Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Impact of COVID-19 social distancing regulations on outpatient diagnostic imaging volumes and no-show rates

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ABSTRACT

Background: The coronavirus disease 2019 (COVID-19) pandemic has significantly impacted outpatient radiology practices, necessitating change in practice infrastructure and workflow.
Objective: The purpose of this study was to assess the consequences of social distancing regulations on 1) outpatient imaging volume and 2) no-show rates per imaging modality.
Methods: Volume and no-show rates of a large, multicenter metropolitan healthcare system outpatient practice were retrospectively stratified by modality including radiography, CT, MRI, ultrasonography, PET, DEXA, and mammography from January 2 to July 21, 2020. Trends were assessed relative to timepoints of significant state and local social distancing regulatory changes.
Results: The decline in imaging volume and rise in no-show rates was first noted on March 10, 2020 following the declaration of a state of emergency in New York State (NYS). Total outpatient imaging volume declined 85% from baseline over the following 5 days. Decreases varied by modality: 88% for radiography, 75% for CT, 73% for MR, 61% for PET, 80% for ultrasonography, 90% for DEXA, and 85% for mammography. Imaging volume and no-show rate recovery preceded the mask mandate of April 15, 2020, and further trended along with New York City's reopening phases. No-show rates recovered within 2 months of the height of the pandemic, however, outpatient imaging volume has yet to recover to baseline after 3 months.
Conclusion: The total outpatient imaging volume declined alongside an increase in the no-show rate following the declaration of a state of emergency in NYS. No-show rates recovered within 2 months of the height of the pandemic with imaging volume yet to recover after 3 months.
Clinical impact: Understanding the impact of social distancing regulations on outpatient imaging volume and no-show rates can potentially aid other outpatient radiology practices and healthcare systems in anticipating upcoming changes as the COVID-19 pandemic evolves.

1. Introduction

Coronavirus disease (COVID-19) is the clinical manifestation of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2),[1] which was first detected in Wuhan, China in December 2019. On January 13, 2020, the first international case of COVID-19 was reported in Thailand.[2] One week later, on January 20, the first confirmed case was announced in the United States.[3] The World Health Organization (WHO) issued a statement on January 30 declaring COVID-19 a global health emergency, and the United States followed suit the following day by declaring a national public health emergency.[4] After the first cases were discovered in New York State (NYS) and New York City (NYC) in early March,[5] New York Governor Andrew Cuomo declared a state of emergency. NYC public schools closed soon after on March 16, and a citywide "stay at home" order was issued on March 22 effectively closing all non-essential businesses and prohibiting gatherings of any size.

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The number of NYC cases, hospitalizations, and deaths from COVID-19 continued to rise exponentially in subsequent weeks, ultimately peaking around April 6 at approximately 1700 hospitalizations and 600 deaths in a single day.[5] A mask mandate was issued on April 15. Over time, with social distancing regulations in place, the number of regional cases and deaths has declined progressively, reaching a low in June and July. On June 8, NYC initiated Phase I of its reopening plan, which included the resumption of elective surgeries and ambulatory care. Phases II-IV gradually followed in June and July. As of July 20th, NYC has seen approximately 220,000 cases, 56,000 hospitalizations, and 19,000 confirmed deaths.[5]

The pandemic has significantly impacted outpatient radiology groups and healthcare systems on a global scale. During this period, healthcare policies have recommended that institutions and providers temporarily pause elective surgeries and imaging as part of a consistent effort to slow the spread of disease and conserve healthcare resources.[6] On March 14, ACR endorsed new guidelines from the Centers of Disease Control and Prevention that specified rescheduling of non-urgent outpatient visits.[7] As a result, significant adjustments were made among radiology practice infrastructure and work patterns. Several studies have outlined the impact of the lockdown and the subsequent drop in overall imaging volume,[8–13] however, as many former epicenters have started to recover and cities reopen, the focus has shifted towards predicting the recovery of imaging volume to pre-pandemic levels.

In this study, we evaluate the relationship between social distancing regulations, outpatient imaging volumes, and no-show rates due to COVID-19 during the surge and recovery periods of the pandemic in a large healthcare system in NYC.

2. Methods

2.1. Study design and participants

This retrospective study was compliant with the Health Insurance Portability and Accountability Act. As data was aggregate daily data of number of studies and no-show rates and did not contain individual personal identifying information, the study did not qualify as human subjects research and did not require an institutional review board process. The study included patients from a large, metropolitan hospital system consisting of six outpatient practices across 3 NYC boroughs (Manhattan, Queens, and Brooklyn) from January 2, 2020 to July 21, 2020. These volumes and no-show rates were further stratified per diagnostic imaging modality, including radiography, CT, MRI, PET, ultrasonography, DEXA, and mammography. Outpatient interventional procedures were excluded for this study. Outcomes were provided as aggregate daily data.

2.2. Significant dates in New York City

Significant local and regional COVID-19 related and social distancing regulations dates (Table 1) were obtained from a timetable published in The New York Times.[14] The first cases in NYC were confirmed on March 1 followed shortly by the governor's declaration of a State of Emergency in NYS on March 7. On March 10, our institution placed restrictions on the number of visitors, up to 2, who could accompany patients to the hospital. From March 17 to May 26, the policy was further modified to restrict nearly all visitors with few exceptions. Additionally, elective surgeries were halted statewide from March 23 to June 5. In graded response to progressive COVID-19 control, NYC reopened progressively more services and commercial availability in four phases between June 8 and July 20.

2.3. Statistical analysis

The total number of scheduled and completed studies was provided for each imaging modality via aggregate data from an Electronic Medical Record Data Warehouse query throughout the hospital system. No-show rates were calculated as the proportion of completed to scheduled exams. Rescheduled exams and those canceled at least one day prior to the study date were excluded from the analysis. Daily volumes and no-show rates for each modality were plotted as line graphs, onto which significant events including implementation of social distancing regulations were overlaid. The respective baseline for imaging volume and no-show rates was calculated using data spanning a period of 4 weeks (February 3–March 2, 2020) prior to the first documented case of COVID-19 in NYC. Volumes and no-show rates were also assessed against respective months from 2019 to address the effect of seasonal changes. Independent-samples *t*-tests were used for statistical analysis. Statistical significance was considered for p values < 0.05. Analyses were conducted with the SPSS statistical package for Windows, Version 25 (IBM, Armonk, New York).

Table 1
Significant dates in New York City pertaining to the COVID-19 pandemic.

Date	Significant events
1/20/20	First case documented in USA
1/30/20	WHO declares global health emergency
3/1/20	First confirmed case in New York City
3/7/20	State of Emergency declared for NYS by Governor Cuomo
3/10/20	Institutional restriction to 1–2 healthy visitors per patient
3/11/20	WHO declares COVID-19 a global pandemic
3/16/20	Closure of NYC public schools
3/16/20	Institutional temporary pause of elective surgeries and imaging
3/22/20	"Stay at Home" order issued for NYS
3/24/20	Institutional restriction of any visitor
4/15/20	Mask mandate issued in NYS
6/8/20	NYC Phase I Reopening
6/9/20	Institutional resumption of elective surgeries and imaging
6/22/20	NYC Phase II Reopening
7/6/20	NYC Phase III Reopening
7/20/20	NYC Phase IV Reopening

3. Results

3.1. Outpatient imaging volume

From January 2 to July 21, 2020, the total outpatient imaging volume throughout our health system included 92,254 studies, consisting of 20,705 radiographs; 16,137 CT; 3360 PET; 18,968 MR; 15,942 US; 2548 DEXA scans; and 14,594 mammograms. In 2019, over the same date range, the total outpatient volume was 133,951 studies, consisting of 31,354 radiographs; 22,629 CT 3847 PET; 25,193 MR; 24,658 US; 4171 DEXA scans; and 22,109 mammograms (Table 2). Fig. 1 displays the imaging case volumes by modality on a timetable of significant social distancing regulation dates. COVID-19 related events leading up to the decline in case volume include the first case in the United States (January 20, 2020), WHO declaration of an international global health emergency (January 30), and 1st case in NYC (March 1). Other COVID-19 related events are listed in Table 1. The largest decline in case volume

Table 2
2019 and 2020 total volume and average no-show rates (NSR) per modality.

January 2–July 19, 2019			January 2–July 17, 2020		
Modality	Total volume	Average NSR (%)	Modality	Total volume	Average NSR (%)
XR	31,354	3.1%	XR	20,705	8.4%
CT	22,629	19.3%	CT	16,137	30.0%
PET	3847	22.2%	PET	3360	27.1%
MRI	25,193	20.6%	MRI	18,968	30.9%
US	24,658	16.6%	US	15,942	28.7%
DEXA	4171	19.8%	DEXA	2548	35.5%
MG	22,109	20.3%	MG	14,594	36.7%
Total:	133,961	17.4%	Total:	92,254	28.2%

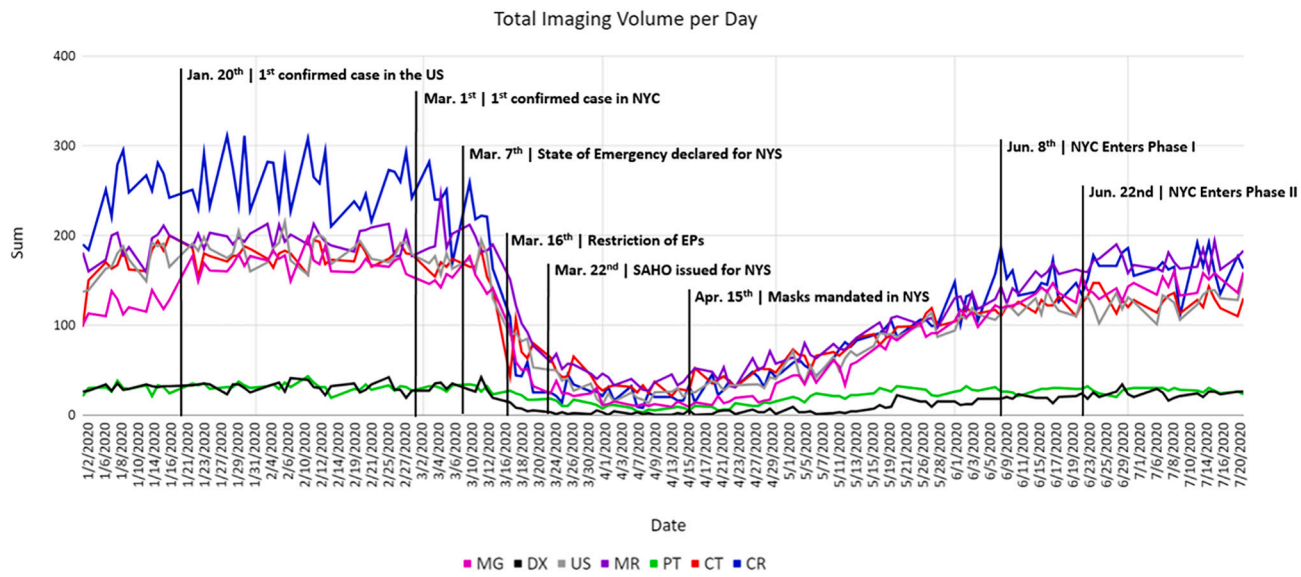

Fig. 1. Trends in outpatient imaging volume per modality along with significant social distancing regulation dates are shown. The total daily number of completed studies is shown by modality: mammography, DEXA, ultrasonography, MR, PET, CT, and radiography.

began shortly after the declaration of a state of emergency in NYS. The overall drop in volume across all modalities was 85% from baseline over the course of 5 days between March 10 and 15. When stratified per modality, this represented a decrease from baseline of 88% for radiography, 75% for CT, 73% for MR, 61% for PET, 80% for ultrasonography, 90% for DEXA, and 85% for mammography. When compared to 2019 data, there was a statistically significant decrease ($p < 0.05$) across all modalities. During this decline, significant events included an institutional policy restricting visitors on March 10, closure of NYC public schools on March 16, institutional policy pausing elective surgeries and imaging on March 16, and New York State "stay at home" order on March 22.

Volume began to slowly recover over a timespan of more than 3 months after April 9. During this recovery, significant dates include a statewide mask mandate on April 15, Phase I of reopening in NYC on June 8, the resumption of elective surgeries and imaging at this institution on June 9, and Phases II–IV (June 22, July 6, and July 20, respectively). As of July 21, the overall average daily volume remains at 22% below baseline, corresponding with 36% below baseline for radiographs, 29% for CT, 12% for MRI, 13% for PET, 28% for US, 23% for DEXA, and 5% for mammograms.

3.2. No-show rates

Fig. 2 demonstrates the trend in the no-show and same day cancelation rate during this period across all outpatient modalities. At baseline from February 3 through March 2, 2020, no-show rates were 3% for radiography, 19% for CT, 29% for MRI, 24% for PET, 20% for ultrasonography, 17% for DEXA, and 24% for mammography, which were not significantly different from a similar timeframe in 2019 (Table 3). On

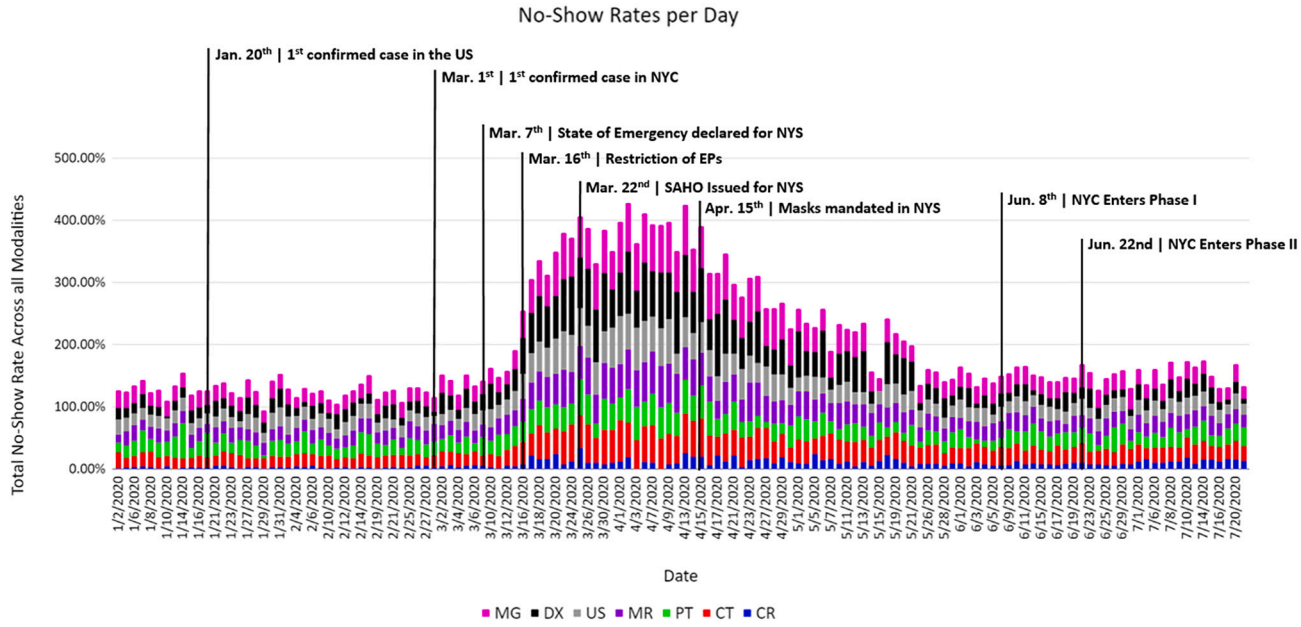

Fig. 2. Trends in outpatient no-show rates per modality along with significant social distancing regulation dates are shown. The total daily no-show rate is shown by modality: mammography, DEXA, ultrasonography, MR, PET, CT, and radiography.

Table 3
Comparison of 2019 vs. 2020 total volume (TV), average daily volume (ADV) of completed studies, and average no-show rates (NSR) per modality in three separate four-week periods before, during, and after the peak of the COVID-19 pandemic.

Modality	2019					
	Feb. 1–Mar. 1		Apr. 1–Apr. 26		Jun. 21–Jul. 19	
	ADV	Average NSR (%)	ADV	Average NSR (%)	ADV	Average NSR (%)
XR	227.0	3.2%	228.8	3.5%	218.1	3.2%
CT	159.0	18.5%	167.0	20.4%	160.6	17.7%
PET	26.0	24.2%	28.3	21.3%	25.9	25.6%
MRI	189.0	19.1%	174.6	22.9%	185.6	21.3%
US	173.0	15.8%	184.7	16.1%	176.8	15.8%
DEXA	30.0	14.7%	31.8	15.3%	30.2	21.9%
MG	154.3	19.1%	151.7	18.5%	158.3	22.7%
Total	**958.3**	**16.4%**	**966.8**	**16.9%**	**955.3**	**18.3%**

Modality	2020					
	Pre-COVID (Feb. 3–Mar. 2)		COVID (Apr. 1–Apr. 28)		Recovery (Jun. 19–Jul. 17)	
	ADV	Average NSR (%)	ADV	Average NSR (%)	ADV	Average NSR (%)
XR	260.0	2.8%	25.8	12.7%	160.3	10.8%
CT	177.0	19.0%	34.1	49.8%	127.1	25.4%
PET	31.0	22.0%	7.7	39.1%	27.8	23.0%
MRI	196.0	21.4%	40.7	53.1%	169.0	24.4%
US	183.0	19.8%	25.5	50.0%	124.1	21.8%
DEXA	31.0	17.2%	2.4	73.5%	23.0	19.6%
MG	168.8	22.8%	13.3	71.2%	142.9	26.3%
Total	**1046.8**	**17.9%**	**149.4**	**49.9%**	**774.0**	**21.6%**

March 10, a sharp rise in no-show rates was observed over a span of 4 weeks, peaking on April 9, where there was up to a 5-fold increase in no-show rates across all modalities. Specifically, no-show rates rose to 26% for radiography, 64% for CT, 47% for MRI, 55% for PET, 43% for ultrasonography, 78% for DEXA, and 70% for mammography. The highest increase in no-show rate was observed for radiography with up to an 8-fold increase. There was a statistically significant difference in no-show rates ($p < 0.05$) compared to the respective months in 2019. Notably, April 9 reflects the nadir of imaging volume across all modalities, as seen in Fig. 1.

By June 1, no-show rates had returned to baseline for all modalities except radiography. In fact, no-show rates for outpatient radiography remained elevated into the following month, averaging 14% as of July 2020, a 4-fold increase in the no-show rate compared to the 3% observed before the pandemic.

4. Discussion

The COVID-19 pandemic has had a significant economic burden on radiology groups and healthcare systems on a global scale. Recent studies from various regions in the country have suggested a decrease in imaging volume ranging from 30 to 90%.[8,10,15] The extent of this impact, in both decline and recovery, has recently been correlated to the number of regional COVID-19 cases reported.[15] As the pandemic continues to unfold throughout the country, an understanding of various factors contributing to the decline and recovery of imaging volume is important for radiology practices and management. In this study, we assessed the relationship between COVID-19 related social distancing regulations, outpatient imaging volumes, and no-show visits in our healthcare system. These findings may allow radiology outpatient practices to prepare for changes in imaging volumes and patient no-show based on state and local social distancing regulations and re-opening.

During the period from March 10 to March 15, our radiology outpatient practices experienced an acute 85% decrease in imaging volume. These findings were consistent with outpatient imaging volume decreases of 88% reported by another regional large hospital system during a similar time period.[8] In decreasing order of degree, modalities demonstrated volume reductions of 90% in DEXA, 88% in radiography, 85% in mammography, 80% in ultrasonography, 75% in CT, 73% in MRI, and 61% in PET. This pattern corresponds with substantial decreases in imaging performed for routine or non-urgent indications. As DEXA, radiography and mammography are often for screening, these modalities are expected to demonstrate a greater decline than other imaging modalities. Ultrasonography, CT, and MRI volume experienced slightly less decline in volume, presumably due to more urgent indications for imaging including cancer imaging or surveillance. Not surprisingly, PET imaging, most commonly performed for cancer imaging, experienced the smallest decline. The difference in reductions by modality compared with reports by Naidich et al[8] and Madhuripan et al[11] may be attributed to broader inclusion of inpatient and ED volume in modality specific results in those studies. Our results demonstrate outpatient specific volume changes which would be expected to demonstrate a greater decline in imagine volume compared to inpatient and ED volumes due to the less urgent or emergent nature of outpatient imaging.

No-show visits have been a long-standing issue in healthcare.[16] Numerous studies have reported the effects of patient no-show rates on radiology practices including potential for delays in patient care and diagnosis, inefficient resource utilization, and potential loss of revenue.[16] We aimed to assess the relationship between social distancing regulations, outpatient imaging volumes, and no-show rates in our outpatient practice. There was a significant increase in no-show visits from April 1 to April 28, 2020 (49.9%) compared with a similar time period in 2019 (16.9%). Frequency of no-show visits began trending towards baseline in mid-April, corresponding with our global volume recovery. To our knowledge, we believe this is the first study to explore the relationship between COVID-19 social distancing regulations, outpatient imaging volume, and no-show visits. These patterns may potentially assist radiology outpatient practices in evaluating resource allocation and prepare for adverse financial impact during a period of social distancing regulations similar to that experienced in NYC.

Reporting of outpatient radiology imaging volume has been limited in the literature largely due to the current status of the pandemic. Even as NYS and other early-impacted states have begun to recover, the incidence of COVID-19 has risen in many other localities, leading to modifications in state and local regulations.[17] Madhuripan et al[11] demonstrated a modest recovery of total radiology imaging volume over the span of 9 weeks although results had yet to recover to baseline. However, these investigators reported a region of relatively low COVID-19 case volume and a low peak inpatient census of 20 at their institution. The severity of the outbreak reported in that study may account for the variable decline and recovery experienced by different practices. Recovery in our outpatient imaging volume had begun by the time a statewide mask mandate had been initiated on April 15. Presumably, the general public may have been hesitant to visit healthcare facilities for fear of exposure, and a self-imposed 'social distancing' with respect to health care facilities contributed to the increased no-show rate. This was especially plausible as the most rapid decline in imaging volume occurred shortly after the announcement of the first confirmed case in NYC on March 1, followed shortly by a state of emergency for NYS on March 7. Recovery of the no-show rate spanned roughly 2.5 months, with a return to baseline by June 1 for most modalities except radiography. This particular observation is not surprising as the majority of our outpatient radiographs had been offered though walk-in appointments that did not require pre-scheduling for radiography until May 18, when pre-scheduling was mandated. The recovery of no-show rates to baseline may also have been attributed to the greater likelihood of patients committing to appointments scheduled in the peri-COVID era.

There are several limitations to our study. As this was a retrospective

study, we could not control for possible unknown confounding variables, and data on indications, referring physicians, CPT codes, and specific anatomical sections for each modality was not obtained for this study. For example, a possible increase in chest CT/CTA may have been masked by an overall decrease in CT attributed by a larger decline in CT abdomen/pelvis volume. Furthermore, our institution's temporary pause of elective surgeries and imaging starting March 16 may confound the precise impact of the regional social distancing regulations on total imaging volume. In other words, these institutional policies may not have been the initial cause for the decreasing volumes, but they may have exacerbated or accelerated patient responses after volumes had already begun to decline. Of note, no-show rates should not be affected by institution-specific closure of elective imaging as these policies were presumably not known to patients. Another limitation is that our healthcare institution is in NYC, which was the initial epicenter of the COVID-19 pandemic in the United States, potentially limiting the applicability of these results. Further investigation and multiregional collaboration may be warranted to ascertain whether these results may be extrapolated to institutions in other regions. Lastly, without interviewing patients, it is difficult to accurately quantify the extent in which social distancing regulations contributed to the overall changes in imaging volume that were observed.

In summary, understanding the impact of social distancing regulations on outpatient imaging volume and no-show rates can potentially aid other outpatient radiology practices and healthcare systems in anticipating upcoming changes as the COVID-19 pandemic evolves.

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Code availability

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Study design/conceptualization: AD, SK, ED, TC, RL, BD
Data curation: SK, KM, BD, JH, NS, BM, DG
Statistical analysis: SK, KM, AD, MF, BM
Manuscript writing: AD, SK
Manuscript editing: KM, ED, TC, BM, DG, MF, BD, RL, BD
Supervision: BD, JH, NS, RL, BD.

Declaration of competing interest

Nothing to disclose.

References

[1] Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395:497–506. https://doi.org/10.1016/S0140-6736(20)30183-5.
[2] Dechsupa S, Assawakosri S, Phakham S, Honsawek S. Positive impact of lockdown on COVID-19 outbreak in Thailand. Travel Med Infect Dis 2020;36. https://doi.org/10.1016/j.tmaid.2020.101802.
[3] Holshue ML, DeBolt C, Lindquist S, et al. First case of 2019 novel coronavirus in the United States. N Engl J Med 2020;382:929–36. https://doi.org/10.1056/NEJMoa2001191.
4. Statement on the second meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov. [Accessed 9 August 2020] [n.d.].
5. COVID-19: data summary, NYC Health. https://www1.nyc.gov/site/doh/covid/covid-19-data.page. [Accessed 9 August 2020] [n.d.].
[6] Stahel PF. How to risk-stratify elective surgery during the COVID-19 pandemic? Patient Saf Surg 2020;14. https://doi.org/10.1186/s13037-020-00235-9.
7. COVID-19 radiology-specific clinical resources, American College of Radiology. https://www.acr.org/Clinical-Resources/COVID-19-Radiology-Resources. [Accessed 9 August 2020] [n.d.].
[8] Naidich JJ, Boltyenkov A, Wang JJ, Chusid J, Hughes D, Sanelli PC. Impact of the coronavirus disease 2019 (COVID-19) pandemic on imaging case volumes. J Am Coll Radiol 2020;17:865–72. https://doi.org/10.1016/j.jacr.2020.05.004.
[9] Naidich JJ, Boltyenkov A, Wang JJ, Chusid J, Hughes D, Sanelli PC. Coronavirus disease 2019 (COVID-19) pandemic shifts inpatient imaging utilization. J Am Coll Radiol 2020. https://doi.org/10.1016/j.jacr.2020.06.011.
[10] Cavallo JJ, Forman HP. The economic impact of the COVID-19 pandemic on radiology practices. Radiology 2020:201495. https://doi.org/10.1148/radiol.2020201495.
[11] Madhuripan N, Cheung HMC, Alicia Cheong LH, Jawahar A, Willis MH, Larson DB. Variables influencing radiology volume recovery during the next phase of the coronavirus disease 2019 (COVID-19) pandemic. J Am Coll Radiol 2020;17:855–64. https://doi.org/10.1016/j.jacr.2020.05.026.
[12] Vagal A, Mahoney M, Allen B, et al. Rescheduling nonurgent care in radiology: implementation during the coronavirus disease 2019 (COVID-19) pandemic. J Am Coll Radiol 2020;17:882–9. https://doi.org/10.1016/j.jacr.2020.05.010.
[13] Cahalane AM, Cui J, Sheridan RM, et al. Changes in interventional radiology practice in a tertiary academic center in the United States during the coronavirus disease 2019 (COVID-19) pandemic. J Am Coll Radiol 2020;17:873–7. https://doi.org/10.1016/j.jacr.2020.05.005.
14. A timeline of the coronavirus pandemic, The New York Times. https://www.nytimes.com/article/coronavirus-timeline.html. [Accessed 9 August 2020] [n.d.].
[15] Sharpe RE, Kuszyk BS, Mossa-Basha M. Special report of the RSNA COVID-19 task force: the short- and long-term financial impact of the COVID-19 pandemic on private radiology practices. Radiology 2020;202517. https://doi.org/10.1148/radiol.2020202517.
[16] Harvey HB, Liu C, Ai J, et al. Predicting no-shows in radiology using regression modeling of data available in the electronic medical record. J Am Coll Radiol 2017;14:1303–9. https://doi.org/10.1016/j.jacr.2017.05.007.
17. Coronavirus in the U.S.: latest map and case count, The New York Times. https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html. [Accessed 9 August 2020] [n.d.].