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.

Clinical Imaging 73 (2021) 38–42

Contents lists available at ScienceDirect

Clinical Imaging

journal homepage: www.elsevier.com/locate/clinimag

Practice, Policy & Education

Impact of the COVID-19 pandemic on radiology physician work RVUs at a large subspecialized radiology practice

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ARTICLE INFO

Keywords:
COVID-19
RVU
Relative value units
Imaging volumes

ABSTRACT

Purpose: As the COVID-19 pandemic continues, efforts by radiology departments to protect patients and healthcare workers and mitigate disease spread have reduced imaging volumes. This study aims to quantify the pandemic's impact on physician productivity across radiology practice areas as measured by physician work Relative Value Units (wRVUs).

Materials and methods: All signed diagnostic and procedural radiology reports were curated from January 1st to July 1st of 2019 and 2020. Physician work RVUs were assigned to each study type based on the Medicare Physician Fee Schedule. Utilizing divisional assignments, radiologist schedules were mapped to each report to generate a sum of wRVUs credited to that division for each week. Differential impact on divisions were calculated relative to a matched timeframe in 2019 and a same length pre-pandemic time period in 2020.

Results: All practice areas saw a substantial decrease in wRVUs from the 2020 pre- to intra-pandemic time period with a mean decrease of 51.5% (range 15.4%–76.9%). The largest declines were in Breast imaging, Musculoskeletal, and Neuroradiology, which had decreases of 76.9%, 75.3%, and 67.5%, respectively. The modalities with the greatest percentage decrease were mammography, MRI, and non-PET nuclear medicine.

Conclusion: All radiology practice areas and modalities experienced a substantial decrease in wRVUs. The greatest decline was in Breast imaging, Neuroradiology, and Musculoskeletal radiology. Understanding the differential impact of the pandemic on practice areas will help radiology departments prepare for the potential depth and duration of the pandemic by better understanding staffing needs and the financial effects.

1. Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic sweeping the nation has caused a massive public health crisis and economic decline. In efforts to protect patients and healthcare workers, as well as mitigate the spread of the novel coronavirus, radiology departments have implemented deferment strategies for elective and non-time sensitive imaging and procedures.[1,2]

Our institution was located in one of the initial hotspots during the COVID-19 pandemic, with the state experiencing nearly 2000 new cases per day in early April and a 4.9% fatality rate as of October 17, 2020.[3] The first confirmed case at our hospital system was on March 16, 2020. Two days later, the radiology department deployed an imaging triage team of radiology residents to review pending and scheduled diagnostic radiology appointments to determine time-sensitivity. A similar process was implemented for procedures with deferment decisions made by staff radiologists in coordination with ordering clinicians. The next two months saw a tremendous decrease in imaging and procedural volumes. A statewide stay-at-home order was initiated on March 23, 2020 and the order was initially lifted on June 1, 2020.[4]

Early reports predicted the impact on radiology departments to last 3–4 months with a 50–70% decline in imaging volumes during the pandemic.[5] Madhuripan et al. reported a 46% decline in baseline imaging volumes compared to the previous year with the greatest impact on the musculoskeletal and breast divisions.[6] A recent study from New York reported an 88% decline in outpatient imaging volumes.[7] The aim of this study was to quantify the impact of the COVID-19 pandemic on radiologist productivity as measured by work Relative Value Units (wRVUs) across various radiology practice areas within a large subspecialized hospital-based radiology department.

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https://doi.org/10.1016/j.clinimag.2020.11.046
Received 11 August 2020; Received in revised form 13 November 2020; Accepted 24 November 2020
Available online 5 December 2020

2. Material and methods

This Health Insurance Portability and Accountability Act-compliant, retrospective study was conducted within a subspecialized radiology practice that is part of a larger medical group and integrated health system. Only locations serviced solely by the subspecialized radiology practice were included, which includes both a tertiary and quaternary hospital, three standalone emergency departments, and multiple satellite imaging centers.

Following institutional review board approval, all signed diagnostic and procedural radiology reports were curated for weeks 2–21 for year 2019 and 2020 along with weeks 22–26 for 2020. Physician work Relative Value Units (wRVUs) and technical component RVUs were assigned to each study type based on the Medicare Physician Fee Schedule. Utilizing divisional assignments within the scheduling software QGenda, LLC (Atlanta, GA), staff radiologist schedules were mapped to each report to generate a sum of wRVUs credited to that division for each week. Practice areas were divided into Emergency Radiology (ER), Body Imaging, Body Interventional Radiology (BIR), Breast Imaging, Vascular Interventional Radiology (VIR), Pediatrics, Musculoskeletal (MSK), Thoracic Imaging, Obstetrics (OB), Nuclear Medicine (NM), and Neuroradiology. Emergency Radiology wRVUs were those attributed to staff within the ER division, which interprets Stat and Inpatient cases during non-daytime hours (3 PM to 7 AM on weekends and 4 PM to 7 AM on weekdays) with staggered staffing. Emergency Department cases read by radiologists within other practice areas were mapped to those respective divisions. In addition, wRVUs were calculated for each of the following diagnostic imaging modalities: radiographs, CT, MRI, mammography, non-PET nuclear medicine, PET/CT, and ultrasound. wRVUs were also calculated according to the location where the imaging or procedure was performed (inpatient, outpatient, Emergency Department) regardless of the practice area of the interpreting radiologist. Weeks of the year were labeled sequentially and wRVUs were calculated within those weeks. Differential impact by divisions and modalities were calculated relative to a matched timeframe in 2019, as well as to a same length pre-pandemic time period in 2020. The pre-pandemic time period was defined as weeks 2–11 and the intra-pandemic time period as weeks 12–21. The examined time periods were each 10 weeks in length. Daily new COVID-19 cases were obtained from the www.michigan.gov public database.

3. Results

Fig. 1 demonstrates the overall trend in total weekly wRVUs for the radiology department in 2019 and 2020 superimposed on daily new COVID-19 cases in Michigan with the majority of cases being within the counties serviced by our health system. Pre-pandemic 2020 wRVUs were higher than their 2019 counterparts, however 2020 wRVUs showed a steep decline coinciding with a rise in new COVID-19 cases and initiation of radiology deferment protocols. wRVUs reached a nadir during week 13, where total wRVUs were down 70.5% from baseline 2019 wRVUs. Early recovery of intra-pandemic wRVUs is noted from weeks 22 to 26 with a recovery to 90.8% of baseline 2019 wRVUs at week 26.

In comparing the pre-pandemic (weeks 2–11) and intra-pandemic (weeks 12–21) time periods in 2020, all practice areas saw a substantial decrease in wRVUs with a mean decrease of 51.5% (range 15.4%–76.9%) (Table 1 and Fig. 2). The largest percentage declines between the pre- and intra-pandemic periods were in Breast, Musculoskeletal, and Neuroradiology, which had decreases of 76.9%, 75.3%, and 67.5%, respectively. The lowest percentage declines were in Pediatrics, OB, Thoracic, ER, and VIR, which had declines of 15.4%, 30.4%, 40.6%, 41.7%, and 42.7%, respectively.

In comparing the intra-pandemic weeks in 2020 (weeks 12–21) with the matched time period in 2019, all practice areas saw a substantial decrease in wRVUs with a mean decrease of 52.1% (range 26.4%–75.1%) (Table 1). The largest declines between 2019 and 2020 were in Breast, Neuroradiology, and Musculoskeletal, which had decreases of 75.1%, 70.6%, and 66.0%, respectively. The lowest declines were again in Pediatrics, OB, Thoracic, VIR, and ER which had declines of 26.4%, 26.9%, 37.9%, 40.2%, and 42.5%, respectively. Technical component RVUs were also reduced during this time, decreasing by 729,798 (54.0%) for weeks 12–21 from 2019 to 2020.

The modalities most impacted by the pandemic were mammography, MRI, and non-PET nuclear medicine, which had wRVU percentage

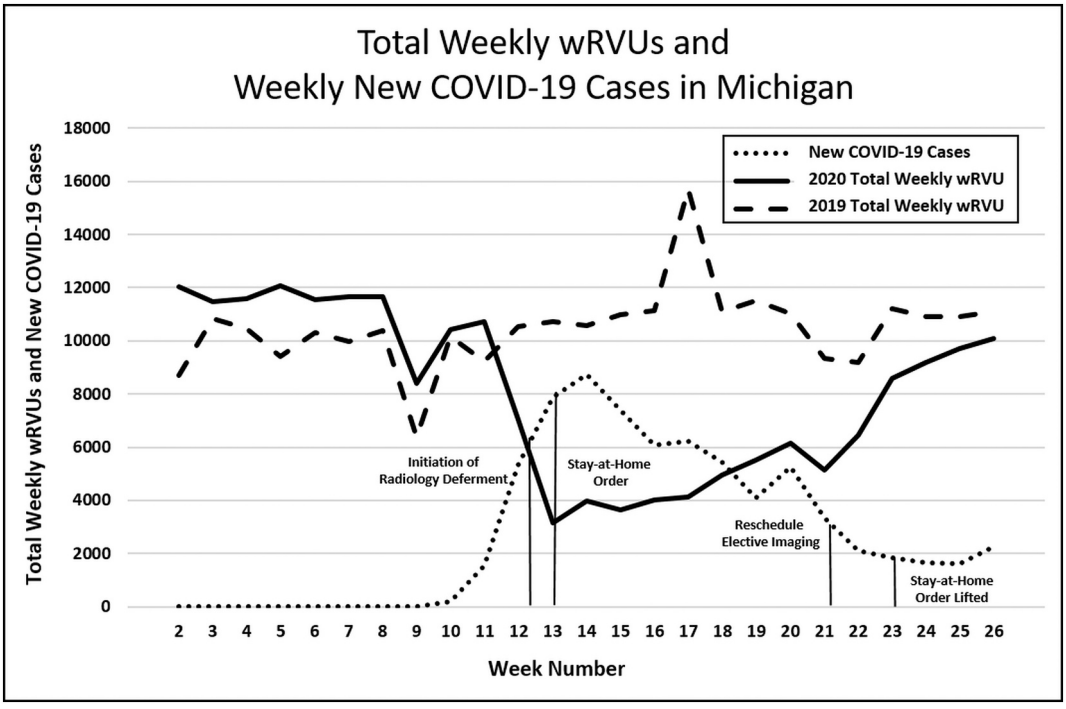

Fig. 1. Line graphs depicting the total weekly wRVUs for weeks 2–26 of the years 2019 and 2020 along with weekly new COVID-19 cases in the state of Michigan.

Table 1
Change in average weekly work RVUs by practice area.

Division	2020 Pre-pandemic (weeks 2–11) vs Intra-pandemic (weeks 12–21)		2020 Intra-pandemic (weeks 12–21) vs 2019 matched timeframe (weeks 12–21)	
	Total difference (wRVU)	% Change	Total difference (wRVU)	% Change
BIR	−178.7	−60.7	−213.6	−64.8
Body	−1373.7	−57.7	−1535.5	−60.4
Breast	−1161.1	−76.9	−1055.2	−75.1
Thoracic	−203.9	−40.6	−182.2	−37.9
ER	−932.2	−41.7	−961.4	−42.5
MSK	−605.1	−75.3	−385.4	−66.0
Neuro	−1346.0	−67.5	−1559.5	−70.6
Nucs	−171.1	−58.0	−207.0	−62.6
OB	−76.6	−30.4	−64.3	−26.9
Peds	−19.0	−15.4	−37.4	−26.4
VIR	−327.8	−42.7	−296.1	−40.2

BIR – Body interventional; ER – Emergency Radiology; MSK – Musculoskeletal; Neuro – Neuroradiology; Nucs – Nuclear Medicine; OB – Obstetrics; Peds – Pediatrics; VIR – Vascular interventional radiology.

decreases of 82.1%, 68%, and 64.9% respectively, from pre-pandemic 2020 levels (Fig. 3 and Table 2) and decreases of 81.6%, 69.7%, and 70.7% respectively, from matched 2019 levels (Table 2). PET/CT scans had the lowest percent decline in wRVUs from pre-pandemic levels and from 2019 at 41.6% and 39.7%, respectively.

Table 2
Change in average weekly work RVUs by modality.

Modality	2020 Pre-pandemic (weeks 2–11) vs intra-pandemic (weeks 12–21)		2020 Intra-pandemic (weeks 12–21) vs 2019 matched timeframe (weeks 12–21)	
	Total difference (wRVU)	% Change	Total difference (wRVU)	% Change
CR	−776.8	−58.0	−671.1	−54.4
CT	−1847.4	−47.5	−1967.6	−49.1
MG	−1045.8	−82.1	−1010.5	−81.6
MR	−1101.4	−68.0	−1191.0	−69.7
NM	−76.4	−64.9	−99.4	−70.7
PT	−58.5	−41.6	−54.0	−39.7
US	−932.2	−55.5	−911.6	−54.9

CR – Computed Radiography; CT – Computed Tomography; MG – Mammography; MR – Magnetic Resonance; NM – Nuclear Medicine; PT – Positron emission tomography (PET); US – Ultrasound.

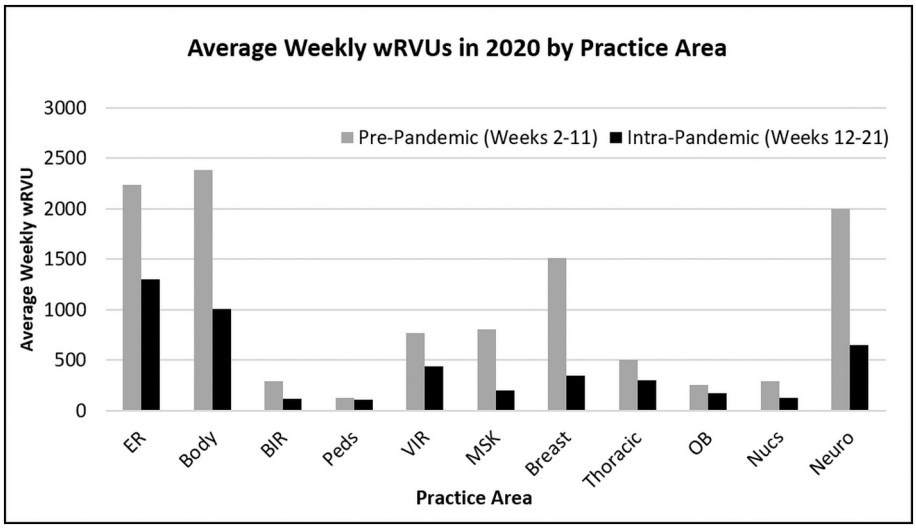

Fig. 2. Average weekly wRVUs during the 2020 pre-pandemic (weeks 2–11) and intra-pandemic (weeks 12–21) time periods by practice area.

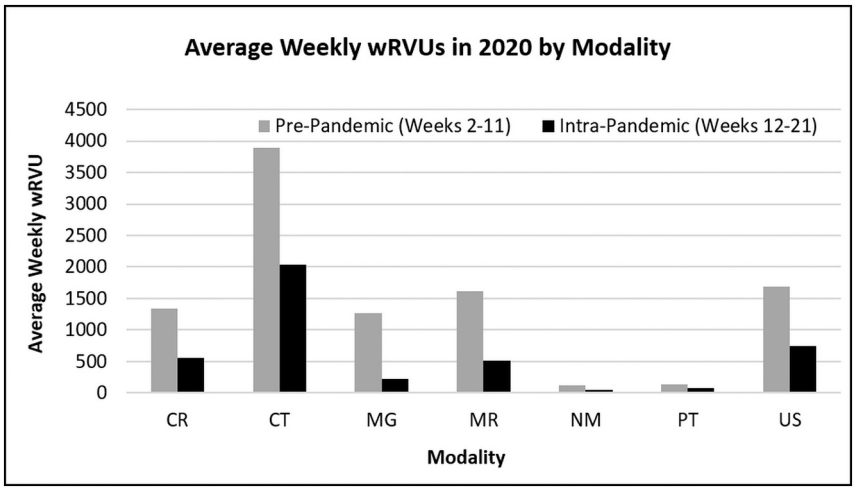

Fig. 3. Average weekly wRVUs during the 2020 pre-pandemic (weeks 2–11) and intra-pandemic (weeks 12–21) time periods by modality.

By imaging location, outpatient wRVUs showed the greatest decline during the intra-pandemic time period reaching a nadir at week 15 with a 77.8% drop from its pre-pandemic peak of 7116.1 wRVUs in week 5 (Fig. 4). In comparison, the percentage decrease in wRVUs from the pre-pandemic peak to nadir was 75.6% for Emergency Department imaging and 67.6% for Inpatient imaging.

4. Discussion

In contrast to recent studies that simply measured imaging volumes, our study examined physician work RVUs, which provide a better estimate of the true impact of COVID-19 on physician and departmental productivity, thereby enabling departments to better estimate staffing needs and plan for the financial effects.

Our study found that all radiology practice areas and modalities experienced a substantial decrease in wRVUs from their 2020 pre-pandemic levels and in comparison to a similar timeframe in 2019. Breast imaging, neuroradiology and musculoskeletal radiology experienced the greatest percent decline in wRVUs, similar to recent studies.[6–8] Breast imaging relies heavily on screening mammograms, which were deferred at our institution, contributing to the sharp decline in wRVUs. Neuroradiology and Musculoskeletal radiology rely heavily on cross-sectional imaging, particularly MRI, which is important because these imaging modalities have higher wRVUs. Outpatient imaging and procedures had the steepest decline in total wRVUs, experiencing an average 65.7% decline from pre-pandemic volumes. This decline in outpatient imaging was similar to a recent study out of New York, however in contrast to that study, our ED and inpatient imaging also had a substantial decrease in wRVUs, likely due to stringent indication criteria for cross-sectional imaging and ultrasound.[7]

4.1. Departmental staffing and financial implications

RVUs were initially developed as part of the Resource-based Relative Value Scale. The total RVUs for any particular radiology study is comprised of three components, a physician work RVU (wRVU), which is assessed in this study, as well as a practice expense and malpractice RVUs. Work RVUs, which are the focus of this study, are based on the amount of time and effort it requires to interpret a particular study. As an example, the standard two-view chest x-ray has a wRVU of 0.22, whereas a CT of the abdomen and pelvis with contrast has a wRVU of 1.82. Therefore, this would imply that interpreting the CT takes approximately 8 times more work than interpreting the chest x-ray. Given this ability to better measure workload, wRVUs have been used to assess radiologists' productivity and help determine optimal staffing in subspecialty departments, thus proving more valuable than simply measuring imaging volumes.[9]

In addition to the impact on radiologist productivity, the financial impact on radiology departments during the COVID-19 pandemic cannot be understated. In particular, the decreased outpatient RVUs significantly impacts total departmental revenue given its more favorable revenue profile.[5] Although this study focused on differences in wRVUs, as previously stated, this makes up only a portion of the total RVUs and revenues associated with an imaging examination. In fact, there would have been a proportionate decrease on the practice expense and malpractice portions of the professional component RVUs as well. Technical component RVUs were also reduced during this time, decreasing by 729,798 (54.0%) for weeks 12–21 from 2019 to 2020. Although correlating this decrease to a precise reduction in total revenue is difficult due to a variable payer mix and contracted reimbursement rates, technical fees account for approximately 80% of our department's overall professional and technical revenue – so the impact is substantial.

By more accurately quantifying COVID-19's impact on workload, productivity, and cost, assessment of changes in RVUs can help departmental administrators not only better understand the financial impact, but also plan for the future. For example, in the event of a second wave or a future decline in imaging volumes, administrators will be able to better anticipate which radiology divisions will be impacted the most, implement cost-saving strategies, and optimize staffing.[10,11]

4.2. Charting a path back to normal

Following planned resumption of elective imaging and procedures by our radiology department during week 21, there was a strong rebound in wRVUs with total weekly wRVUs reaching 90.8% of baseline 2019 wRVUs in week 26, thirteen weeks after the nadir (Fig. 1). The rebound to near baseline imaging wRVUs can be attributed, in part, to an efficient and effective re-engagement team and strategy, which followed many of the guiding principles supplied by the American College of Radiology.[10,12]

Prior to resumption of elective non-time sensitive exams, there was a large backlog of triaged cases that were deemed non-urgent by the imaging triage team and referring clinicians. These exams were prioritized by the re-engagement team according to clinical indication, date ordered, and modality to determine when the exams would be rescheduled. Follow-up with the ordering providers aided in determining if studies were still needed, knowing that this would decrease the backlog by removing unnecessary studies from the queue. A review process was implemented to ensure orders were not duplicated for the same patient and were not already completed in house or at an outside institution.

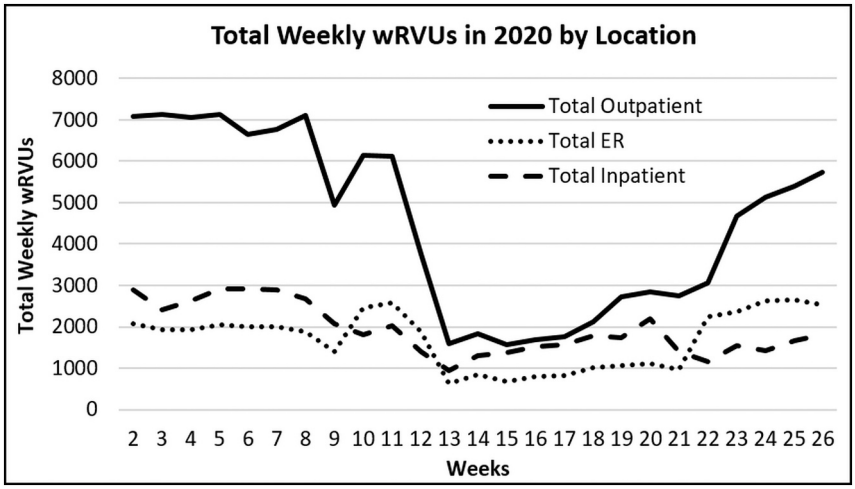

Fig. 4. Line graphs depicting the total weekly wRVUs for 2020 weeks 2–26 by patient location, including outpatient, emergency department, and inpatient.

This aided in the efficient re-launch of elective radiology services.[13]

The re-engagement team, in conjunction with experts from infection control, also prepared the department with safety protocols and developed a tiered and efficient rescheduling protocol to address the backlog of cases. This included spacing out appointments to decongest waiting rooms, screening patients with temperature checks, and adding social distance signage. For outpatient interventional radiology procedures requiring conscious sedation or general anesthesia, all patients were required to have a negative COVID-19 test within 48 h of the procedure. Extended hours and extra shifts were implemented to accommodate the surge of volume. Early morning, evening and weekend hours were added with supplemented technologist and radiologist coverage.[13]

The strong rebound in wRVUs can also, in part, be attributed to reestablishment of the referral base for our services. Increased outpatient clinic appointments and surgeries with referrals requiring radiology services obviously contributed to the rebound, however the rebound would not have been as robust without an efficient re-engagement strategy. Our integrated multidisciplinary institution allowed a collaborative effort with our referring colleagues to quickly ramp down and ramp up radiology services, which may not be as seamless in a private radiology practice.

4.3. Lessons learned

COVID-19 took the entire medical community by surprise – and radiology was no exception. To maintain stability during a tumultuous pandemic and prepare for a second wave or another practice-altering crisis, radiology departments must reflect on past experiences. Understanding which divisions and modalities were most affected allows departmental leaders to plan for the future by preparing budgets, developing strategies to mitigate RVU loss, and optimizing staffing. In our institution, department-wide policies regarding vacation and time off were implemented to optimize staffing. However, the lessons learned in this study will allow more targeted actions to be taken in the future that can be implemented at a divisional, rather than departmental, level.

The COVID-19 pandemic also made clear that collaboration with referring colleagues is critical in efficient crisis management. With capable triage and re-engagement teams, as well as a strong relationship with referring clinicians, radiology departments can mitigate RVU loss by effectively triaging studies and developing a tailored re-engagement plan that will restore RVUs to baseline levels. Furthermore, an effective and safe re-engagement strategy is also critical in instilling confidence in patients that it is safe to return to the radiology department.

Limitations of this study include its restriction to a single large subspecialized radiology practice and the locations it services, which may not be generalizable to other practice settings. In addition, generalizability may also be limited due to varied COVID-19 prevalence and stay-at-home orders amongst states. This study may also underestimate the decline in wRVUs since our department was initially on track to exceed 2019 wRVUs. In addition, there is some cross-coverage between practice areas so there could be a small amount of mis-mapped wRVUs. Our pediatric division is small and without an associated children's hospital, therefore our pediatric wRVUs may not be representative. Additionally, cardiac MRI, coronary calcium scoring and cardiac nuclear stress tests are read in conjunction with cardiologists at our institution and the distribution of cardiac wRVUs will likely be variable amongst different practices. Finally, the financial impact is limited by the assumption that the reimbursement was at Medicare levels, whereas some studies may have been higher or lower depending on the payer mix.

5. Conclusion

As the United States continues to endure a surge in COVID-19 cases in various states, understanding the differential impact of the pandemic on practice areas would be prudent in better preparing radiology departments for the potential depth and duration of COVID-19's impact on their departments. Understanding which practice areas are most impacted during a pandemic will help departments anticipate staffing needs and establish budgets.

Declaration of competing interest

None.

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