

Using Health Information Technology to Improve Adherence to Opioid Prescribing Guidelines in Primary Care

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Objective: To evaluate the impact of a clinical dashboard for opioid analgesic management on opioid prescribing and adherence to opioid practice guidelines in primary care.

Methods: A pre/postimplementation evaluation using electronic health record (EHR) data from patients receiving chronic opioid therapy (COT) between April 1, 2011 and March 31, 2013. Measures include annual proportions of COT patients who received urine drug testing, signed an opioid treatment agreement, had a documented assessment of pain-related functional status, and had at least 1 visit with a behavioral health provider.

Results: Adherence to several opioid prescribing guidelines improved in the postimplementation year compared with the preimplementation year: (1) the proportions of COT patients with a signed opioid treatment agreement and urine drug testing increased from 49% to 63% and 66% to 86%, respectively. The proportion of COT patients with a documented assessment of functional status increased from 33% to 46% and those with a behavioral health visit increased from 24% to 28%. However, there was a small decline in the proportion of patients prescribed COT from 3.4% to 3.1%.

Discussion: Implementation of an opioid dashboard led to increased adherence to certain opioid practice guidelines and a decline in COT. This may be attributable to more efficient team-based pain management facilitated by the dashboard and increased transparency of opioid prescription practices. Health Information Technology solutions such as clinical dashboards can increase adherence to practice guidelines.

Key Words: health information technology, chronic pain, quality improvement, opioids

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More than half of the estimated 100 million Americans who report chronic pain¹ receive care in the primary care setting, where opioid analgesic medications are increasingly being used for managing acute and chronic noncancer pain.² Rates of opioid sales have increased 4-fold between 1999 and 2010,³ and although opioids are an

appropriate therapeutic option in certain circumstances,⁴ there is limited evidence for their efficacy in long-term pain management.⁵ In addition, the use of prescription opioid analgesics is associated with significant risks due to their side-effect profile, addictive properties, and potential for diversion.⁶ Morbidity and mortality from prescription opioid overdoses has increased 5-fold for women and 3.6 times for men between 1999 and 2010.⁷ Straightforward and effective solutions, such as those leveraging the power of information technology, are needed to help primary care providers (PCPs) apply evidence-based strategies to address this significant public health problem.

Practice guidelines for the use of chronic opioid therapy (COT) for pain management have been developed to improve patient safety and reduce the risk of diversion and physical dependence or addiction. Recommendations include the routine use of urine drug testing (UDT), opioid treatment agreements (OTAs),^{8–11} and the frequent reassessment of pain severity and functional status.⁹ Use of these tools may help improve adherence to COT.¹² In addition, guidelines recommend consultation or comanagement with behavioral health providers, particularly for patients with a history of psychosocial comorbidities and/or addiction issues.⁹

However, studies suggest that adopting opioid practice guidelines is challenging for PCPs.¹³ Most primary care practices have limited resources to monitor and care for patients with chronic medical conditions such as chronic pain¹⁴ and face time constraints that limit the delivery of comprehensive care for chronic conditions¹⁵ including opioid management.^{16,17} Therefore, use of OTA and UDT is low.^{6,18,19}

There is evidence that Health Information Technology (HIT) can improve physician adherence to treatment guidelines.^{20–23} Clinical dashboards are condition-specific, web-based HIT applications for quality reporting and patient management that can help healthcare teams by providing them with timely, clinically relevant information at the practice or individual provider level.²⁴ Dashboards can display adherence to care measures,²⁵ provide performance improvement comparisons,^{26,27} (eg, individual performance against that of the entire clinic) and “drill down” from population level to individual-patient level data.²⁸ Dashboards have been developed to support specific quality improvement initiatives^{29,30} and for a variety of conditions^{31–33} but have not, to our knowledge, been developed for opioid analgesic management.

Patients with lower socioeconomic status are particularly impacted by chronic pain³⁴ and have fewer resources to address these challenges. To improve adherence to practice guidelines and agency policies for COT, we developed, implemented, and evaluated a clinical dashboard for opioid analgesic management in a large, multisite Federally Qualified Health Center (FQHC). The display of structured data was designed to help front-line providers caring for medically

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underserved patients quickly identify their patients receiving COT for pain management and to provide timely, accurate, and actionable data on patients' OAT, UDT, functional status assessments, and behavioral health appointments. Our hypothesis was that providers would be motivated to follow these practice guidelines when information on their opioid prescribing and adherence rates was made available to them.

METHODS

Setting

Community Health Center Inc. (CHCI) is a multisite FQHC in Connecticut providing comprehensive primary care services for over 140,000 medically underserved patients. Chronic pain and opioid misuse are extremely common in this population.³⁵ Medical care at CHCI is delivered by primary care teams comprised of nurses (registered nurse and/or licensed practical nurse), medical assistants, and PCPs, including internists, pediatricians, family doctors, physician assistants, and family and adult nurse practitioners.

CHCI's policy for COT for pain management is based on current practice guidelines⁸⁻¹¹ and requires that all patients receiving COT have: (1) an OTA; (2) urine toxicology screens at least once every 6 months; and (3) pain and functional status reassessed at least every 3 months using a formal assessment tool. In addition, the policy recommends interdisciplinary comanagement between primary care and behavioral health providers for all patients reporting chronic pain. Providers are required to review this policy for pain management at the time of employment and annually thereafter. However, data on adherence rates has not been available before creation of the dashboard.

All primary care team members play a role in caring for patients with chronic pain. PCPs are responsible for all longitudinal care including pain management. Nurses often see patients independently to provide education and care coordination. Medical assistants administer screening questions including the numeric pain rating scale and assist with obtaining and documenting OTA and UDT.

CHCI uses a fully integrated EHR for all medical, dental, and behavioral healthcare. Structured data from all clinical visits, patient demographics, prescriptions, referrals, laboratory orders, and test results are housed in a customized clinical data warehouse. In addition, scanned documents including pain and functional status assessment forms and OTAs are stored in specifically labeled electronic folders in the EHR. The warehouse updates every 24 hours, is secure, subject oriented, and built to meet or exceed all International Organization for Standardization standards. This study was reviewed and approved by the Institutional Review Board of CHCI.

Identification of Patients Receiving Opioids Chronically

For the purposes of this study, COT was defined as the patient's use of any individual or combination of nonliquid oral or transdermal opioids, excluding buprenorphine, for 90 days or more, contiguous or noncontiguous, during the previous 365 days. Duration of opioid use was determined from the "duration" field in the electronic prescription. For prescriptions in which the duration field was blank, we estimated the duration by dividing the total number of pills

dispensed by the daily frequency ordered. For example, an opioid prescription with instructions to "take two pills BID, dispense 60 pills," would account for 15 days of opioid use. For prescriptions written as "PRN" without an indicated duration of use, we assumed that the opioid was taken for the maximum indicated frequency. For example, a prescription with instructions to "take one pill daily PRN, dispense 30" would account for 30 days of opioid use.

Clinical Dashboard for Opioid Analgesic Management

The dashboard was developed to serve as a central, actionable data repository where PCPs and other members of the care team could access information regarding their patients receiving COT. Providers could see their rate of adherence to CHCI's COT practice guidelines in comparison with their colleagues. Two programmers working closely with the research and clinical leadership teams at CHCI used Microsoft Sequel Server Reporting Services to query the data warehouse for information on patients meeting criteria for COT. Reports were built from this information (eg, presence of a completed OTA in the charts), ultimately feeding into the display of the dashboard, which was housed on an agency-wide Microsoft SharePoint page. After 3 months of development and testing, the dashboard was introduced to all clinical staff during an agency-wide grand rounds presentation on April 27, 2012. During this introduction, providers and pod members were shown how to locate the dashboard on the intranet, and use it at their discretion to plan care and assess their performance.

The dashboard displayed a summary page of key COT statistics for all PCPs at the agency. These included the number and percentage of adult patients receiving COT in each PCP's panel and the number and percentage of the patients who: (1) had an OTA signed and scanned into the medical record, (2) had an UDT screen within the past 6 months, (3) had a structured pain and functional assessment questionnaire completed and scanned in the medical record within the past 3 months, and (4) had been seen by a behavioral health provider at least once in the past year. Providers could also "drill down" to a list of all individual patients, view their detailed COT-related information (including dates of upcoming appointments), and determine which patients were due for any of these items. Team members could browse the dashboard, sort, export, or print out the data. Figure 1 shows selected screenshots of the dashboard. In addition to the dashboard, PCPs, nurses, and medical assistants received a weekly feedback report called the "Missed Opportunities Report." This report contained the names of patients receiving COT who had been seen by their PCP in the preceding week, were due for an OTA, a UDT, or a pain-specific functional assessment and did not receive 1 or more of these items.

To evaluate the impact of the clinical dashboard on opioid prescribing and adherence to opioid practice guidelines we examined data gathered during the dashboard preimplementation year from April 2011 to March 2012 and during the postimplementation year from April 2012 to March 2013. Our study samples consisted of CHCI patients aged 18 years and older and receiving COT. We compared the clinical and demographic characteristics of these patients between the 2 years. We also compared the proportions of COT patients who received UDT, signed an OTA, had a documented assessment of pain-related functional status, and had at least 1 visit with a behavioral



Data as of: 10/31/2014

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	Total of Current Opioid Patients	Panel Size (12-mon)	% of Panel on Chronic Opioids	Total of 1-Utox Patients (6-mon)	% Utox Completed	Total of Contract Patients (ever)	% of Opioid Contract (ever)	Total of Contract Patients (12-mon)	% of Opioid Contract (12-mon)	Patients Not Seen (Med) within 3-mon	% Not Seen within 3-mon	Patients Seen By BH within 3-mon	% Seen By BH within 3-mon	Facility
Provider 1	7	870	0.80%	7	100.00%	6	85.71%	3	42.86%	0	0.00%	3	42.86%	CHC Site 1
Provider 2	55	1239	4.44%	35	63.64%	49	89.09%	41	74.55%	5	9.09%	2	3.64%	CHC Site 2
Provider 3	53	1182	4.48%	42	79.25%	47	88.68%	36	67.92%	4	7.55%	4	7.55%	CHC Site 3
Provider 4	4	172	2.33%	3	75.00%	4	100.00%	2	50.00%	0	0.00%	0	0.00%	CHC Site 4
Provider 5	65	828	7.85%	33	50.77%	18	27.69%	7	10.77%	5	7.69%	12	18.46%	CHC Site 5
Provider 6	21	811	2.59%	19	90.48%	20	95.24%	16	76.19%	2	9.52%	5	23.81%	CHC Site 6
Provider 7	4	1129	0.35%	4	100.00%	3	75.00%	3	75.00%	0	0.00%	1	25.00%	CHC Site 7
Provider 8	27	1207	2.24%	11	40.74%	18	66.67%	7	25.93%	1	3.70%	5	18.52%	CHC Site 4
Provider 9	76	1046	7.27%	48	63.16%	32	42.11%	8	10.53%	2	2.63%	9	11.84%	CHC Site 8
Provider 10	2	836	0.24%	2	100.00%	2	100.00%	1	50.00%	0	0.00%	1	50.00%	CHC Site 3
Provider 11	1	29	3.45%	1	100.00%	0	0.00%	0	0.00%	0	0.00%	1	100.00%	CHC Site 2
Provider 12	9	1102	0.82%	6	66.67%	6	66.67%	4	44.44%	0	0.00%	2	22.22%	CHC Site 3
Provider 13	18	410	4.39%	15	83.33%	12	66.67%	9	50.00%	0	0.00%	7	38.89%	CHC Site 5
Provider 14	3	191	1.57%	3	100.00%	3	100.00%	1	33.33%	0	0.00%	2	66.67%	CHC Site 5

Chronic Opioid Patients

Provider 1

	Gender	Race	Last Med Encounter w/ PCP	Next Medical Visit	Last Utox Date	Currently On Opioid (Y/N)	Under Opioid Contract (Y/N)	Last BH Date	Next BH Visit	Last Visited BH Provider	Last Visited BH Site
Patient 1	F	Hispanic	10/xx/2014	10/xx/2014	7/xx/2014	Y	Y	1/xx/2014		BH Provider 1	CHC Site 1
Patient 2	F	White	8/xx/2014		8/xx/2014	Y	N	10/xx/2014		BH Provider 1	CHC Site 1
Patient 3	M	Black or African American	9/xx/2014	10/xx/2014	7/xx/2014	Y	Y				
Patient 4	M	American	10/xx/2014		10/xx/2014	Y	Y	2/xx/2013		BH Provider 2	CHC Site 2
Patient 5	M	Hispanic	10/xx/2014	10/xx/2014	6/xx/2014	Y	Y	10/xx/2014	11/xx/2014	BH Provider 1	CHC Site 1
Patient 6	F	White	8/xx/2014	10/xx/2014	8/xx/2014	Y	Y	8/xx/2014		BH Provider 1	CHC Site 1
Patient 7	F	Hispanic	10/xx/2014		6/xx/2014	Y	Y	8/xx/2013		BH Provider 3	CHC Site 1

FIGURE 1. Select images of the opioid dashboard as viewed on the CHCI SharePoint page. *All patient and provider identifiers have been removed.

health provider. Nine months after implementation of the dashboard, the use of the scanned functional assessment form was discontinued in favor of an online pain management template. We compared this data for the time during which the scanned questionnaires were in use. Descriptive statistics were used to analyze the data. For comparisons, we used the χ^2 test to compare proportions, and the Student *t* test to compare means. All tests were 2-sided and considered significant at *P* < 0.05.

We also administered a web-based survey to CHCI PCPs 1 year after the implementation, asking about actual use and satisfaction with the dashboard. All providers received an email invitation to complete the survey and a reminder 2 weeks later.

RESULTS

Patient Characteristics

During the year before implementation 1309 patients had received COT or 3.4% of all CHCI patients aged 18 years and above with at least 1 medical primary care visit during that year compared with 1270 patients or 3.1% of all CHCI adult patients with at least 1 medical primary care visit in the postimplementation year. Table 1 shows the demographics and selected clinical characteristics of patients who received COT for the 2 study periods; there were no statistically significant differences between the 2 years.

Changes in Guideline Adherence Measures

Table 2 shows the changes in rates of UDTs, OTAs, pain and functional assessments, and behavioral health comanagement for patients receiving COT in the year preceding the dashboard compared with the 1-year period after its implementation. One year after implementation, 806 out of 1270 (63%) COT patients had an OTA, increased from 645 of 1309 (49%). The number of COT patients with a UDT within the preceding 6 months increased from 867 (66%) to 1097 (86%). The percentage of COT patients with at least 1 behavioral health visit in the past year increased from 317 (24%) to 355 (28%). All 3 changes were statistically significant. Patients with a completed pain functional assessment within the preceding 3 months increased from 428 (33%) to 589 (46%) after 9 months of dashboard use. After this time, CHCI changed its policy on functional assessment form completion so that it was no longer collected on forms, but rather in templates within the EHR. Figure 2 displays the steady increases in UDTs, OTAs, and functional assessments seen at select time points after the dashboard's implementation.

Opioid Prescribing

There was a small but statistically significant decline in the percentage of adult patients who received prescriptions for opioid analgesics. In the year before implementation of the dashboard, 5055 (13.0%) out of 38,873 adult patients with at least 1 medical visit during the year received 1 or

TABLE 1. Demographic and Selected Clinical Characteristics of Patients Who Received COT

	Preimplementation Year, N (%)	Postimplementation Year, N (%)
Total patients	1309 (100)	1270 (100)
Sex		
Female	767 (58.6)	744 (58.6)
Age		
18-29	62 (4.7)	59 (4.6)
30-39	194 (14.8)	186 (14.6)
40-49	383 (29.3)	350 (27.6)
50-59	434 (33.2)	424 (33.4)
60-69	175 (13.4)	189 (14.9)
70 +	61 (4.7)	62 (4.9)
Race		
White	754 (57.6)	696 (54.8)
Black	170 (13.0)	162 (12.8)
Hispanic	361 (27.6)	386 (30.4)
Other	16 (1.2)	22 (1.7)
Unreported	8 (0.6)	4 (0.3)
Insurance		
Medicaid	792 (60.5)	791 (62.3)
Medicare	341 (26.1)	301 (23.7)
Private insurance	102 (7.8)	92 (7.2)
Other public insurance	1 (0.1)	2 (0.2)
Uninsured	73 (5.6)	84 (6.6)
Pain scores		
Pain > 4 × 2	1172 (89.5)	1132 (89.1)
Pain > 8	1056 (80.7)	1044 (82.2)

more prescriptions for an opioid medication. In the following year this percentage decreased to 5081 out of 40,629 (12.5%) ($P = 0.036$). The percentage of patients receiving COT also declined, from 1309 (3.4%) to 1270 (3.1%) ($P = 0.057$).

Survey Results

Fourteen of the 53 PCPs with patients on COT in the postimplementation period responded to the satisfaction survey (26.4% response rate). Fifty-four percent of survey respondents felt that the missed opportunities report was helpful. Eighty-five percent of responders reported that the dashboard helps them identify patients on chronic opioids, and gaps in services for patients. Fifty-four percent reported that the clinical dashboard helps them to plan care for these patients and 69% felt that it was easy to use the dashboard to help collaborate about a patient with their

TABLE 2. Comparison of Adherence to CHCI COT Guidelines Preimplementation and Postimplementation of the Dashboard

Patients Receiving COT With	Preimplementation Year (N = 1309)	Postimplementation Year (N = 1270)	P
Opioid agreement, N (%)	645 (49.3)	806 (63.5)	< 0.001
Urine toxicology within 6 mo, N (%)	867 (66.2)	1,097 (86.4)	< 0.001
CHCI behavioral health visit, N (%)	317 (24.2)	355 (27.9)	0.03
Pain functional assessment within 3 mo*, N (%)	428 (32.7)	589 (46.4)	< 0.001

*Based on 9 months of data.

team. Overall, 77% of PCPs felt that the dashboard was clinically useful.

DISCUSSION

Implementation of the dashboard was associated with an increase in the use of OTAs, UDTs, pain and functional assessment questionnaires, and behavioral health visits. In addition, there was a small but clinically significant reduction in the percentage of adult patients receiving COT.

HIT is increasingly being used to improve the quality and efficiency of healthcare delivery, patient safety, and patient-centered care.³⁶ Our study is unique in its use of HIT to improve opioid prescribing for pain, but consistent with other studies that have demonstrated the use of HIT technologies to improve medication adherence, increase the safety of electronic prescribing,³⁷ and increase physician adherence to treatment protocols.²⁰⁻²²

Use of opioids to treat chronic pain has increased by a factor of 10 since 1990,³⁸ and with this increase has come a substantial increase in emergency room visits and deaths due to unintentional prescription opioid overdoses.³⁹ There is wide variation in PCPs' opioid prescribing patterns^{6,35,40-44} and in their adherence to guidelines for documentation and management of pain.^{45,46} Surveys of providers suggest that use of opioid treatment guidelines and UDT monitoring are low with only 43% of providers reporting the use of treatment agreements¹⁸ and between 8% and 26% routinely using UDT,^{6,47,48} far lower rates than those achieved in this study. Although some targeted interventions have been shown to increase rates of UDT^{49,50} and the use of opioid agreements,⁵⁰ ours is the first to use an information technology solution. Further studies are needed to explore the impact of adherence to these guidelines on meaningful clinical outcomes.

Several factors may explain the improvements we observed in adherence to opioid practice guidelines. The dashboard provided actionable data that providers could use prospectively in planning care for patients with upcoming visits because it targets process measures (vs. patient outcome measures). Many PCPs utilized the dashboard during morning "huddles" during which they reviewed the dashboard with their support staff, noted which patients were due for pain management follow-up care, and assigned tasks to the appropriate staff member to obtain the needed items. This observation suggests that improvements may be partly attributable to the motivation gain effect.^{51,52} This effect is seen when an individual's performance and motivation improves as a member of a team working under conjunctive task demands, than the individual working alone, especially when that individual feels indispensable to the team.^{53,54} The transparency and availability of the opioid guideline adherence data on a webpage, results in continuous performance feedback that in turn may result in social comparisons, may promote a revising of performance goals, and feelings of heightened implicit competitiveness.^{53,55,56} In addition, impression management (ie, the desire to create a favorable impression) may also have led to enhanced focus on these particular standards. Although only 54% of providers who noted using the dashboard felt that the missed opportunities report was useful, they may still have been motivated by such public disclosure to improve their adherence to the measured guidelines.

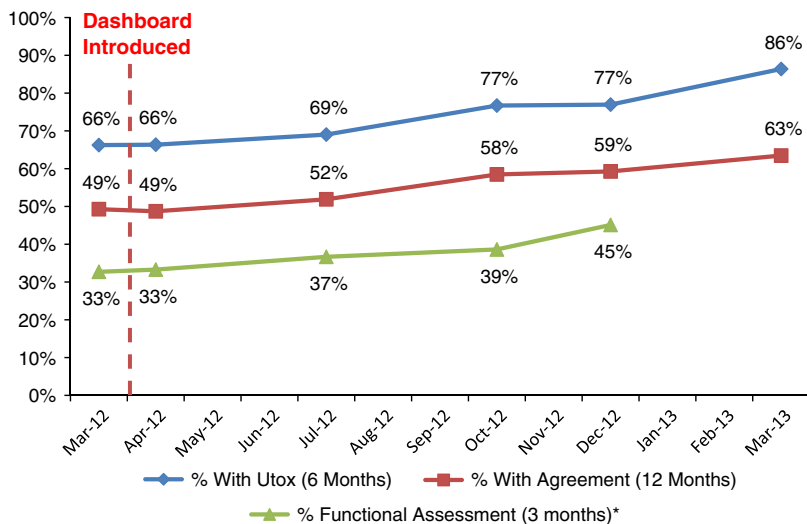


FIGURE 2. Opioid agreements, UDT monitoring and functional status rates for COT patients over the year in which the dashboard was available. *Based on 9 months of date.

We also observed a small decline in the percentage of adult patients receiving COT after the introduction of the dashboard. Although the numbers are small, any stabilization or reduction in the rates of opioid prescribing may be clinically significant in light of the overall trend toward increased opioid prescribing nationwide.³ Providing information on percent of patients in each provider’s panel receiving opioids may have called attention to provider variation in opioid prescribing and led higher prescribing providers to alter their prescribing patterns and reduce reliance on opioids. Increases in OTAs may have led clinicians to more strictly monitor and regulate opioid use. In addition, increasing use of UDTd may have increased identification of aberrant use of prescription opioids⁵⁷ and prompted clinicians to cease prescribing opioids in such circumstances. Further studies are needed to explore the impact of interventions such as ours on provider prescribing patterns.

There is the need for further study providers’ use of the tool and its impact on practice, now that the dashboard has been implemented and demonstrated to be effective. Future modifications are planned to enhance this tool. During the next phase of dashboard development, we plan to add more detail on daily-prescribed morphine equivalent doses⁵⁸ and identify potentially dangerous combinations of medications, such as opioids coprescribed with benzodiazepines. Providing this additional data to providers may further help to identify variations in guideline adherence and call attention to areas where additional education or supervision are needed.

This project had several limitations. First, the lack of a control group limits the ability to assert causality between the implementation of the dashboard and the changes observed in guideline adherence. However, run-in data collected before introduction of the dashboard showed no improvement in any of the measures, although improvement was noted immediately after its implementation with steady increases over the ensuing 12 months. Another limitation was the decision to include patients who received 90 days of opioids noncontiguously on the dashboard. This decision was made to increase the ability to detect patients who were using opioids chronically, but may have experienced treatment

interruptions or used them regularly but intermittently. This may have resulted in some patients being included in the analysis that were felt by the provider not to represent chronic opioid users and therefore not required to have an opioid agreement, UDT, or functional assessment. Furthermore, OTAs were completed on paper forms that had to be scanned into a folder in the EHR to be “counted” on the dashboard and in our data collection. It is possible that some OTAs were completed but not scanned correctly. Lastly, we were not able to reliably assess how regularly the clinical teams used the dashboard. Our survey at the end of the postimplementation year with CHCI providers did offer insights into the dashboard use but the limited response rate may have underestimated the dashboard use.

Providing effective care for patients with chronic pain is challenging, particularly in under-resourced settings such as FQHCs. PCPs often feel like they are caught between the competing imperatives of alleviating pain and suffering and avoiding contributing to the growing problem of prescription medication abuse. The opioid dashboard provided a valuable tool for front-line providers to help improve adherence to important treatment guidelines that in turn, may reduce the negative consequences of opioid misuse. As healthcare becomes increasingly complex, HIT solutions such as this are needed to help a heavily burdened primary care system meet the needs of patients in an evidence-based, patient-centered manner.

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