EP News: Quality Improvement and Outcomes

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In this issue of **Heart**Rhythm, we present a new quarterly feature highlighting quality improvement in the delivery of heart rhythm care. These quarterly features will summarize key publications of relevance to the electrophysiology community and provide a forum for recognizing the growing importance of measuring, reporting, and improving the quality of heart rhythm care.

The Heart Rhythm Society (HRS) already has a long tradition of quality improvement. Historically, quality improvement at HRS has been grounded in strong leadership in health policy relating to heart rhythm care through various efforts, including engagement with stakeholder groups focused on quality, such as clinical registry programs, and in the development of HRS-led electrophysiology-specific performance measures. More recently, the HRS Board of Trustees has identified quality improvement as a particular area of strategic importance to the Society, with a specific charge to raise the level of expertise in quality improvement within our organization and among our membership.

The establishment of this feature in **Heart**Rhythm reflects the importance of quality improvement in our field. We support the Society's effort to contribute to better understanding of quality improvement in the heart rhythm community. We look forward to sharing these ideas and learning with you.

Piloting a multifaceted, electronic medical record–based intervention to improve prescription of anticoagulation (SUPPORT AF)

Kapoor et al (J Am Heart Assoc 2018;7:e009946, PMID 30371161) conducted a prospective quality improvement initiative to assess whether use of an electronic medical record–based intervention could improve use of oral anticoagulation for the prevention of atrial fibrillation–related stroke. The intervention had 2 parts. First, providers were informed of their oral anticoagulation-prescribing patterns relative to their peers. Second, electronic medical record messages were sent the day before they saw a patient with atrial fibrillation who was eligible for, but not receiving, oral anticoagulation. After 10 weeks, among the 227 providers, there was no change in oral anticoagulation utilization in either the cardiology (0.2% lower) or primary care (0.01% higher) providers relative to controls. *Based on these data, the authors conclude that the use of an electronic medical record–based intervention is feasible but, by itself, did not improve utilization of oral anticoagulation in their practice environment.*

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A multifaceted intervention to improve treatment with oral anticoagulants in atrial fibrillation (IMPACT-AF): An international, cluster-randomized trial

Vinereanu et al (Lancet 2017;390:1737, PMID 28859942) conducted a 2-arm, prospective, international, cluster-randomized, controlled trial to test the effectiveness of a multifaceted intervention to improve anticoagulation utilization in patients with atrial fibrillation. Centers (n = 48) were randomized 1:1 to a quality improvement educational intervention or usual care. The intervention involved the education of both providers and patients. The primary outcome was the change in the proportion of patients with atrial fibrillation and an indication for stroke prevention who were treated with oral anticoagulation. Oral anticoagulation increased in the intervention group from 68% at baseline to 80% at 1 year vs 64%–67% in the control group (absolute difference 9.1%; odds ratio 3.28; 95% confidence interval 1.67–6.44; $P = .0002$). There was also a reduction in the secondary outcome of stroke in the intervention group relative to the control group (hazard ratio 0.48; 95% confidence interval 0.23–0.99; $P = .0434$). *Based on these findings, the authors conclude that a multifaceted and multilevel educational intervention can improve stroke prevention in patients with atrial fibrillation across the globe.*

Prevention of arrhythmia device infection (the PADIT Trial results)

Krahn et al (J Am Coll Cardiol 2018;72:3098, PMID 30545448) conducted a cluster randomized crossover trial with waived consent that tested a strategy of conventional vs incremental periprocedural antibiotics for all cardiac implantable electronic device procedures. The conventional treatment included preprocedural cefazolin infusion, while the incremental treatment included preprocedural cefazolin plus vancomycin, intraprocedural bacitracin pocket wash, and oral cephalexin (500 mg 4 times per day) for 2 days postprocedure. The primary outcome was 1-year hospitalization for device infection in high-risk patients (any repeat procedures on an existing pocket) after adjustment for random cluster and cluster-period effects. Among 19,603 patients enrolled at 28 centers, 12,842 were high-risk procedures. Infection occurred in 1.03% receiving conventional treatment and 0.78% receiving incremental treatment. Among high-risk patients, the primary end point of hospitalization for infection occurred in 77 patients (1.23%) in the conventional arm and in 66 patients (1.01%) receiving incremental antibiotic treatment ($P = .26$). The analysis of subgroups did not identify any patient characteristics associated with benefit from incremental antibiotic therapy. *The authors conclude that device infection rates in contemporary practice are low and that a strategy of incremental antibiotics (bacitracin pocket wash and postprocedure cephalexin) did not significantly reduce infection risk in patients undergoing cardiac implantable electronic device procedures.*

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EP News: Quality Improvement and Outcomes

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This is the second in a series of **Heart**Rhythm quarterly features, highlighting science relevant to quality improvement. The focus of this feature is the prevention of cardiac implantable electronic device infection.

Antibacterial envelope to prevent cardiac implantable device infection

Taraki et al (N Engl J Med 2019;380:1895, PMID 30883056) conducted a prospective, international, randomized controlled trial to assess the safety and efficacy of an absorbable, antibiotic-eluting envelope in reducing the incidence of cardiac implantable electronic device (CIED) infection. Patients undergoing generator change, device upgrade, device revision, or implantation of a new cardiac resynchronization therapy – defibrillator were included. The primary end point was major CIED infection, resulting in system extraction or revision, infection recurrence after discontinuing long-term antibiotic therapy, or death within 12 months of implantation. There were 6983 patients randomized in a 1:1 ratio to receive the envelope or not. All received standard strategies to prevent infection, and >98% of both groups received preoperative antibiotics. The primary end point of major CIED infection occurred in 0.7% of patients with an envelope and 1.2% of patients without (hazard ratio 0.60; 95% confidence interval 0.36–0.98; $P = .04$). Subgroup analysis did not identify any characteristics associated with benefit from the envelope. *The authors conclude that adjunctive use of an antibacterial envelope reduced the incidence of major CIED infection by 40%.*

PERSPECTIVE: Impressively, this trial demonstrated a 40% risk reduction with only a 1.2% infection risk in the control group. However, with an absolute risk reduction of 0.5% and a Number Needed to Treat (NNT) of ~200, there is a need to better understand the cost-effectiveness and optimal patient selection for the envelope.

Preoperative antibiotics and cardiovascular implantable electronic device infection: A cohort study in veterans

Alzahrani et al (Pacing Clin Electrophysiol 2018;41:1513, PMID 30221380) conducted a retrospective cohort analysis of the VA system to assess whether vancomycin use was associated with an increased risk of cardiovascular implantable electronic device (CIED) infection when compared to cefazolin or other beta-lactam antibiotics. The primary outcome was CIED infection identified by administrative codes. Patients who received a combination of antibiotics including vancomycin were included in the vancomycin group. Among 10,454 CIED procedures, vancomycin was used in 40.6%. The CIED infection rate was significantly higher in patients who received vancomycin (1.01% vs 0.34%; $P < .001$), and this persisted after logistic regression. Limitations include the predominantly male veteran population and potential for unmeasured confounding by indication, especially that many patients receive vancomycin if they have known Methicillin-resistant Staphylococcus aureus (MRSA) colonization. *The authors conclude that among patients who received surgical site infection prophylaxis for CIED placement or revision, there was (1) an unanticipated high rate of vancomycin use and (2) a 3-fold increase in the incidence of subsequent CIED infection in vancomycin recipients.*

PERSPECTIVE: Professional society guidelines recommend beta-lactam antibiotics preoperatively and reserve vancomycin for penicillin allergies, although some advocate for use when MRSA colonization is present or with high local resistance. We should consider vancomycin use carefully, as there remains concern of less effective alternate antibiotics.

Use of antimicrobial agent pocket irrigation for cardiovascular implantable electronic device infection prophylaxis: Results from an international survey

Given that local antibiotic usage for cardiovascular implantable electronic device (CIED) infection prophylaxis, in particular pocket irrigation, is a well-known strategy but with little data on its clinical effectiveness, Zheng et al (Pacing Clin Elect 2018;41:1298, PMID 30109698) sent an anonymous voluntary online survey to 2092 arrhythmia-oriented cardiologists in 51 countries to assess practice patterns. There were 487 responses, and 87% of respondents report using intraoperative antimicrobial agent pocket irrigation and/or an antimicrobial eluting pouch in an attempt to reduce CIED infection. The majority of respondents (54%) believe that antimicrobial agent pocket irrigation is effective in reducing CIED infection. Bacitracin (48%), vancomycin (39%), and cephalosporin (29%) are the most commonly chosen antibiotics. A majority of the respondents are unaware of the cost of using antimicrobial agent pocket irrigation (69%), and neither are they concerned (67%). *Based on these findings, the authors conclude that while there are little clinical data to support or discourage practice, the antimicrobial agent pocket irrigation for CIED infection prophylaxis is currently widely used.*

PERSPECTIVE: While the effect of antimicrobial agent pocket irrigation was not studied directly in the Prevention of Arrhythmia Device Infection (PADIT) Trial, it did not show benefit of the combination of preprocedural cefazolin plus vancomycin, intraprocedural bacitracin pocket wash, and 2-day postprocedural oral cephalexin when compared to preprocedural cefazolin. Further research for standardization is warranted.

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EP News: Quality Improvement and Outcomes

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Clinical decision support and shared decision making

In this issue of **Heart**Rhythm, we present recent publications relevant to quality of care and outcomes, particularly in relation to clinical decision support and shared decision making.

Alert-based computerized decision support for high-risk hospitalized patients with atrial fibrillation not prescribed anticoagulation: a randomized, controlled trial (AF-ALERT)

Piazza et al (Eur Heart J Jun 29, 2019; doi: 10.1093/eurheartj/ehz385, PMID 31228189) conducted a single-center randomized study to evaluate the efficacy of an electronic medical record–based alert system in anticoagulation prescription practices for hospitalized patients with atrial fibrillation. A total of 458 patients with a CHA_2DS_2-VASc score of ≥ 1 not receiving anticoagulation at the time of admission were randomized to either the intervention or the control group. The admitting providers received a best practice alert for the 248 patients in the intervention group, notifying them of the patient's elevated risk of stroke with an option to either select the anticoagulation order set or decline anticoagulation while providing rationale for that decision. The anticoagulation order set was selected in 35.4% of alerts; the most common reason for not anticoagulating was bleeding risk (50%). The median CHA_2DS_2-VASc score was 4 in both groups, with only 9 patients (4 in the intervention group and 5 in the control group) having a CHA_2DS_2-VASc score of 1 for female sex alone. The primary outcome of new anticoagulation prescription orders was higher in the intervention group than in the control group during hospitalization (25.8% vs 9.5%; $P < .0001$), at the time of discharge (23.8% vs 12.9%; $P = .003$), and at 90 days (27.8% vs 17.1%; $P = .007$). The secondary outcome of composite major adverse cardiovascular events (cerebrovascular accident, systemic embolism, myocardial infarction [MI], and all-cause mortality) at 90 days was 55% lower in the intervention group than in the control group (11.3% vs 21.9%; $P = .002$), with an 87% decrease in the frequency of MI (1.2% vs 8.6%; $P < .001$) and an 88% lower incidence of cerebrovascular accident or systemic embolic event (0% vs 2.4%; $P = .02$) in the intervention group. *The authors concluded that the alert-based computerized decision support intervention improved anticoagulation prescription rates and decreased major adverse cardiovascular events in hospitalized patients with atrial fibrillation who are at an elevated stroke risk.*

Decision aids that facilitate elements of shared decision making in chronic illnesses: a systematic review

Wieringa et al (Syst Rev 2019;8:121, PMID 31109357) presented the findings of a systematic review of shared decision making (SDM) tools. Specifically, they evaluated whether 20 decision aids in cardiovascular disease, respiratory disease, or diabetes used the formal 6 criteria of high-quality decision aids identified by the International Patient Decision Aid Standards (IPDAS) and whether concordance with these criteria was associated with SDM outcomes. These 6 criteria include situation diagnosis, choice awareness, option clarification, discussion of harms and benefits, deliberation of patient preferences, and making the decision. The authors found that all (20 of 20 [100%]) the tools clarified options and most (18 of 20 [90%]) discussed harms and benefits. Only 4 (20%) met all 6 criteria, and the investigators found no association between concordance with IPDAS criteria and SDM outcomes. *The authors conclude that SDM tools are primarily designed to present options and their harms and benefits and that they were not able to identify an association between concordance with IPDAS criteria and SDM outcomes.*

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EP News: Quality Improvement and Outcomes

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In this issue of *Heart Rhythm Journal* we continue this quarterly feature highlighting important developments and advances in quality improvement or systems-based practice improvement in the delivery of heart rhythm care. This issue focuses on quality improvement surrounding atrial fibrillation (AF) and highlights some opportunities for measuring, reporting, and improving the quality of heart rhythm care for AF.

Implications of the LEGACY trial on US atrial fibrillation patients: An NCDR Research to Practice Project

Gehi et al (Am J Cardiol 2017;119:579, PMID 28038724) evaluated how a potential weight reduction program could affect outcomes in patients with AF who undergo catheter ablation in US clinical practice. As part of the research to practice initiative, the authors assessed how many patients in the National Cardiovascular Disease Registry (NCDR) PINNACLE cohort with AF would have been eligible for inclusion in the Long-term Effect of Goal Directed Weight Management in an Atrial Fibrillation Cohort (LEGACY) study (Pathak K, J Am Coll Cardiol 2015;66:985–996). LEGACY demonstrated that weight reduction resulted in a reduction in AF burden and improvement in AF symptom severity. Among 349,999 patients enrolled in the PINNACLE registry from 179 US practices, 197,255 (56%) met the weight reduction program enrollment criteria. Patients who met the criteria for the weight reduction program had a mean age of 69 years; 73% had paroxysmal AF; 85% had hypertension; 26% had diabetes; 23% had heart failure; and the mean body mass index (BMI) was 35. Of note, only 1 in 4 of these patients was receiving an antiarrhythmic medication. Compared with Australian patients enrolled in the LEGACY study, US PINNACLE patients with AF were older, had lower rates of tobacco and alcohol consumption, and had higher BMI. Because US patients had less tobacco and alcohol consumption, the authors hypothesized that a weight loss program might have a greater effect in US patients with AF and obesity undergoing AF ablation. *On the basis of the overall data, the authors conclude that there is a significant opportunity to improve outcomes after catheter ablation in more than half of all patients undergoing ablation in the United States. The first step in any quality improvement process is measuring the problem of interest. This study from Gehi et al helps measure the potential effect of weight reduction in patients with AF in the United States undergoing ablation. Future studies should address how systematic weight reduction can be implemented in AF centers, particularly in patients undergoing ablation.*

Provider specialty, anticoagulation prescription patterns, and stroke risk in atrial fibrillation

O'Neal et al (J Am Heart Assoc 2018;7:e007943, PMID 29525778) examined differences in oral anticoagulant prescription by provider specialty in patients with AF as a potential area of quality improvement for clinical practice. The MarketScan databases from 2009 to 2014 were used to examine oral anticoagulation prescription fills in 388,045 patients (mean age 68 ± 15 years; 41% women) with incident AF. Provider specialty of the prescriber (cardiology vs primary care) was obtained from outpatient services and pharmacy claims and assigned to anticoagulant prescriptions. Of the cohort, 235,739 patients (61%) received a prescription fill from a cardiology provider vs 152,306 (39%) from primary care provider. Those patients seen by cardiology providers had a higher likelihood of filling oral anticoagulant prescriptions than did patients seen by primary care providers (39% vs 27%; relative risk [RR] 1.39; 95% confidence interval [CI] 1.37–1.40), which was observed in both types of anticoagulants including direct oral anticoagulants (RR 1.74; 95% CI 1.71–1.78) and warfarin (RR 1.24; 95% CI 1.22–1.26). Stroke risk was lower in patients seen by cardiology providers (hazard ratio [HR] 0.90; 95% CI 0.86–0.94) than in patients seen by primary care providers, but bleeding risk was no different (HR 1.03; 95% CI 0.98–1.07). *The authors conclude that AF patients seen by cardiology providers as outpatients were more likely to initiate oral anticoagulant treatment to reduce stroke risk than patients seen by primary care providers. The authors posit that early referral to cardiology may increase the initiation of oral anticoagulant therapy to improve outcomes in patients with AF.*

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EP News: Center-Specific Quality Improvement

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In this EP News, we focus on the concept of center-specific quality improvement (QI). Large multicenter trials, observational studies, and practice guidelines provide us with the evidence and expert recommendations to standardize care delivery, inform QI initiatives, and improve outcomes across care delivery systems. However, at its core, QI is a continuous process and not simply the achievement of a specific threshold goal or the ability to define a center's care as "high quality." Center-specific QI projects are developed and implemented at individual centers. They may target a range of systems from hospital-wide to individual provider practices, and they are tailored to the strengths, challenges, and needs of a particular health care environment. The smaller scale of center-specific QI allows for continuous iteration and evolution of QI efforts in a process that is nimble and dynamic.

The basic process of QI revolves around the PDSA (Plan, Do, Study, Act) cycle. The intention is to implement small changes in system processes and care delivery systems while studying the impact immediately and adjusting the intervention "in real time" as the outcomes are realized. This feature of continuous adjustment is one of the major differentiators between QI and methodologically rigorous but narrowly focused large-scale trials. The relative ease of implementing these small center-specific QI processes should make them highly prevalent. However, because they are focused on center-specific systems, the translatability across centers may be limited, thereby making publication of results rare.

Occasionally, an implemented change may impact a local system significantly, such that dissemination of the process may be of benefit to other centers. For centers interested in publishing results of health care QI efforts, SQUIRE (Standards for QUality Improvement Reporting Excellence) guidelines provide a framework for reporting. These guidelines are intended for describing system-level work to improve the quality, safety, and value of health care.

The studies summarized here exemplify the value of conducting center-specific QI work and disseminating the results to the larger scientific and clinical communities.

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Utilization of a radiation safety timeout reduces radiation exposure during electrophysiological procedures

Recognizing the high impact that checklists and timeouts have had across surgical and procedural systems, Aizer et al (JACC Clin Electrophysiol 2019;5:626–634) implemented a simple 7-question preprocedural safety timeout focused on radiation use and protection for the pending case. Baseline data were collected for 6 months before the change. The primary target of improvement was reduction in the dose–area product. After initiation of the change, the outcomes were analyzed every 3 months until an improvement was realized or for a total of 12 months. The project spanned 1040 procedures, of which 43% occurred after the change. The addition of the checklist reduced patients' fluoroscopy dose by 21% and, most significantly, reduced its use by the individual practitioners with the highest baseline fluoroscopy use. Protective shield use and ultrasound-guided access also significantly increased. Somewhat surprisingly and atypical of a continuous QI process, the checklist process was removed after the improvement was realized. Post removal, there was a lasting positive impact on fluoroscopy reduction, although not all of the originally implemented actions remained intact. In a traditional QI process, the checklist procedure would have been continued and potentially modified to further improve outcomes.

Quality improvement in cardiac implantable electronic device follow-up

In this study, Beaney et al (Heart Rhythm 2019;16[5 Suppl]:S263) instituted a plan to standardize and improve the completeness of implantable cardiac device follow-up. They developed a standard protocol for both pacemaker and implantable cardioverter–defibrillator (ICD) follow-up. A retrospective analysis of 100 pacemaker and ICD follow-ups identified those portions of the newly developed standard protocol that were commonly not done, such as evaluating the underlying rhythm or adjusting the settings for ventricular tachycardia below the detection rate. This study presents the first step of their QI process by identifying the problem to be solved. The next step will be to implement interventions to improve the completion and documentation of the missed portions of cardiac implantable electronic device (CIED) follow-up. Once that is complete, it is anticipated that the authors will reanalyze another set of device follow-up to assess how the intervention improved CIED follow-up completeness. This study is an excellent example of the first step of a PDSA cycle.

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EP News: Quality Improvement and Outcomes: Physician Burnout

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Physician burnout

In this issue of *Heart Rhythm Journal*, we present recent publications relevant to quality of care and outcomes, particularly in relation to physician burnout. Although a myriad of terms may be used to define *burnout* as it relates to work, the core underlying characteristics consist of the triad including emotional exhaustion, depersonalization, and reduced personal accomplishment (Annu Rev Psychol 2001;52:397). More than 50% of physicians in a US report have at least 1 symptom of burnout (Mayo Clin Proc 2015;90:1600), yet this news predated the recent transformation of the health care world caused by the coronavirus disease 2019 pandemic. As a result, there is a particular urgency now to study mechanisms that address and then improve physician burnout. Such interventions would additionally mitigate the consequences of the downstream effects of physician burnout, including impaired physician health and/or reduced quality of patient care. In the recent white paper "Framework for Improving Joy in Work," the Institute for Healthcare Improvement frames physician burnout from the perspective of experiencing joy in work and identifies key elements critical for organizations to improve joy in work. One of those elements—teamwork—is highlighted in the first publication that focuses on evidence evaluating the effect of organizational-led interventions on physician burnout, stress, and job satisfaction. While literature concerning physician burnout specific to electrophysiology is lacking, the first study provides useful insights for future directions to reduce burnout, or improve joy in work, as an electrophysiology community. The second selected publication is of equal significance as it reports on the prevalence of burnout in cardiologists. Consistent with the former study, while the research is not electrophysiology specific, the results do underscore the significance of burnout in our own backyard.

Effect of organization-directed workplace interventions on physician burnout: A systematic review

DeChant et al (Mayo Clin Proc Innov Qual Outcomes 2019;3:384, PMID 31993558) reviewed 50 studies that evaluated the efficacy of workplace-driven interventions on physician burnout, stress, or job satisfaction. Seventy percent of the studies (35 of 50) reported improved outcomes. Interventions associated with the most consistent positive effects included use of scribes or medical assistants (MAs) to lessen electronic health record (EHR) duties, promotion of team-based care (such as expanded roles for MAs), facilitation of improved physician communication/support, alteration of workflows for reduced redundancy, and designation of provider level responsibilities for maximal efficiency. In contrast, approaches to limit work hours or implement EHR interventions did not overwhelmingly improve the measures, though EHR optimization strategies did. The authors additionally recognized the review's limitations including the heterogeneity of the studies and the lower tiered evidence levels of most (80%) references. *The authors conclude that organization-directed interventions that streamline workflows, provide professional support, optimize EHRs, and reduce EHR administrative tasks through team-based care and by using scribes and MAs can positively affect physician burnout.*

Burnout and career satisfaction among US cardiologists

Mehta et al (J Am Coll Cardiol 2019;73:3345, PMID 31248556) presented the results of a Professional Life Survey and Mini Z survey in order to address burnout among cardiologists. Survey respondents, including 1321 men and 953 women, were categorized into 2 groups: no burnout (no burnout or feeling stressed, but not burned out) and burnout ($\geq$1 symptoms of burnout, constant feelings of burnout, or complete burnout feelings). The majority of survey respondents (73.2%) did not report burnout symptoms. Among this group, 23.7% reported enjoying their work and 49.5% reported being under stress with less energy. Approximately a quarter of respondents reported being burned out; 19.2% experienced at least 1 symptom of burnout, 6.4% reported chronic burnout symptoms that led to frequently thinking of work frustrations, and 1.2% reported feeling completely burned out to the point of possibly needing outside intervention. Mid-career cardiologists (8–21 years of practice) and women reported burnout more frequently than did their counterparts. Physicians reporting burnout were less likely to report being treated fairly at work, feeling valued, and feeling that their contributions matter compared with their peers ($P \leq .001$ for all). *The authors conclude that by identifying specific modifiable drivers among cardiologists, data may inform efforts to understand the causes of burnout and to design solutions at an individual and organizational level.*

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EP News: Quality Improvement and Outcomes

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In this issue of *Heart Rhythm*, we continue this quarterly feature highlighting developments and advances in quality improvement in the delivery of heart rhythm care. The current issue focuses on quality improvement surrounding the challenges created for heart rhythm care during the coronavirus disease 2019 (COVID-19) pandemic.

Restructuring electrophysiology during the COVID-19 pandemic: A practical guide from a New York City hospital network

Rubin et al (Crit Pathw Cardiol 2020 Apr 27:10.1097, PMID 32324622) reported on the experiences from 4 different electrophysiology programs in a large New York City hospital network during the time that New York was the global epicenter of the COVID-19 pandemic. They describe their successful implementation of the HRS/ACC/AHA COVID-19 practice guidance[1] and other critical changes to their practice. Providing a pathway for other centers, they describe 7 key steps for strategic implementation: (1) acknowledging that a public health crisis has arrived; (2) determining what urgent electrophysiologic procedures are possible; (3) optimizing staff deployment to minimize exposure and preserve personal protective equipment; (4) coordinating with other clinical sections, electrophysiology groups, and hospitals; (5) developing strategic plan for management of inpatient consultations; (6) establishing telemedicine; and (7) planning administrative restructuring. They described their "ramp-down," including a reduction in laboratory case volume of 80%–95% following implementation of a policy to perform procedures only in patients felt to have a likelihood of significant clinical deterioration within a short period of time (ie, 48 hours to 1–2 weeks). The authors also share their pearls regarding specific patient management, including the challenges encountered in the implementation of telehealth. They also describe the use of remote inpatient consultation and telemetry for QTc determinations in COVID-positive patients, performing generator change within 1 month after the onset of elective replacement indicator, and prioritization of same-day discharges whenever possible. *Based upon their experience, the authors conclude and emphasize the need for proactive planning during a pandemic, including the importance of developing contingency plans before the COVID-19 pandemic reaches a hospital system. They also emphasize the importance of streamlining care and mobilization of resources necessary for transitioning to telemedicine in the midst of a pandemic.*

Inpatient use of ambulatory telemetry monitors for COVID-19 patients treated with hydroxychloroquine and/or azithromycin

Chang et al (J Am Coll Cardiol 2020;75:2992–2993, PMID 32330546) conducted a single-center study evaluating the safety and feasibility of utilizing mobile cardiac outpatient telemetry for heart rhythm and QT monitoring in 117 patients with COVID-19 who were receiving hydroxychloroquine with or without azithromycin and were hospitalized on non-telemetry floors. Monitoring was continued until discharge or until the hydroxychloroquine with or without azithromycin therapy was completed. The average age of the patients was 60 years, 41% were women, 5% had coronary artery disease, and less than 1% had heart failure. Over 295 patient days of follow-up, there were 28 urgent alerts in 18 patients, including 15 alerts for atrial fibrillation with rapid ventricular rates, 2 alerts for nonsustained ventricular tachycardia, and 5 alerts for a QTc $>$500 ms. Overall, 16 of the 28 urgent alerts resulted in changes in patient management. Hydroxychloroquine was stopped in 1 patient after the QTc increased from 460 to 565 ms. *The authors conclude that although mobile cardiac outpatient telemetry has not been approved for QTc monitoring for patients with atrial fibrillation or flutter, QRS duration $>$160 ms, or T wave $<$5% of the peak QRS amplitude, their single-center study suggests that innovative management of QTc monitoring is possible under the resource-constrained conditions of a pandemic.*

Reference

1. Lakkireddy DR, Chung MK, Gopinathannair R, et al. Guidance for Cardiac Electrophysiology During the COVID-19 Pandemic from the Heart Rhythm Society COVID-19 Task Force; Electrophysiology Section of the American College of Cardiology; and the Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, American Heart Association [published online ahead of print]. Heart Rhythm 2020 Apr 1. S1547-5271(20)30289-7.

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EP News: Quality Improvement and Outcomes

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In this issue of *Heart Rhythm Journal*, we summarize key publications of relevance to the electrophysiology community regarding the use of system-based processes to improve heart rhythm care and outcomes for patients with atrial fibrillation (AF). The featured research highlights challenges in improving the rate of guideline-directed anticoagulation to prevent stroke for high-risk patients with AF, including the benefits and limitations of the use of shared decision-making tools. This summary also reports on efforts to identify additional quality indicators to measure AF care and outcomes.

SUPPORT-AF II: Supporting use of anticoagulants through provider profiling of oral anticoagulant therapy for atrial fibrillation

Kapoor et al (Circ Cardiovasc Qual Outcomes February 17, 2020; doi:10.1161/CIRCOUTCOMES.119.005871, PMID 32063041) conducted a cluster-randomized study of electronic profiling and messaging for providers making decisions about anticoagulation in patients with atrial fibrillation. Previous provider-directed electronic messaging interventions have not improved anticoagulation use in patients with atrial fibrillation. The authors randomized outpatient providers to an intervention consisting of electronic medical record notifications to clinicians, e-mail notifications reporting physician prescription performance compared to peers, focus groups regarding knowledge gaps and prescription barriers, and academic detailing consisting of in-person or web-based presentation of several topics related to anticoagulation in atrial fibrillation. At baseline, 71% and 74% of intervention and control group patients, respectively, were anticoagulated, and appropriate utilization increased by only 1.3% and 1.5%, respectively, after 6 months of follow-up. Patient refusal was the most common reason for patients not being on anticoagulation. *The authors conclude that electronic messaging intervention was feasible but did not increase oral anticoagulation use. Interventions targeting patients declining anticoagulation may be necessary to improve rates of oral anticoagulation.*

Assessment of shared decision making for stroke prevention in patients with atrial fibrillation: A randomized clinical trial

Kunnerman et al (JAMA Intern Med 2020;180:1215, PMID 32897386) conducted a randomized trial to assess the extent to which use of the anticoagulation choice shared decision making (SDM) tool that presents individualized risk estimates and compares anticoagulant treatment options affects the quality of SDM and anticoagulant treatment decisions in 922 at-risk patients with atrial fibrillation. Encounters were randomized to either the standard care or use of an SDM tool (intervention arm). Participants in both arms demonstrated low accuracy in their risk perception; reported high communication quality, high knowledge levels, and low decisional conflict; and would similarly recommend the approach used in their encounter. Clinicians were significantly more satisfied after intervention encounters. While the use of the tool to foster and support SDM resulted in improvements in several aspects of SDM quality and clinician satisfaction, it had no significant effect on anticoagulation prescription frequency or encounter duration. *The authors conclude that the use of an SDM encounter tool improved several measures of SDM quality and clinician satisfaction, but with no significant effect on treatment decisions or encounter duration. These results inform expectations about the value of implementing SDM tools in the care of patients with AF.*

Quality indicators for the care and outcomes of adults with atrial fibrillation

Arbello et al (Europace August 29, 2020; doi:10.1093/europace/euaa253, PMID 32860039) developed quality indicators that may be used to evaluate the quality of care and outcomes for patients with atrial fibrillation (AF). Experts representing international heart rhythm specialty associations collaborated to systematically review literature and identify 6 domains of AF patient care: patient assessment, anticoagulation, rate control, rhythm control, risk factor management, and outcomes. They suggest 17 main and 17 secondary quality indicators within these 6 domains, including patient-reported outcome measures. Relevant specifications were described for each quality indicator to enhance their use in practice. The authors considered structural quality indicators, such as the volume of catheter ablation cases, for operators and institutions, as not under the control of health care providers. Thus, these were not included in the final set of indicators. Of note, quality indicators for anticoagulation align with European guidelines but differ from current US guideline recommendations. Additional quality indicators, such as recommended screening for AF, require prospective validation. *The authors conclude that implementation of these quality indicators will improve the quality of AF care.*

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EP News: Quality Improvement and Outcomes

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This article continues the series of *Heart Rhythm Journal* quarterly features highlighting science relevant to quality improvement. The focus of this feature is practice improvement surrounding the use and implementation of cardioversion in the treatment of atrial fibrillation. The featured research investigates different approaches to the timing and performance of cardioversion to improve efficacy, labor, and cost.

Early or delayed cardioversion in recent-onset atrial fibrillation (RACE 7 ACWAS)

Pluymaekers et al (N Engl J Med 2019;380:1499, PMID 30883054) conducted a multicenter randomized trial to assess whether a "wait-and-see" strategy was noninferior to early cardioversion in new-onset atrial fibrillation (AF). A total of 437 patients who presented to the emergency department at a variety of hospital settings (academic, nonacademic teaching, and nonteaching) with hemodynamically stable, symptomatic AF of <36 hours' duration were randomized to either a "wait-and-see" approach or an early cardioversion approach. The "wait-and-see" arm was given increasing doses of rate control medications to obtain relief from symptoms and a heart rate of <110 beats/min. Twenty-four hours later, the "wait-and-see" cohort was evaluated in an outpatient setting and, if AF was still present, was referred to the emergency department for cardioversion. The early cardioversion arm was preferentially treated with pharmacological cardioversion or, if necessary, electrical cardioversion. Both groups were evaluated 4 weeks after the initial presentation to assess for AF. The total median duration of the index visit—including delayed cardioversion if necessary—was 30 minutes less in the "wait-and-see" approach (95% confidence interval). In the "wait-and-see" arm, 69% of patients converted spontaneously to sinus rhythm vs 16% in the early cardioversion group. The presence of sinus rhythm at 4-week follow-up was 91% in the "wait-and-see" arm and 94% in the early cardioversion arm ($P = .005$ for noninferiority). In the 355 patients with mobile cardiac telemetric data, recurrence of AF occurred in 30% of the "wait-and-see" arm and 29% in the early cardioversion arm. There were no significant differences between the 2 groups with respect to complications. *On the basis of these findings, the authors conclude that a "wait-and-see" approach to new-onset AF can reduce need for cardioversion, decrease the duration of initial presentation, and lead to fewer misclassifications of persistent AF.*

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Electrical vs pharmacological cardioversion for emergency department patients with acute atrial fibrillation (RAFF2): A partial factor randomized trial

Stiell et al (Lancet 2020;395:339, PMID 32007169) conducted a partial factor study to compare pharmacological vs electrical cardioversion of acute atrial fibrillation (AF) (protocol 1) in addition to a comparison of anteroposterior vs anterolateral pad placement in electrical cardioversion of acute AF (protocol 2). Protocol 1 was blind randomization of 396 patients presenting to 11 academic emergency centers with new-onset, hemodynamically stable AF to either pharmacological cardioversion with procainamide followed by electrical cardioversion if necessary or placebo infusion followed by electrical cardioversion. Protocol 2 randomized the subset of patients requiring electrical cardioversion from protocol 1 (244 in all) to an open-label comparison of anteroposterior vs anterolateral pad placement. Conversion to sinus rhythm occurred in 96% of the patients in the pharmacological arm—with a median time to conversion of 23 minutes—vs 92% of patients in the shock-only arm ($P = .07$). Pharmacological cardioversion was found to be more effective in patients presenting with their first episode of AF, as well as in those younger than 70 years. Of the 77% of patients who returned for follow-up at day 14, 95% were in sinus rhythm. There was no difference between the outcomes for the 2 pad positions (94% anterolateral vs 92% anteroposterior; $P = .68$). *The authors conclude that pharmacological cardioversion of acute AF provides a rapid, less labor-intensive resolution of arrhythmia, allowing discharge home and avoiding costly, unnecessary hospital admission or next-day reevaluation by cardiologists.*

Evaluation of a novel cardioversion intervention for atrial fibrillation: The Ottawa AF cardioversion protocol

Ramirez et al (Europace 2019;21:708, PMID 30535367) conducted a trial to evaluate the effectiveness of a standardized protocol for electrical cardioversion (ECV) of atrial fibrillation (AF). For the first 3 years of the trial, the approach to 500 ECVs of AF was performed at the discretion of the treating physician. After a 3-month training period of 48 cardiologists and cardiac surgeons, 389 ECVs of AF were performed using a standardized protocol over the subsequent 2 years. Using the standardized protocol, cardioversion success was increased by 7.4% (91.8% phase I vs 99.2% phase II; $P < .001$). There was a 9.2% absolute increase in first shock success (79.8% phase I vs 88.4% phase II; $P < .001$) and a 6.9% absolute increase in sustained ECV success (84.7% phase I vs 91.6% phase II; $P = .002$). There were no procedural complications in either phase of the study. *This study shows that with the implementation of an institutional standardized protocol, initial and long-term success of ECV of AF can be significantly improved with a number needed to treat of 14.*

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EP News: Quality Improvement and Outcomes: Defining and Measuring Atrial Fibrillation Quality Indicators in Canada

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Defining and measuring atrial fibrillation quality indicators

Understanding the quality of atrial fibrillation (AF) care delivery is critically important for identifying care gaps, targeting improvement efforts, and guiding resource allocation. In this effort, several professional societies have defined a series of AF quality indicators (QIs) that can be used to monitor adherence to evidence-based processes and AF-related outcomes. In Canada, this effort has been led by the Canadian Cardiovascular Society (CCS). On behalf of the CCS AF QI Working Group, in this issue of *Heart Rhythm Journal,* we summarize our process for defining and measuring AF QIs, present 2 recent publications reporting national data on key AF Qis, and discuss challenges encountered and future directions.

In 2016, the Working Group published an initial report identifying and defining priority QIs in 3 distinct categories: *access to care, treatment, and outcomes* (Can J Cardiol 2016;32:1566, PMID 27297003). An iterative process resulted in the selection of 3 priority QIs: (1) proportion of AF patients at high risk for stroke receiving an oral anticoagulant; (2) annual rate of stroke; and (3) annual rate of major hemorrhage. A feasibility assessment followed, which determined that none of the QIs as defined could be adequately measured with existing data sources. In particular, Canada lacks a nationally standardized data collection system for ambulatory care and prescription medications. Since this initial effort, the Working Group reconvened, confirming the relevance of the 3 original QIs and added 2 QIs (CJC Open 2019;1:198, PMID 32159107): (4) proportion of patients with nonvalvular atrial fibrillation (NVAF) in whom stroke risk was quantified; and (5) annual rate of incident heart failure (HF) hospitalization. An environmental scan determined the 5 QIs could be measured in a limited capacity using a national inpatient care database.

Trends in rates of incident AF/AFL hospitalizations, stroke risk, and mortality

Sandhu et al (Can J Cardiol 2021;37:310–318, PMID 32360794) examined trends in incident NVAF hospitalizations, stroke-risk profiles, and associated in-hospital mortality between 2006 and 2015. A total of 578,947 patients were hospitalized with incident NVAF in any diagnostic field. Median age was 77 years (interquartile range 68–84), 82% were ≥65 years, 54% were men, and 69% had a CHA2DS2-Vasc score ≥3. The overall age- and sex-standardized rate of NVAF hospitalization was 315 per 100,000 population and declined by 2% per year ($P < .001$). The majority of patients were at high risk for stroke, without significant trends in risk level. The average adjusted in-hospital mortality was 8.80 per 100 patients (95% confidence interval [CI] 8.80–8.81), with a 2% annual decline in rate over the study period ($P < .001$). *The authors conclude that further investigations are needed evaluating whether changes in AF risk factors, emergency department practice patterns, admission standards, and extent of outpatient AF care may contribute to declining hospitalization rates. Determining risk of stroke for patients with AF, a priority QI, demonstrates the majority of patients are at high risk. Hospitalization provides an important opportunity to initiate oral anticoagulant therapy or document reasons for contraindication.*

Ten-year trends in stroke, major bleeding, and HF

Wilton et al (CJC Open, https://doi.org/10.1016/j.cjco.2021.01.003) examined trends in 1-year incidence of stroke/systemic embolism (SSE), major bleeding, and HF for patients discharged after a first hospitalization with incident NVAF. The study period and cohort characteristics were similar to the study by Sandhu et al. Within 1 year of discharge, 3.5% were hospitalized for SSE, 1.6% for major bleeding, and 8.6% for new HF. Over the study period, risk-adjusted yearly rates of incident SSE (risk ratio 0.99l 95% CI 0.98–0.99; $P = .002$) and HF (risk ratio 0.99; 95% CI 0.99–1.00; $P = .001$) declined by ≤1% absolute, while major bleeding remained unchanged (risk ratio 1.00; 95% CI 0.99–1.00; $P = .28$). *The authors conclude that efforts to study process-based QIs, with increased focus on HF prevention, are needed.*

These publications illustrate incremental progress in our ability to assess the quality of AF care in Canada. However, important challenges in the meaningful measurement of QIs remain, particularly with the collection and sharing of relevant data across provincial boundaries, and a lack of resources for quality measurement and improvement. The CCS continues to press Canada's federal government to better fund cardiovascular QI measurement and reporting.

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EP News: Quality Improvement and Outcomes

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AF center of excellence success: The importance of building a strong electronic foundation

Atrial fibrillation (AF) is increasing in age-adjusted incidence and global prevalence, and it is associated with a number of adverse clinical and fiscal outcomes (Chugh et al, Circulation 2014;129:837, PMID 24345399). While treatment advances have improved clinical outcomes, existing AF care delivery processes typically are fragmented and disconnected. This lack of coordination frequently limits the achievement of high-quality, guideline-directed clinical outcomes (Deshmukh et al, Circulation 2013;128:2104, PMID 24061087).

Aiming to address prevailing care delivery gaps, the Heart Rhythm Society initiated processes to provide input to clinicians and institutions on how to design an AF center of excellence (CoE) as a tool to advance quality AF care delivery. The premise underlying the motivation for creating an AF CoE is the belief that patient-centric, multidisciplinary, integrated teams providing coordinated, systems-based, guideline-directed AF care have the potential to generate a salutary effect on AF outcomes. The rationale for, and information on, the steps needed to establish an AF CoE were outlined in a recent Heart Rhythm Society document (Piccini et al, Heart Rhythm 2020;17:1804, PMID 32387248).

Developing effective AF CoEs requires a foundation of integrated clinical, administrative, electronic health record (EHR) and information technology (IT) teams. In this article, we focus on the requisite introductory steps necessary to link EHR capabilities to COE initiatives in order to track data and improve current outcomes using as our acronym "VAULT TO TOP."

1. *V*ision: To ensure programmatic alignment, the clinical, administrative, and EHR teams should strongly consider creating a vision statement to guide future endeavors.
2. *A*ppropriate scale—prioritization: While there are many important clinical needs (eg, risk modification and thromboembolic risk reduction), one cannot "boil the ocean." When introducing new programs, organizations should select 1 or a very limited number of initiatives to ensure focus and avoid spreading limited resources too thin. New opportunities can be added subsequently after the implementation of the initial choice(s).
3. *U*nderstand EHR technical roles: Most EHR/IT technical teams characteristically include multiple participants—IT engineers, who build and connect hardware and software; data resource analysts, who input and extract data; and business intelligence experts, who analyze the information. All must be included and roles defined to ensure that clinicians and administrative leaders have access to relevant results.
4. *L*ist components tracked: When choosing quality outcomes to be tracked, clinician and administrative leaders should collaborate and assess both clinical and economic results. Positive financial sequelae will often result in the provision of additional resources to advance clinical initiatives.
5. *T*ag champions: When possible, hire a dedicated AF CoE coordinator, who can regularly interface with the chosen clinical (physician, allied professional, and nurse), EHR, and administration leads, to ensure alignment and address operational and clinical concerns as they manifest.
6. *T*racking outcomes: Using agreed-upon documentation methods (eg, EHR "smart phrases" and discrete data fields) and positioning data in a consistent location in the EHR is mandatory to facilitate easy access to accurate information and inform decision making. Electronic "dashboards" with relevant clinical and, in some cases, financial information tracked over time and by facility and provider can be useful.
7. *O*utside comparison—metric generation: When selecting a prioritized initiative, the baseline performance level must be analyzed to ensure the existence of a clinical deficiency. After confirmation of the deficiency, the team must select the level of achievement desired and the timeline over which it can be reached. In most circumstances, organizations should emulate a "best-in-class" group (eg, registry participant high end performers and best outcome performers determined by a literature review). The selected and recommended goals must be agreed upon by all the participant stakeholders.
8. *T*ake score: Since most health care systems include many institutions, ultimately all relevant parties should be included. Outcomes must therefore be assessed at several levels (ie, system, institution, division, and individual) so that broad-based excellence is achieved.
9. *O*pen book: Electronically based educational programs readily available to patients, caregivers, staff, and referring clinicians are important to ensure universal access and facilitate shared decision-making processes.
10. *P*rogress: After initial successes, a larger net can be cast, extending EHR, administrative, and clinical capabilities in order to continuously innovate and seek excellence in a variety of clinical initiatives.

"By failing to prepare, you are preparing to fail." Benjamin Franklin

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EP News: Quality Improvement and Outcomes: Engaging pharmacists to improve patient adherence to prescribed medication

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Pharmacists have a unique role and responsibility in an individual's care, especially for those with chronic disease. Insights into how pharmacy fellows can be engaged to assess and improve guideline-concordant anticoagulation for atrial fibrillation (AF) were gathered from a quality improvement project sponsored by the Heart Rhythm Society, in collaboration with the University of Florida.

A recent Centers for Disease Control and Prevention fact sheet (https://www.cdc.gov/heartdisease/atrial_fibrillation.htm) estimates that by 2030, 12.1 million people in the United States will receive a diagnosis of AF. AF accounts for a 5-fold increased risk of ischemic stroke and causes about 1 in 7 strokes.

The Heart Rhythm Society Preventing Preventable Strokes initiative currently underway at the University of Florida aims to improve guideline-concordant anticoagulation via patient communication. With the help of IT analysts using Epic electronic health record databases, patients with AF were identified and grouped on the basis of the presence of an active oral anticoagulation (OAC) medication and placed into 1 of 3 groups:

1. Patients with a CHA_2DS_2-VASc score warranting OAC but with no current record of anticoagulation were urged to talk to their doctor as soon as possible to discuss how to prevent stroke.
2. Patients with a CHA_2DS_2-VASc score warranting OAC and currently receiving anticoagulation therapy were reminded of the importance of medication adherence to prevent stroke.
3. Patients with a CHA_2DS_2-VASc score too low to warrant OAC at this time were informed that their risk can change as they age and as new health conditions arise. Continued discussions with their physician to reassess their risk of stroke were recommended.

Pharmacy fellows helped with this effort in multiple ways:

- **Reviewed all records** before any messages were sent to ensure that the database records were accurate.
- **Sent the messages** to patients via Epic MyChart.
- **Reviewed** patient profiles, in order to determine whether another message was warranted.
- **Sent follow-up messages** to those at highest risk based on CHA_2DS_2-VASc score and lack of current anticoagulation.

While the pharmacy fellows helped identify and reach the patients, they also learned important lessons, including the following:

- **Some patients do not have a full understanding of their medication therapy.** Many patients stated that they were currently on anticoagulation therapy with clopidogrel or aspirin; however, treatment with antiplatelet medications is not sufficient to lower a patient's risk of stroke. *This gap in patient knowledge illustrates the need for patient education, and the pharmacist is uniquely positioned to play the role of an educator.*
- **Some patients are not aware of the importance of following their medication regimen.** It is critical that patients remain consistent with their medication schedule and do not miss doses. When reviewing patient histories, it is clear that some patients do not take their medication as instructed and are not picking up their prescriptions as expected. *Pharmacists can offer interventions and guidance to patients so that they can keep up with their medication and eliminate any barriers causing the patient not to take their medication.*
- **Some patients may be hesitant or wary to take anticoagulation medications because of the potential associated bleeding risks.** Current guidelines recommend the use of warfarin or direct acting OAC in order to reduce the risk of stroke. Some of these medications require extensive counseling regarding international normalized ratio tests, diet modification, bleeding risk, and other associated side effects. *Pharmacists can play a key role in educating patients about how to mitigate these risks and take the medication safely to yield optimal efficacy.*
- **The data in the electronic health record does not always accurately reflect the diagnosis of AF, the anticoagulation status of patients, or care received from other health systems.** *Pharmacists can delve into the details to find individuals categorized incorrectly on the basis of errors in data entry.*

Conclusion

It is evident that pharmacists and pharmacy students have a role in improving anticoagulation rates for patients with AF. In addition to helping with process management, patients need counseling and guidance on their disease state and the medications that are prescribed. With the proper guidance, patients can reduce their risk of stroke while also mitigating the associated side effects. Physicians should feel comfortable asking pharmacists to assist. An interprofessional collaboration between the patient, the physician, and the pharmacist can help improve outcomes for patients with AF.

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EP News: Quality Improvement and Outcomes: Remote monitoring of pediatric cardiac implantable electronic devices

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Remote monitoring of pediatric cardiac implantable electronic devices (CIEDs) has become an important tool in outpatient management. Recent guidelines (Shah et al, JACC Clin Electrophysiol 2021;7:1437, PMID 34794667) from the Pediatric and Congenital Electrophysiology Society (PACES) have recommended remote monitoring of CIEDs every 3–12 months for pacemakers and every 3–6 months for implantable cardioverter-defibrillators, with an increase in frequency when the device is approaching elective replacement indicators. Compared with their adult counterparts, pediatric and adult patients with congenital heart disease have a higher frequency of epicardial devices that carry an elevated risk of lead fracture, which may lead to adverse outcomes, especially in pacemaker-dependent patients (Post et al, Neth Heart J 2011;19:331, PMID 21567217). CIED remote transmission remains a vital modality to ensure safe monitoring and assessment of temporal CIED trends, especially battery longevity and lead functionality. Furthermore, advances in remote monitoring foster a sense of disease-specific knowledge, improved self-management, and shared decision making (Walker et al, Int J Med Inform 2019;124:78, PMID 30784430).

The PACES Quality Improvement (QI committee) has designed a QI project to address gaps in adherence to recommended remote transmissions and potential barriers. Since there is a large range of device volume by center, the project is designed to allow for different measures of success that will be defined by each individual center. This project will focus on 3 specific, measurable, achievable, relevant and time-bound (SMART) aims:

1. *Initial transmission:* The initial setup and pairing for CIED remote transmissions is vital to ensure long-term success. For families, limitations can include a lack of equipment, connectivity/infrastructure, and knowledge gaps. Provider issues may include lack of industry support, location of implantation (electrophysiology suite vs operating room), lack of administrative/staff support, and a lack of end-user confirmation. *The goal is to increase initial enrollment, defined as a remote transmission within 14 days of new CIED implantation or generator change, by 25% or to a total adherence of 80% over a 90-day period.*
2. *Total enrollment:* There are patients with CIEDs who either were never enrolled in a remote program or have been lost to follow-up without remote transmissions for more than 12 months. These patients may comprise a significant proportion of an individual center's device volume. The limitation in many cases is related to a lack of equipment or outdated equipment that is no longer supported by current technologies (such as requiring a landline telephone connection to transmit). Similar to our other metrics, provider challenges center around an inability to identify patients that are not transmitting and a lack of end-user confirmation. *The goal is to increase overall center enrollment by 25% or to a total center enrollment of 80% over a 90-day period.*
3. *Adherence to guidelines:* Despite successful enrollment at the time of surgery, adherence to published remote transmission guidelines is impeded by a multitude of barriers. Examples of such barriers include but are not limited to lack of a cellular signal, nonfunctioning equipment, poor connection, knowledge gaps, and inadequate insurance coverage. Providers (physicians, advanced practice providers, nurses, and technicians) are limited by a lack of end-user confirmation to demonstrate the absence of adherence. *The goals for improvements within this domain are both time and longitudinally based: with either an increase in 20% of total adherence or a goal of 75% adherence over a 180-day period.*

Although the specific intervention will vary by institution, the PACES QI Committee has developed resources to facilitate success. The committee will provide resources for each individual company, including company-specific remote monitoring tip sheets to address potential knowledge gaps and highlight troubleshooting solutions for patients, families, and providers. Providers will have access to a CIED implant checklist that details postimplant steps to ensure successful initial enrollment and transmission. Each institution will have the option to enter into a PACES-approved remote monitoring agreement with the patient and family designed to enhance the understanding of the importance of remote transmissions and the consequences of poor adherence. Each center will plan for 90-day cycles to institute and reassess interventions for future Plan, Do, Study, Act cycles.

Currently there are 24 participating centers (including 1 international), and the first application of interventions is planned for fall 2022. The PACES QI Committee is excited to launch its first society-sponsored QI project and looks forward to collaborating with these and additional centers throughout the world.

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EP NEWS

EP News: Quality Improvement and Outcomes

The impact of data integrity on improving anticoagulation for patients with atrial fibrillation

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Quality improvement (QI) is based on a methodology of baseline measurement, intervention, and remeasurement/analysis, with iterative improvement cycles along the way. The accuracy of the data used for measuring and remeasuring quality is therefore paramount, which leads to the question: *What if the data are not accurate?*

Anticoagulation (AC) for atrial fibrillation (AF) has been the cornerstone strategy to reduce the risk of stroke. Unfortunately, an estimated 1 million people in the United States who meet guideline criteria for AC have been identified as untreated (Hsu et al, JAMA Cardiol 2016;1:55, PMID 27437655). Recent QI efforts led by the Heart Rhythm Society have identified some patients incorrectly coded in the electronic health record (EHR) as having AF and some incorrectly coded as not being anticoagulated. QI initiatives undertaken at the University of Florida Jacksonville and Gainesville campuses unearthed EHR data inaccuracies when compared with manual chart review. While the goal should be to eliminate strokes caused by lack of AC for patients with AF, these data integrity issues caused us to question whether the global AC percentages in the literature may be inflated by inaccurate data in the EHR.

Data compilation and subsequent analysis drive decision making during the QI process. The importance of data integrity in achieving QI success cannot be overstated. The University of Florida uncovered data inaccuracies that affected multiple phases of the QI initiatives, including establishing benchmark data for AC performance, targeting best practice advisories to physicians, sending educational materials to patients, monitoring the study progress, and measuring the outcome of the improvement in AC rate.

The problem of data integrity is multifaceted and complex. Some issues were found to be related to the use of administrative data to identify patients not anticoagulated in concordance with guidelines. EHRs retain diagnoses used when physicians order electrocardiograms because of concerns for AF or other dysrhythmias. If, instead of diagnoses such as tachycardia or presyncope, a diagnosis of AF is entered, then that diagnosis may persist in the administrative record even if the patient is ultimately found not to be in AF, and the misrepresentation will appear in reports used to identify patients who are not anticoagulated.

Other sources of problems stem from lack of consistency and standards for clinician data entry. Inadequate shared rules among EHR developers and users lead to problem and medication lists that are not sufficiently accurate for clinical or research use. We found that a percentage of those identified as not being on AC actually were appropriately anticoagulated.

With the ever-growing complexity of health care, health information technologies, including EHRs, were originally adopted to transform the US health care system to be more efficient, safe, and consistent (Avendano et al, Cureus 2022;14:e26330, PMID 35911305). EHRs have become the standard tool for collecting data, but that data collection comes with the potential for errors and resulting consequences in patient care. Shortcomings in design and implementation, especially with regard to data entry standards and consideration of user behavior, have resulted in health information technologies failing to achieve projected benefits and cost savings.

Currently, there are no regulatory requirements to evaluate EHR efficacy and safety and standardization, and certification processes do not address problems regarding implementation, clinician usability, or information integrity. These gaps result in an absence of shared responsibility for product functionality between EHR developers and EHR users. Problem and medication lists lack system tools to automatically update or reconcile records. Errors in design have led to data being lost, incorrectly displayed, or incorrectly transmitted, all of which adversely affect patient care and outcomes.

At a system level, a potential solution to data integrity is to decrease design flaws by working with EHR vendors to identify program features that result in errors and user workarounds. Understanding the root cause of errors can allow designers to target the source of the problems. Additionally, organizations can enhance data integrity by adopting clear EHR policies and procedures around clinical and administrative data entry, providing training on expected EHR data standards, and enacting internal monitoring system for data irregularities. Researchers should use methods such as chart review to validate use of administrative data which can be confounded by EHR inaccuracies.

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