

Implementation and Rapid Scaling of an Extended Hours Cardiovascular Computed Tomography and Magnetic Resonance Imaging Service for Multiple Health Systems Using a Multidisciplinary Digital Medical Practice

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INTRODUCTION

Cardiac CT (CCT) now has a Class IA indication in 2021 ACC Chest Pain Guidelines. Anticipating a workforce shortage to meet growth in CCT, we founded a digital imaging collaborative, Innovation Health Service (IHS), to train, certify, and connect advanced imaging doctors with multiple healthcare systems including Emergency Departments (ED) and private imaging centers across the country for rapid diagnosis of life-threatening and outpatient cardiac conditions.

METHOD

22 cardiologists and 20 radiologists with expertise in CCT and Cardiac MRI (CMRI) spanning the continental U.S. and Hawaii joined three systems engineers over videoconferencing to design a digital collaborative serving patients at hospitals and imaging centers. We identified needs at an 11-hospital system in Virginia with high volumes of acute and outpatient chest pain referrals but lacking local imagers, another outside Chicago with no CMRI imagers, and a private imaging center in California with no CMRI imager. Our team engineered tools and innovations to optimize patient safety, imager efficiency, turn-around-time for emergency diagnostics, and total system performance.

RESULTS

Service commenced in 2019 providing CCT & CMRI reporting, management recommendations, and doctor-to-doctor verbal communication as needed 0700-2300 EST. Our volume increased 95% by 2021 to average 450 scans monthly. Median time-to-diagnosis for ED chest pain CCT scans was 38 minutes, with average 63 minutes. Cardiac CT identified obstructive coronary artery disease (CAD) in 10% of patients, non-obstructive CAD in 58%, and no disease in 32%, reflecting appropriate patient selection in this population. Non-emergent inpatient CCT and CMRI scans were resulted in less than 24 hours, with the majority less than 8 hours.

We created a successful digital medical practice of Cardiologists, Radiologists, and Engineers across North America to provide extended-hours diagnostic imaging services and consultation for multiple time zones achieving a median ED turnaround time of 38 minutes.



During the pandemic multiple service lines requested CCT services for indications that were not at first anticipated, including the use of triple-phase Cardiac CT to replace Transesophageal Echo (TEE) for patients pre- and post-left atrial appendage occlusion, and prior to cardioversion, to reduce potential staff exposures to Covid.

CONCLUSIONS

- A networked team of expert physician imagers and systems engineers can successfully collaborate to scale an efficient cloud-based digital system and deliver emergency diagnostic services to widely dispersed facilities with extended hours.
- Guideline-based diagnostics, including the reduction in death and myocardial infarction from cardiac CT in multiple trials, and fast emergency department and telemetry bed decompression, can be scaled through the night at healthcare systems, imaging facilities, and free-standing emergency departments despite physician workforce shortages by instantaneously matching idle physician expertise with patients in need.



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