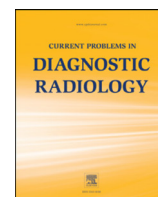




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## Creating a Radiology Call Center Hotline and “HOT” Sites: Centralizing Radiology Questions and Cohorting Out-patient Care During the COVID-19 Pandemic

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### ABSTRACT

**Introduction:** Amidst COVID-19 crisis, confusion exists over current radiology operations due to influx of new data and new protocols. In order to decrease confusion and reduce imaging facility related COVID-19 transmissions, we created a dedicated radiology COVID-19 call center and dedicated out-patient COVID-19 imaging sites (referred to “HOT” sites).

**Materials and Methods:** We created a central radiology call center hotline, staffed by our radiology technologists, to answer all radiology questions related to COVID-19 and help with scheduling exams. All out-patient x-ray exams became mandatory to schedule through the call center so proper COVID-19 screening could occur. If positive for COVID-19 symptoms, they are sent to “HOT” sites. Various statistical analyses were performed.

**Results:** A total of 2548 calls were received over 7 weeks with linear increase in calls during this period ( $R^2 = 0.17$ ,  $P = 0.003$ ). Most common reasons for calling were related to scheduling ( $n = 2336$ , 92%) and radiology operations ( $n = 145$ , 6%). At our main “HOT” site, from a total of 371 separate patient encounters by date of study, 72 patient encounters (19%) were COVID-19 positive at time of exam.

**Discussion:** This project provides efficient and reassuring radiology operations during an emergency situation by providing a single reliable point of contact and a source of truth for all facets of radiology. In doing so, we facilitate high quality patient centered care while protecting the health of our patients and staff.

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### Description of the Problem

While there are therapies to mitigate symptoms and speed recovery from COVID-19 infection, a cure or vaccine is not currently available.<sup>1</sup> Given this, public health measures in response to the outbreak currently serve as the best “treatment” to mitigate spread of disease.<sup>2–4</sup> For radiology departments around the world, the pandemic has forced leaders to think of modified approaches to continue providing radiological care while ensuring both worker and patient safety.<sup>5–8</sup> However, the constant influx of new COVID-19 data and subsequent frequent alterations in hospital protocols can lead to both staff and patient confusion amidst the COVID-19 pandemic. In order to decrease confusion and streamline operations of the new imaging paradigm during the pandemic, our institution created a dedicated radiology COVID-19 call center. Additionally, we created several dedicated out-patient COVID-19 imaging sites (referred to as our “HOT” sites). The aim of the “HOT” sites is to reduce the spread of

COVID-19 via imaging facility transmission. We share our experiences in creating the call center and “HOT” sites in hopes that other institutions can create a similar model to benefit the care of their patients.

### Institutional Approach Employed to Address the Problem

Informed consent was waived for this retrospective, HIPAA compliant project. IRB approval was waived for this quality improvement project that took place at a large academic tertiary care center that serves as the flagship hospital for a multistate academic health system composed of 7 hospitals across the states of CT and RI (2944 beds). These sites are staffed by 4 different radiology groups (2 private practices, 1 hybrid private/academic practice, and 1 academic practice).

#### Creation of Radiology Call Center

In keeping with the national trend toward health care system integration and consolidation,<sup>9–10</sup> we created a central radiology call center hotline housed at one of our temporarily closed out-patient radiology facilities to serve all 7 hospitals across our health system. Its first day of operation was on March 23, 2020 and the center

The author(s) declare(s) that they had full access to all of the data in this study and the author(s) take(s) complete responsibility for the integrity of the data and the accuracy of the data analysis.

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remains open to date. The call center was open 7 days a week (7am–7pm) until May 31, with hours reduced to Monday to Saturday (8am–5pm weekdays and 8am–3pm Saturday) on June 1. Beginning August 22, Saturday hours were also removed. Reduction in hours was implemented as COVID infection rates dropped in our region, call volume analysis showed low numbers during weekends and evenings, and some radiology call center staff returned to their normal clinical duties with increased radiology out-patient appointments. A voice-mail is available for calls after hours with calls returned the next business day. Our health system also created a central call center at the onset of the pandemic to serve as a go-to resource for all COVID-19 related questions for both patients and providers which has remained operational 7 days a week (7am–7pm). The staff for the main health system center was educated on the creation of the radiology center and instructed to transfer any calls related to radiology to our center. We recorded the call volume, reasons for calling, types of callers, and hospital facility the call was best associated with.

### Call Center Staffing

Staffing is composed of 2 to 3 radiology technologists (mix of different modalities), central scheduling staff, and 2 assistant chief radiology technologists who serve as managers for the newly created team. This allows for up to seven staff to be present at once, each of which has access to a phone and computer workstation. Bilingual staff is also utilized to assist with our Spanish speaking population. All staff are updated each morning on current protocols, policies, and hours of operation. Temporary closure of many out-patient facilities and deferral of all routine radiology testing created a large pool of technologists available to cross train and work in these new roles. One second year or more senior radiology resident was also assigned to the call center as a clinical back up for call center staff and to interface with ordering providers when questions arose. This rotation was staffed by residents pulled from front line clinical service who was working from home Monday to Friday, 8am–5pm. Residents rotated on a weekly basis from March through June, 2020 and their reasons for involvements were documented. However, as residents eventually returned to work onsite, questions have been directed to appropriate inpatient radiology section during business hours. Any radiologist calls after 5pm on weekday or during the weekend are fielded by the radiology residents and staff onsite in our main emergency department radiology reading room which has coverage 24 hours a day.

### Creation of Out-patient COVID-19 Imaging “HOT” Sites

As healthcare setting transmissions can play an important role in disease spread,<sup>11</sup> our department spearheaded creation of “HOT” sites or designated out-patient facilities to image COVID-19 positive or patients under investigation (PUI) across the state. PUI are patients who exhibit symptoms of COVID-19 with no laboratory polymerase chain reaction confirmation or clinical concern for false negative COVID-19 results. The COVID-19 test results at the time of imaging were recorded. This operation launched on March 30, 2020. All sites are operational 5 days a week following normal business hours. This model follows several guidelines published from the World Health Organization to allow for cohorting patients into the same facility when being treated or worked up for COVID-19 to decrease community transmission and conserve personal protective equipment (PPE).<sup>12</sup>

As part of our transition to a “HOT” site model for out-patient imaging, we also changed the process for patient to obtain radiographs. Walk-in appointments are disallowed so that patients could only be scheduled through the call center. A best practice advisory was created in our electronic medical record (EPIC, Verona WI) with instructions to call the radiology center to schedule all radiograph appointments starting March 30, 2020. Call center staff screen all

**TABLE 1**

Screening questions for COVID-19 asked to all patients prior to radiology appointment and during check-in

| COVID-19 Screening Questions   |
|--|
| Positive COVID-19 test<br>OR<br>Any of the following:  |
| <ul style="list-style-type: none"> <li>• Fever of <math>\geq 100</math> Fahrenheit degrees or 37.8 Celsius degrees</li> <li>• New cough</li> <li>• New shortness of breath</li> <li>• New sore throat</li> <li>• New chills</li> <li>• New loss of smell or taste</li> </ul> |
| OR<br>Any of the following:  |
| <ul style="list-style-type: none"> <li>• Close contact with someone confirmed or suspected of COVID-19 over the last month</li> <li>• Advised to stay home by a medical professional due to illness that might be COVID-19</li> </ul>  |

patients at time of scheduling for COVID-19 (Table 1). These questions are primarily tailored to the common COVID-19 symptoms and risk factors for infection.<sup>13–16</sup> Patients who screen positive are scheduled at the relevant “HOT” site for that modality. Furthermore, patients who are assigned to be imaged at a non “HOT” site receives a pre-appointment phone calls 24–48 hours before their appointments to be re-screened. They are also re-screened for symptoms with temperature checks upon arrival to imaging facilities. Any patients who screen positive for COVID-19 are routed to the closest radiology “HOT” site when feasible on the day of exam.

### Statistical Analysis

Statistical analysis was performed using Excel (Microsoft Corporation, Version 15). Linear regression was used to examine call volume and the number of exams over time. *P* values  $<0.05$  are considered statistically significant.

### Description of the Outcomes of the Institutional Practice or Change in Practice

Call volume and call reasons from March 23<sup>rd</sup> through May 10<sup>th</sup> 2020 were analyzed. A total of 2548 calls were received over 7 weeks. Average number of calls per day by week were 8, 48, 42, 53, 63, 67, and 99 for weeks 1–7, respectively (Figure 1). A linear increase in calls during this period ( $R^2 = 0.17$ ,  $P = 0.003$ ) was noted. Calling reasons are tabulated in Table 2. Scheduling issues reflected the most common reason for a call. The top 3 callers were patients or their family members ( $n = 2144$ , 86%), clinic staff ( $n = 124$ , 5%), and providers ( $n = 110$ , 4%). Most calls from patients were associated with our main academic tertiary care center ( $n = 2111$ , 85%).

Five calls in total were made to our senior radiology residents in the duration of 7 weeks. These calls involved deciding whether the patient was a “HOT” site candidate or not. These patients had screened positive to the questionnaire but had tested negative for COVID. The residents searched patient’s EPIC chart, reviewed imaging, and called the provider to determine their clinical status and determine if there was a concern for a false negative COVID-19 test.

A total of 405 radiological studies in 355 unique patients were performed during these 7 weeks at our main “HOT” site. Some patients had more than one radiology exam on same day and others had exams on different days. Of the 355 unique patients assessed, 16 returned for imaging at the HOT site on a separate day for a total of 371 separate patient encounters by date of study. Seventy-two out of the total 371 patient encounters (19%) were COVID-19 positive by testing at time of exam with the remaining patients deemed PUI.

### Call Center Volume

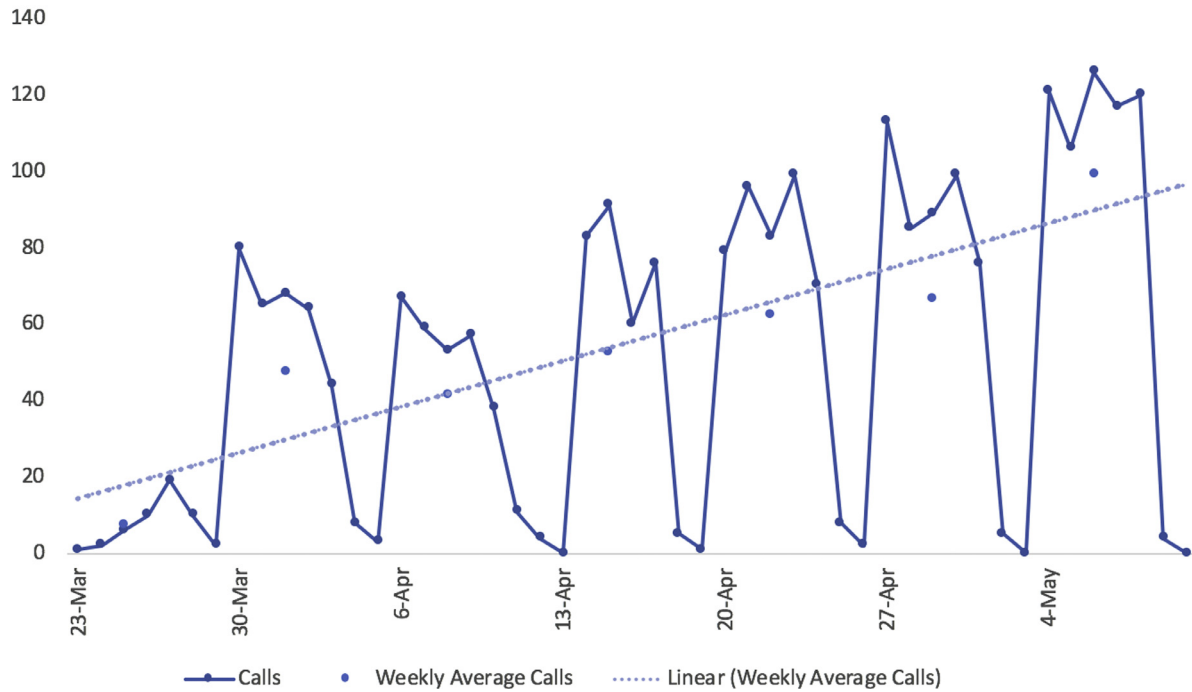


FIG 1. Daily and weekly radiology call center volume trend in its first 7 weeks.

#### Discussion of Future Directions

A significant linear increase of call center utilization was noted over time with nearly 100 calls a day being fielded by week 7. As expected, calls related to scheduling constituting the most frequent call reason, with sudden rise in week 2 when it became mandatory to schedule all x-ray exams through the call center so proper COVID-19 screening could occur. While some of the increase in call volume can be attributed to higher rates of imaging utilization as the pandemic progressed in our community, our out-patient volume at nonHOT site locations (internal data) has remained relatively flat over the same time period. We therefore attribute the progressive increase in utilization as likely related to increased awareness of the resource amongst ordering providers and patients. However, as the current pandemic curve begins to flatten, we expect the call volume to decrease and the call center to eventually disassemble once the threat of COVID-19 infection falls. Nevertheless, in the event of resurgence of COVID-19 or other future pandemics, a blueprint to quickly centralize an operational group encompassing 4 different radiology practices spanning 7 hospital sites in 2 states is now available. The model has served our health network well and is now allowing a

similar approach as we ramp-up operations in a period still complicated by frequent changes in operations including PPE guidance, pre-appointment screening, and handling greater numbers of patients who are recovering from COVID in the community.

To our knowledge, no other published experience on creating this model exists for US radiology practices. Prior work has shown that health-care based call centers that improve availability of timely and accurate information are associated with increased patient satisfaction.<sup>17</sup> Similar models have been used during H1N1 and influenza outbreaks, including screening and directing patients to get appropriate help.<sup>18-19</sup> In our multi-hospital system, there are unintended discrepancies in policies and working hours between radiology facilities. This made it susceptible to inadvertently disseminate incorrect information and be variably available, respectively. Furthermore, our health system previously operated with a large diverse group of schedulers, and also allowed some clinic staff to schedule radiology exams. Scaling down and centralizing this operation has been crucial in not only serving as a unified accessible source of updated radiology information, but also allowing proper screening and directing COVID-19 positive or PUI patients to be booked at our “HOT” sites. At our main institutional “HOT” site, 19% of patients imaged were COVID positive by lab testing at time of exam with the remaining deemed PUI based on screening.

Our study has a few limitations. The call center and “HOT” sites are made for a large multi-state health system. Due to rapidity in which center was created during current crisis, we did not measure or categorize calls across the health system prior to call center creation to allow before and after comparison. We did not assess the subsequent COVID-19 test status for all the PUI patients imaged at our “HOT” site as many out-patients in our state were managed conservatively for presumed COVID-19 infection due to lack of easily accessible testing during early weeks of the pandemic. Lastly, we did not poll patients or providers to gather satisfaction scores for their experience using the call center or “HOT” sites.

In summary, we report the creation of a system wide centralized radiology call center and dedicated COVID-19 out-patient “HOT” sites

TABLE 2  
Distribution of reasons for calls made to the radiology call center

| Reason for Calls with Subcategory (n = 2548) | Percentage |
|--|------------|
| Scheduling (2336)                            | 92%        |
| Radiology operations (145)                   | 6%         |
| Location/direction/parking (43)              | 2%         |
| Policy and protocol (42)                     | 2%         |
| Radiology COVID-19 question (27)             | 1%         |
| Radiology report (16)                        | <1%        |
| Call Center information (17)                 | <1%        |
| Miscellaneous (10)                           | <1%        |
| Non-Radiology related (67)                   | 3%         |
| Non-radiology COVID-19 question (22)         | <1%        |
| Lab question (23)                            | <1%        |
| Miscellaneous (22)                           | <1%        |

to effectively schedule, image, and answer radiology operational issues during the current COVID-19 healthcare crisis. The center continues to provide efficient and reassuring radiology operations by providing a single reliable point of contact and a source of truth for all facets of radiology across several locations spanning two states. In doing so, we facilitate high quality patient centered care while protecting the health of our patients and staff. While the call center and “HOT” sites will eventually disassemble, the model leaves us with a blueprint on how to handle any future COVID-19 resurgence or a new pandemic.

#### Authors contributions

Jang, B: acquisition, analysis, and interpretation of data and draft and critical revision of the manuscript.

Facchini, D: draft and critical revision of the manuscript.

Staib, L: analysis and interpretation of data and manuscript critical revision.

Fernandez, A: data acquisition and manuscript revision.

Pye, S: data acquisition and manuscript revision.

Goodman, TR: draft and critical revision of the manuscript.

Granucci, C: draft and critical revision of the manuscript.

Guertin, N: draft and critical revision of the manuscript.

Pahade, JK: conception and design the study, analysis, and interpretation of data, and draft and critical revision of the manuscript.

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