utilizing a shared EHR, similar quality query algorithms and a partnership model allowed providers to benchmark and improve the quality of care across safety-net clinics with differing patient populations and health care delivery models. Consumers need to be aware that comparisons between clinical sites may not be equivalent if one or more (a) uses different algorithms or unstandardized measures and/or (b) lacks access to regional initiatives [8, 14]. Findings from this study indicate that process and outcome measures for the most common chronic conditions can be com-

pared over time. Yet, high quality data retrieval mechanisms, along with a partnership model may be essential steps to determining the full impact of an EHR implementation process.

Conflict of Interest

The authors declare that they have no conflicts of interest in the research.

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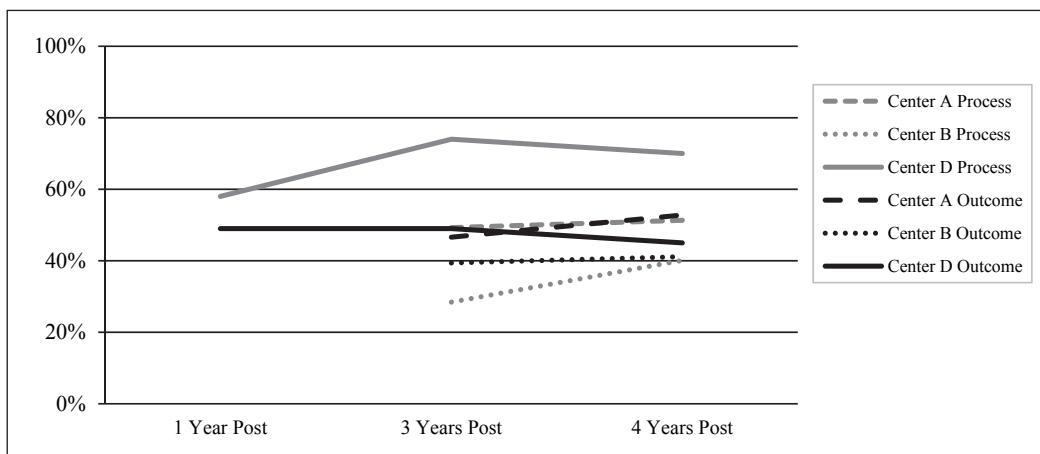


Fig. 1 Composite Scores for Diabetes Process and Outcome Measures (1, 3, and 4 Years Post EHR Implementation)
Centers A, B, and D Compared

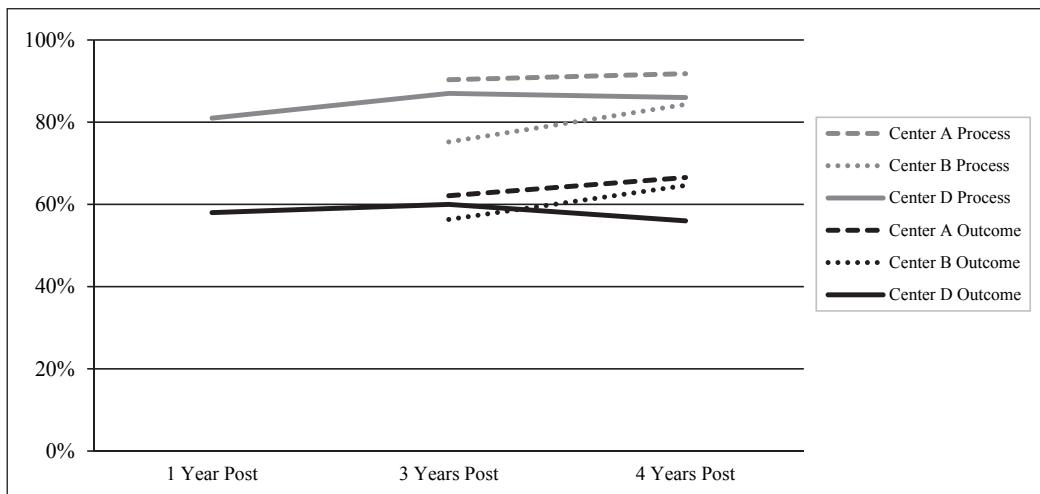


Fig. 2 Hypertension Process and Outcome Measures (1, 3, and 4 Years Post EHR Implementation) (Process=% visits
with BP, Outcome=last BP <140/90) Centers A, B, and D Compared

Table 1 Health Center Characteristics

Center Name (Center Type, Collaborative)	Lo- cation	Go Live Date	Total Annual Visit Volume (During Study Period)	Population Served	Type of Care
Center A (CHC, FQHC, Diabetes Collabor- ative)	Illinois	Sept. 2006	>42,000	Urban, Hispanic and re- cent Mexican & Puerto Rican 34% uninsured	Primary care including Behavioral Health
Center B (CHC, FQHC, HIV Collaborative)	Illinois	Oct. 2006	>10,000	Urban, HIV, Gay, Les- bian, Bisexual, Trans- gender 68% uninsured	Primary Care including Behavioral Health (adult only)
Center C (CHC, FQHC, Diabetes Collabor- ative)	Illinois	Dec. 2006	>14,000	Urban, homeless, mi- grant, recent refugee 72% uninsured	Primary Care including Behavioral Health
Center D (NMHC, FQHC, Diabetes Collabor- ative)	California	Aug. 2008	>13,00	Urban, homeless finan- cially disadvantaged 70% uninured	Primary Care including Behavioral Health (adult only)

Table 2 Process and Outcome Quality Metrics: Description, Numerators, Denominators and Visit Selection Criteria

Measure Description	Measure Set	Numerator	Denominator
Diabetes Process			
<i>2+ HbA_{1c}s blood tests obtained – Patients with 2 HbA_{1c}'s in last year (at least 3 months apart)</i>	HDC*	Active Diabetes Patients having 2 or more HbA _{1c} blood tests (that are at least 91 days apart) during the measurement period.	Active Diabetes Patients with a minimum of two visits in the reporting year
<i>Self-Mgmt. Goals set – Self Management Goal (%)</i>	HDC	Active Diabetes Patients with Self-Management Goal setting observation during the measurement period.	Active Diabetes Patients
<i>Smoking Status noted – % of patients assessed for smoking status</i>	HDC	Adult Diabetes Patient with a smoking status documented or deterrent medication less than 12 months prior to most recent office visit.	Active Adult Diabetes Patients
<i>Smoking Advice given – % of smokers who were recommended or offered an intervention for smoking cessation</i>	HDC	Patients who were recommended or offered an intervention for smoking cessation	All patients who are smokers 18–75 years of age
<i>Eye Exam performed – % performed</i>	HDC	Active Diabetes Patients	Patients who received a dilated retinal eye exam by an ophthalmologist or optometrist with documentation in the medical record.
<i>Foot Exam performed – % performed</i>	HDC	Active Diabetes Patients; excluding patients with bilateral foot/leg amputation with ICD-9-CM exclusion codes for 2.9 Foot Exam)	Active Diabetes Patients with documented foot exams for all three components).
<i>Microalbumin obtained – % with lab test</i>	HDC	Active Diabetes patients (12 to 70 years) not currently taking ACE or ARB with microalbuminuria test.	Active Diabetes patients (12 to 70 years) not currently taking ACE or ARB.
<i>Flu Vaccine given – % documented vaccine given</i>	HDC	Active Diabetes Patients who received an immunization for influenza in the measurement year.	Active Diabetes Patients, excluding those with both patient and medical reason to exclude.
<i>Pneumovax given – % documented vaccine given</i>	HDC	Active Diabetes Patients who received an immunization for pneumonia, ever.	Active Diabetes Patients, excluding those with both patient and medical reason to exclude.
<i>Depression assessed – % depression screening assessed</i>	HDC	Active Diabetes Patients who are documented as having depression screening in the measurement year.	Active Diabetes Patients.
Hypertension Process			
<i>% BP assessed – % Of Visits With BP</i>	DOQ-IT+	Patient visits with valid BP measurement values (both systolic and diastolic) recorded on the office visit during the measurement period.	All Adult Hypertension Patients during the measurement period excluding decliners.

Table 2 Continued

Measure Description	Measure Set	Numerator	Denominator
Diabetes Outcome			
<i>HbA_{1c} < 7.0 – % with last HbA_{1c} < 7.0</i>	ADA**	Last HbA _{1c} less than 7.0% less than 12 months from recent office visit.	Adult Diabetes Patients.
<i>BP<130/80 – Blood Pressure less than 130/80 (%)</i>	HDC	Active Diabetes Patients with most recent BP Systolic < 130 and Diastolic < 80 during the measurement period.	Active Diabetes Patients with documented BP during measurement period.
<i>LDL<100 – Cholesterol Test (LDL<100)</i>	HDC	Active Diabetes Patients with most recent LDL < 100 during the measurement year.	Active Diabetes Patients with recent LDL test.
Hypertension Outcome			
<i>BP < 140/90 – % of Patients With Last BP < 140/90</i>	DOQ-IT+	Patients from the denominator with most recent BP value less than 140/90. Both BP values must be recorded on the office visit day.	All Adult Hypertension Patients with BP value recorded on or after the most recent visit during the measurement period, excluding decliners.
Diabetes Visit Extraction Criteria	All active patients with diabetes (ICD-9-CM Codes: 250, 357.2, 362.0, 366.41, 648.0) 18 years of age at the start of the measurement period and active as per population selection condition with at least two face-to-face office visits during the reporting year.		
Hypertension Visit Extraction Criteria	All active patients with hypertension (ICD-9-CM Codes: 401.0, 401.1, 401.9, 402.xx, 403.xx, 404.xx) equal to or greater than 18 years at start of measurement period with at least two face-to-face office visits with the physician, physicians' assistant, or nurse practitioner and systolic and diastolic BP readings.		

* Health Disparities Collaboratives; ** American Diabetes Association; + Doctors Office Quality-Information Technology

Table 3 Individual Center Process and Outcome Quality Metrics and Results by Year and Center

	Center A		Center B		Center C		Center D		
Active DM patients	863	1000	70	84	*	535	133	191	206
HTN patients (with recent BP value)	958	1166	142	195	*	1134	302	452	500
Chronic Disease Performance Measures	Year 3 %	Year 4 %	Year 3 %	Year 4 %	Year 3 %	Year 4 %	Year 1 %	Year 3 %	Year 4 %
Diabetes Process									
2+ HbA _{1c} 's obtained	62	71	46	52	48	47	39	65	67
<i>Self-Mgmt. Goals set</i>	28	24	7	7	46	28	29	60	42
Smoking Status noted	62	66	39	61	54	40	83	96	99
Smoking Advice given	49	66	38	80	75	68	81	89	100
Eye Exam performed	30	36	10	21	38	21	68	68	57
Foot Exam performed	67	66	30	50	46	60	80	84	86
Microalbumin obtained	74	62	22	36	42	40	14	62	47
<i>Flu Vaccine given</i>	46	38	26	30	32	46	18	53	35
Pneumovax given	73	74	38	49	58	48	60	70	73
<i>Depression assessed</i>	23	27	34	48	37	35	82	95	99
Hypertension Process									
% BP assessed	90	92	75	84	86	82	81	87	86
Diabetes Outcome									
HbA _{1c} < 7.0 %	36	42	38	46	33	34	44	55	42
BP<130/80 mmHg	53	57	37	33	43	41	42	38	37
LDL<100 mg/dL	50	60	47	49	51	52	65	57	58
Hypertension Outcome									
BP < 140/90 mmHg	62	67	56	65	55	58	58	60	56

BP = blood pressure; Self-Mgmt. = self-management

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