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Short Communication

Electronic health records and outpatient cardiovascular disease care delivery: Insights from the American College of Cardiology's PINNACLE India Quality Improvement Program (PIQIP)

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ABSTRACT

Background: There has been a push toward implementation of electronic health records (EHRs) in federally-funded hospitals under the current policies initiated by the Indian government, with a lack of evidence supporting their adoption. We analyzed data from the American College of Cardiology's PINNACLE (Practice Innovation and Clinical Excellence) India Quality Improvement Program (PIQIP) to evaluate the association between EHR use and quality of cardiovascular disease care in India.

Methods and Results: Between 2011–2016, we collected data on performance measures for patients with coronary artery disease (CAD), heart failure (HF) and atrial fibrillation (AF) among 17 participating practices in PIQIP. There were 19,035 patients with CAD, 9,373 patients with HF, and 1,127 patients with AF. Documentation of co-morbidity burden in patients with CAD was lower among practices with EHR—hypertension (49.8% vs. 52.1%, $p = 0.003$), diabetes (34.9% vs. 38.3%, $p < 0.001$), and hyperlipidemia (0.2 vs. 3.9%, $p < 0.001$). On the contrary, documentation of medication prescription was higher in CAD patients seen at practices with EHR—aspirin (63.2% vs. 17.8%, $p < 0.001$), clopidogrel (41.7% vs. 27.4%, $p < 0.001$), beta-blockers (61.4% vs. 9.8%, $p < 0.001$), and ACE-i or ARBs (53.9% vs. 16.4%, $p < 0.001$). Similarly, documentation of receipt of beta-blockers (43.8% vs. 10.7%, $p < 0.001$), ACE-i or ARBs (40.8% vs. 16.1%, $p < 0.001$), and beta-blockers + ACE-i or ARBs (36.4% vs. 3.6%, $p < 0.001$) was also significantly higher in patients with HF seen at practices with EHR. Among patients with AF, documentation of oral anticoagulation use was significantly higher among EHR practices—warfarin (42.5% vs. 26.1%, $p < 0.001$).

Conclusions: Documentation of receipt of guideline-directed medical therapy in CAD, HF, and AF was significantly higher in practices with EHRs in India compared with sites without EHRs. Our findings shed a spotlight on the value of EHRs in future health care policy-making in India with regard to

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widespread adoption of EHRs in primary and advanced specialty care settings across public and private sectors.

PINNACLE India Quality Improvement Program (PIQIP) is India's first outpatient cardiovascular registry established by the American College of Cardiology (ACC) for performance measurement of coronary artery disease (CAD), heart failure (HF), and atrial fibrillation (AF).[1] Not all sites that contribute data in the PIQIP registry have electronic health record (EHRs)-facilitated documentation capabilities for data collection and entry. There is a push toward implementation of EHRs in federally-funded hospitals in India under the policies initiated by the Indian government.[2] The evidence-base supporting this policy change is lacking.[3] This study evaluated the impact of EHRs on documentation of guideline-directed medical therapy (GDMT) in CAD, HF, and AF in India.

Data on GDMT use was collected on patients seeking care among 17 participating cardiology practices in PIQIP between 2011 and 2016. Diagnoses of CAD, HF, and AF were determined based on physicians' documentation on the OPD card.[1] The HF cohort comprised of patients with a documented left ventricular ejection fraction $\leq$40%. GDMT for patients with CAD included prescription of aspirin, clopidogrel, beta-blockers, and angiotensin-converting enzyme inhibitors (ACE-i) or angiotensin receptor blockers (ARBs). For HF patients, GDMT included prescription of beta-blockers, ACE-i or ARBs, and the combination of beta-blockers + ACE-i or ARBs. GDMT for AF included warfarin use. Data on GDMT for each condition represents use of medications by unique patients at any encounter during the study interval. We first assessed differences in baseline characteristics between patients seeking care in EHR versus non-EHR practices. Individual medication prescription for each of the disease states was compared between EHR and non-EHR practices. We then performed logistic regression analyses adjusting for patient's age, sex, practice location (urban vs. rural), history of hypertension or diabetes mellitus, and number of outpatient visits during the study interval to determine whether presence of EHR was independently associated with better documentation of quality. Data integrity was ensured by randomly sampling 25% OPD cards.[1]

There were 19,035 patients with CAD (13,619 in EHR practices), 9373 patients with HF (8923 in EHR practices), and 1127 patients with AF (431 in EHR practices). Of the 17 practices, only 2 had fully-integrated and operational EHRs. The mean age of the study population was 51.0 $\pm$ 17.6 years, and 67.1% were men. The mean number of encounters per patient were 2.7, with more encounters per patient in non-EHR practices compared with EHR practices (4.4 vs. 2.1). Documentation of co-morbidity burden in patients with CAD was lower among practices with EHR—hypertension (49.8% vs. 52.1%, $p = 0.003$), diabetes (34.9% vs. 38.3%, $p < 0.001$), and hyperlipidemia (0.2 vs. 3.9%, $p < 0.001$). On the contrary, documentation of medication prescription was higher in CAD patients seen at practices with EHR—aspirin (63.2% vs. 17.8%, $p < 0.001$), clopidogrel (41.7% vs. 27.4%, $p < 0.001$), beta-blockers (61.4% vs. 9.8%, $p < 0.001$), and ACE-i or ARBs (53.9% vs. 16.4%, $p < 0.001$). Similarly, documentation of receipt of beta-blockers (43.8% vs. 10.7%, $p < 0.001$), ACE-i or ARBs (40.8% vs. 16.1%, $p < 0.001$), and beta-blockers + ACE-i or ARBs (36.4% vs. 3.6%, $p < 0.001$) was also significantly higher in patients with HF seen at practices with EHR. Among patients with AF, documentation of warfarin use was significantly higher among EHR practices — 42.5% vs. 26.1%, $p < 0.001$ (Table 1). In adjusted logistic regression analyses, presence of EHR was independently associated with better documentation of medication prescription across the spectrum of cardiovascular diseases — CAD (aspirin, OR 11.62 [95% CI 10.6–12.8]; clopidogrel, OR 2.05 [95% CI 1.9–2.2]; beta-blockers, OR 31.95 [95% CI 28.0–36.4]; and ACE-i or ARBs, OR 8.62 [95% CI 7.8–9.5]), HF (beta-blockers, OR 78.60 [95% CI 48.9–126.2]; ACE-i or ARBs, OR 12.90 [95% CI 9.3–18]; and beta-blockers + ACE-i or ARBs, OR 649.2 [95% CI 305–1382.1]), and AF (warfarin, OR 1.84 [95% CI 1.5–2.2]).

Our results indicate that the documentation of receipt of GDMT in CAD, HF, and AF was significantly higher in practices with EHR in India compared with sites without EHR. Study limitations include lack of data on medication contraindications that along with variable documentation practices in India may have impacted GDMT prescription. Our results cannot be entirely explained by better documentation because of EHR use, as baseline co-morbidities were more frequently documented in practices with no EHR.

Our findings have implications in future health care policy-making in India with regard to widespread adoption of EHRs in primary and advanced specialty care OPDs in both public and private health care settings.

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Disclosures

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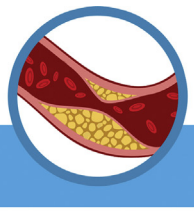
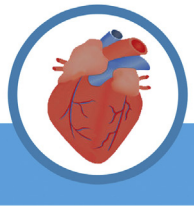
Dr. Deepak L. Bhatt discloses the following relationships – Advisory Board: Cardax, Elsevier Practice Update Cardiology, Medscape Cardiology, Regado Biosciences; Board of Directors: Boston VA Research Institute, Society of Cardiovascular Patient Care; Chair: American Heart Association Quality Oversight Committee; Data Monitoring Committees: Duke Clinical Research Institute, Harvard Clinical Research Institute, Mayo Clinic, Population Health Research Institute; Honoraria: American College of Cardiology (Senior Associate Editor, Clinical Trials and News, ACC.org), Belvoir Publications (Editor in Chief, Harvard Heart Letter), Duke Clinical Research Institute (clinical trial steering committees), Harvard Clinical Research Institute (clinical trial steering committee), HMP Communications (Editor in Chief, Journal of Invasive Cardiology), Journal of the American College of Cardiology (Guest Editor; Associate Editor), Population Health Research Institute (clinical trial steering committee), Slack Publications (Chief Medical Editor, Cardiology Today's Intervention), Society of Cardiovascular Patient Care (Secretary/Treasurer), WebMD (CME steering committees); Other: Clinical Cardiology (Deputy Editor), NCDR-ACTION Registry Steering Committee (Chair), VA CART Research and Publications Committee (Chair); Research Funding: Amarin, Amgen, AstraZeneca, Bristol-Myers Squibb, Eisai, Ethicon, Forest Laboratories, Ischemix, Lilly, Medtronic, Pfizer, Roche, Sanofi Aventis, The Medicines Company; Royalties: Elsevier (Editor, Cardiovascular Intervention: A Companion to Braunwald's Heart Disease); Site Co-Investigator: Biotronik, Boston Scientific, St. Jude Medical; Trustee: American College of Cardiology; Unfunded Research: FlowCo, PLx Pharma, Takeda.

Table 1



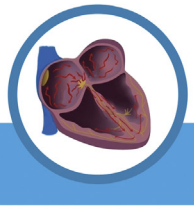
Coronary artery disease (n= 19,035)

	Practices with EHR (n=13619)	Practices without EHR (n=5416)	P value
Hypertension	6776 (49.8%)	2823 (52.1%)	0.003
Diabetes mellitus	4754 (34.9%)	2072 (38.3%)	<0.001
Hyperlipidemia	27 (0.2%)	213 (3.9%)	<0.001
Aspirin	8607 (63.2%)	964 (17.8%)	<0.001
Clopidogrel	5679 (41.7%)	1483 (27.4%)	<0.001
Beta-blockers	8365 (61.4%)	530 (9.8%)	<0.001
ACE-i or ARBs	7346 (53.9%)	888 (16.4%)	<0.001



Heart failure
(left ventricular ejection fraction ≤ 40%) (n=9373)

	Practices with EHR (n=8925)	Practices without EHR (n=448)	P value
Beta-blockers	3907 (43.8%)	48 (10.7%)	<0.001
ACE-i or ARBs	3644 (40.8%)	72 (16.1%)	<0.001
Beta-blockers + ACE-i or ARBs	3248 (36.4%)	16 (3.6%)	<0.001
Diuretics	3073 (34.4%)	230 (51.3%)	<0.001



Atrial fibrillation (n= 1127)

	Practices with EHR (n=8925)	Practices without EHR (n=448)	P value
Warfarin	183 (42.5%)	182 (26.1%)	<0.001

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ihj.2018.03.002.

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