USE OF AN AUTOMATED ELECTROCARDIOGRAM SCREENING APPLICATION AND REFERRAL PROCESS TO ANALYZE AND ENHANCE UTILIZATION OF CARDIAC ELECTROPHYSIOLOGY SERVICES

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ABSTRACT

Background: Utilization of cardiac electrophysiology (EP) may be low in practices, where this service line has only been recently introduced. We developed a screening and referral process to analyze the barriers and facilitate access to evidence-based EP interventions, which reduce morbidity and mortality.

Methods: An automated screening app was developed to identify electrocardiograms (EKG) within an inpatient electronic medical record system (McKesson Cardiology), where EP referral may have significant impact on outcomes (left bundle branch block, atrial flutter, supraventricular tachycardia, 2nd or 3rd grade atrioventricular block). The processed data was then reviewed to identify unreferred candidates without valid contraindications. The primary providers were then notified with the specific indication and recommended intervention.

Results: 3354 EKGs were analyzed in a 2-month period (1877 patients). 111 patients had at least one positive screening criterion. 32% had no valid indication after review, 16% had already been seen by EP, 15% were false positives due to incorrect EKG interpretation, 15% had valid contraindications, 6% had inpatient EP referral. A further 17% had valid EP referral indication (58% for ablation, 16% for device implant, 26% for cardiac/EP workup); notices were sent to the cardiologist (63%), primary care physician (26%), while an outpatient provider could not be identified in 11%. Despite providing the indication and recommended intervention, no outpatient EP referrals were made.

The automated screening app saved an estimated 560 minutes of manual EKG review time. The screening had a positive predictive value of 87.9% and a negative predictive value of 99.2% for the selected criteria. 287 minutes were required for the chart reviews.

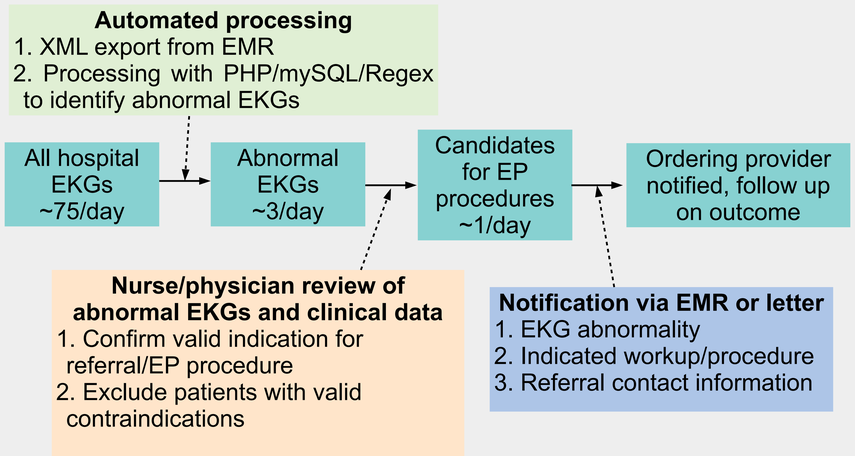
Conclusions: the developed automated screening app is time-efficient and accurately identifies patients who may benefit from EP interventions. The low outpatient referral rate, despite providing specific indications, will need to be targeted for improvement.

BACKGROUND/METHODS

- EKGs are frequently ordered in hospitals, even by non-cardiac providers. The interpreting phyisician usually has no clinical data and communication of abnormal findings to the ordering provider is not routinely performed
- We developed an automated EKG screening process and analyzed its efficacy on improving referral rate for cardiology/electrophysiology services
- Rural hospital with single EP provider in the region
- High-risk EKG abnormalities were selected for screening, where evidence based guidelines exist to guide management

EKG abnormality	EP procedure – after evaluation for structural heart disease, comorbidities and reversible etiology
Left bundle branch block	CRT pacemaker or defibrillator
Atrial flutter	Ablation
Supraventricular tachycardia	Medical management or ablation
2nd degree atrioventricular block	Dual chamber or CRT pacemaker or defibrillator
3rd degree atrioventricular block	Dual chamber or CRT pacemaker or defibrillator

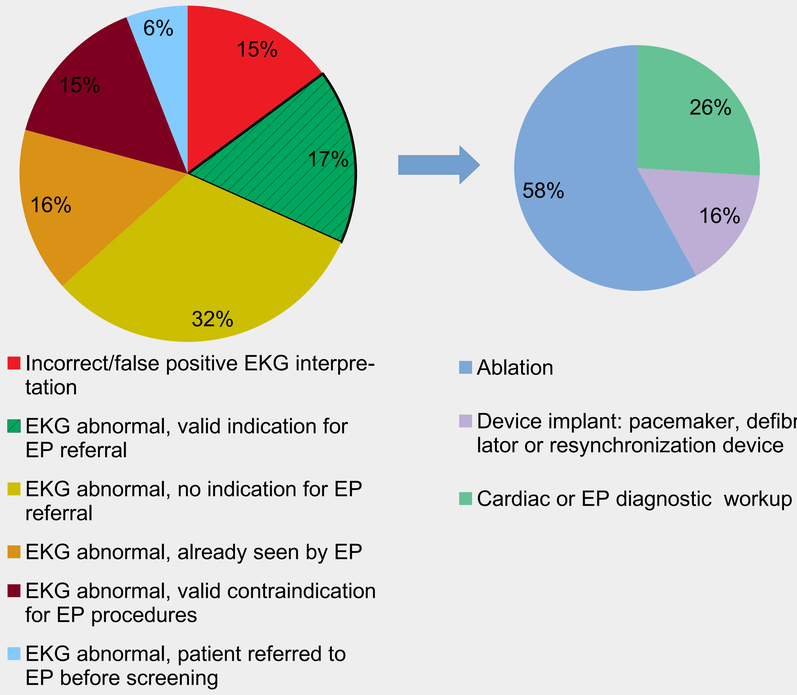
ANALYSIS AND REFERRAL PROCESS



RESULTS – EFFICACY OF SCREENING AND REFERRAL PROCESS

Automated processing	
EKGs analyzed in a 2-month period	3354
Abnormal EKG (1+ positive screening criteria)	111 (3.3% of EKGs, 5.9% of patients)
Accuracy of EKG interpretations	87.9% positive predictive value 99.2% negative predictive value
Accuracy of the algorithm to identify EKGs based on the screening criteria	100% positive and negative predictive value
Nurse/physician review	
Time required to review screened EKGs and correlate with clinical data	287 minutes 2.6 min/patient
Time saved using the automated EKG screening	560 minutes
Follow up on abnormal result notifications	
Providers notified	Cardiologist 63% Primary care provider 26% Primary provider unknown 11%
Outcome of referral	76% - provider did not refer the patient to EP 12% - patient did not comply with follow up 11% - primary provider unknown 6% - provider offered EP referral, patient declined

RESULTS – REVIEW OF 111 ABNORMAL EKGS



CONCLUSION

- The developed automated EKG screening tool is accurate and time efficient
  - 100% accurate to identify abnormal EKGs based on the screening criteria
  - 66% less review time vs. manual process
  - 15 minutes of nurse/physician review time was required with this process to identify one patient with valid indication and no contraindication for an EP procedure
  - 1% of patients were identified as candidates for EP referral
- Despite including only patients without contraindications, describing the specific EKG abnormality and recommended workup/procedure, the EP referral rate did not increase
  - Provider feedback on the notifications will need to be analyzed and used to improve the acceptance of the process
  - Patient noncompliance with follow up and refusal of recommended treatment – ratio similar to clinic no show ratio in the practice and may be difficult to improve

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Disclosures: Attila Roka: none.