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COVID-19 Impact on Well-Being and Education in Radiology Residencies: A Survey of the Association of Program Directors in Radiology

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COVID-19 Impact on Well-Being and Education in Radiology Residencies: A Survey of the Association of Program Directors in Radiology

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Rationale and Objectives: The COVID-19 pandemic has forced rapid evolution of the healthcare environment. Efforts to mitigate the spread of the virus through social distancing and shelter-at-home edicts have unintended consequences upon clinical and educational missions and mental well-being of radiology departments. We sought to understand the impact of the COVID-19 pandemic on radiology residencies with respect to the educational mission and perceptions of impact on well-being.

Materials and Methods: This study was IRB exempt. An anonymous 22 question survey regarding the impact of COVID-19 pandemic on educational and clinical missions of residencies, its perceived impact upon morale of radiologists and trainees and a query of innovative solutions devised in response, was emailed to the Association of Program Directors in Radiology membership. Survey data were collected using SurveyMonkey (San Mateo, California).

Results: Respondents felt the COVID-19 pandemic has negatively impacted their residency programs. Regarding the educational mission impact, 70.1% (75/107) report moderate/marked negative impact and 2.8% (3/107) that educational activities have ceased. Regarding the pandemic's impact on resident morale, 44.8% (48/107) perceive moderate/marked negative effect; perceived resident morale in programs with redeployment is significantly worse with 57.1% (12/21) reporting moderate/marked decrease. Respondents overwhelmingly report adequate resident access to mental health resources during the acute phase of the pandemic (88.8%, 95/107). Regarding morale of program directors, 61% (65/106) report either mild or marked decreased morale. Program innovations reported by program directors were catalogued and shared.

Conclusion: The COVID-19 pandemic has markedly impacted the perceived well-being and educational missions of radiology residency programs across the United States.

Key words: COVID-19; Radiology resident; Program director; Association of Program Directors in Radiology; Well-being.

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INTRODUCTION

As the world grapples with the new realities of life in the setting of the COVID-19 pandemic, daily practices in healthcare are rapidly evolving. Out of necessity,

radiology residencies and departments are implementing changes to the clinical and educational environments (1–4). Wide implementation of social distancing and shelter-at-home edicts intend to “flatten the curve” of spread of COVID-19. While

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these efforts have yielded their intended effect, there are wide-reaching unintended consequences, specifically on imaging case volumes and case mix, resident education sessions, and well-being of radiologists; faculty and residents alike are impacted (1,3,5). For instance, outpatient imaging volumes have decreased more than 70% in some centers and inpatient volumes have decreased as much as 50% (6–8).

Similarly, the educational landscape in radiology residencies has the potential to be markedly impacted now and into the future. With decreased volume of imaging studies, trainees' education through exposure to clinical work is impacted and social distancing measures alter how resident-faculty case readouts occur (1,2,4). Social distancing measures will likely alter the face of didactic and case-based educational content of radiology residencies (1,2,4).

With its attendant added stressors, the COVID-19 pandemic has the potential to impact the physical and emotional well-being of radiologists. For instance, symptoms of depression, anxiety, and distress were reported in 50%, 45%, and nearly 75% respectively of surveyed health care workers in China during the COVID-19 pandemic (9). Prior to the COVID-19 pandemic, nearly half of practicing radiologists reported symptoms of burnout in the 2020 Medscape survey (10), nearly 80% of radiologists, midlevel providers, and physicians reported burnout as a significant workplace issue in the 2018 American College of Radiology Human Resources Commission Workforce survey, and only 21% of survey respondents felt that they had effective means to address burnout (11). At baseline, radiology trainees are also prone to burnout, with up to 85% of radiology residents and fellows reporting symptoms indicative of burnout (12–14). Given these extraordinary baseline rates of burnout in radiology trainees, it stands to reason that we might expect to see further issues emerge in our radiology residents as we navigate through, and beyond, the COVID-19 pandemic.

The Well-Being Subcommittee of the Association of Program Directors in Radiology (APDR) Common Program Requirements Ad Hoc Committee and prior collaborative APDR committee members conducted a study of APDR members to better understand the impact of the COVID-19 pandemic on radiology residencies with respect to the educational mission and perceptions on impact on well-being.

METHODS

The study protocol was deemed compliant with the Health Insurance Portability and Accountability Act and was exempted from further review and monitoring by the institutional review board of the lead author's institution.

Members of the Well-Being subcommittee of APDR Common Program Requirements Ad Hoc Committee and co-author program directors from prior collaborative APDR committee experiences developed a short survey regarding the impact of COVID-19 pandemic on the clinical and educational missions of residencies, its perceived impact upon morale of radiologists and trainees, including innovative

solutions departments have devised to address pandemic challenges. The survey was reviewed and vetted by the APDR Survey Committee establishing face validity and a pilot test was undertaken before survey distribution. On April 16, 2020, a link to the approved anonymous online survey was distributed to the membership of APDR. A single email reminder was sent 14 days later; a total of 4 weeks was allowed to complete the online survey. Survey data were collected using SurveyMonkey (San Mateo, California).

The full survey instrument can be viewed as an appendix to this article (Appendix A). Twenty-two total questions were administered: eighteen survey questions which included items to gauge program directors' perceptions of the impact of the COVID-19 pandemic on educational, clinical, and well-being missions of their department, three questions sought data on the educational role of the respondent and characteristics of the respondent's radiology residency. Respondents were encouraged to provide free-text comments as a component of open-ended questions employed in 20 of the 22 survey questions. In an attempt to remove barriers to participation, survey respondents were not required to respond to every question to contribute.

Simple comparative statistics were performed.

RESULTS

Of the 312 APDR members who received the survey, 108 responded, yielding an overall response rate of 34.6%. The characteristics of the survey respondents and the programs they represent are shown in Table 1. Accreditation Council for Graduate Medical Education Pandemic Stage 1 is defined as routine clinical and educational operations, Stage 2 as clinical demands increased beyond routine, and Stage 3 as

TABLE 1. Demographics of 108 Survey Respondents and Their Programs. Accreditation Council for Graduate Medical Education (ACGME)

Department Role	
Program director	81.5% (88/108)
Associate program director	12.0% (13/108)
Department chair	2.8% (3/108)
Education vice-chair	2.8% (3/108)
Faculty	0.9% (1/108)
Program Size	
Small (≤ 12 residents)	13.9% (15/108)
Medium (13–35 residents)	53.7% (58/108)
Large (≥ 35 residents)	32.4% (35/108)
Institutional Type	
Academic medical center	79.3% (85/108)
Community-based	11.3% (12/108)
Hybrid	1.9% (2/108)
ACGME Pandemic Stage	
Stage 1	12.8% (12/94)
Stage 2	44.7% (42/94)
Stage 3	42.6% (40/94)

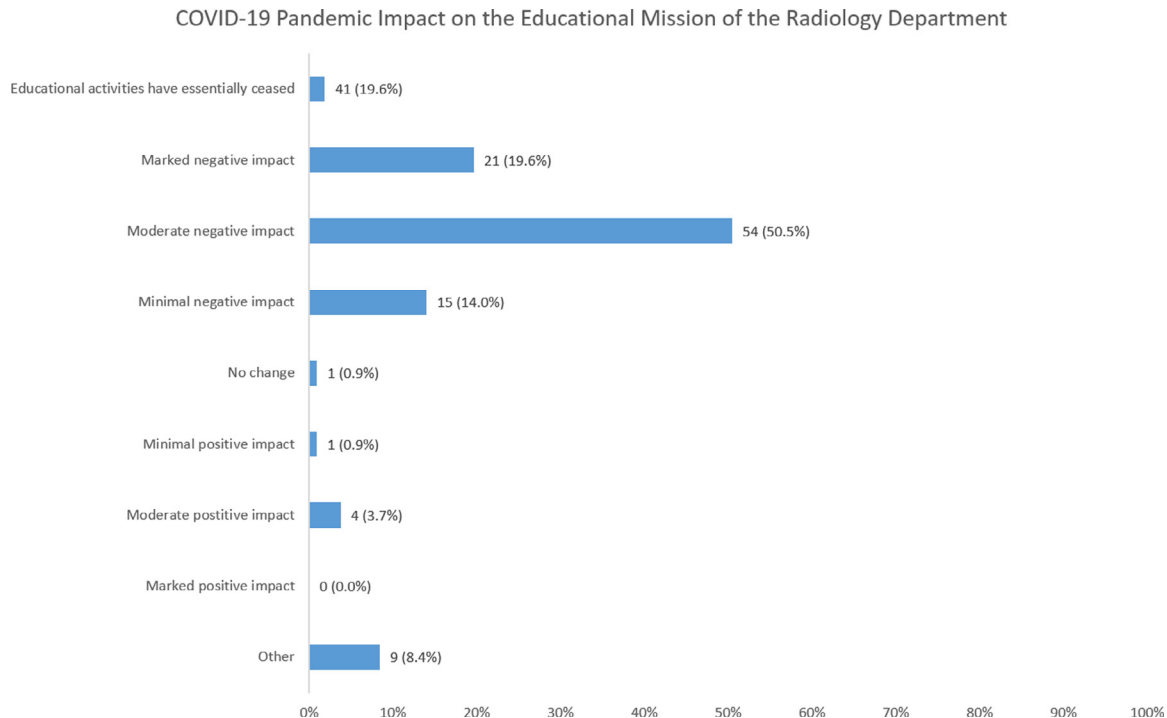


Figure 1. Impact of COVID-19 pandemic upon the educational mission of the radiology department. One hundred and seven respondents completed this question. All of the free-text responses associated with the response of “other” indicated that the pandemic has had a mixed impact upon the educational mission of the radiology department. (Color version of figure is available online.)

pandemic emergency status (15). Overwhelmingly, respondents felt that the COVID-19 pandemic has negatively impacted their residency programs with respect to educational, clinical, and well-being matters.

Regarding the educational mission, 70.0% (75/107) report either a marked or moderate negative impact (Fig 1). Regarding the impact on resident’s participation in the clinical mission, 83.2% (89/107) report either marked or moderate impact (Fig 2). Table 2 lists the ways formal educational sessions and clinical activities have been affected, and Table 3 offers a thematic summary with specific examples of innovative educational and clinical solutions reported by the respondents.

Regarding the pandemic’s impact on perceived resident morale, 75.7% (81/107) perceive either a moderate or marked decrease sense of morale (Fig 3). Factors influencing morale are shown in Table 4.

When specifically questioned about resident redeployment, 66.4% (71/107) of programs confirm residents have not been redeployed. Of the 46 respondents describing redeployment of their residents, 13.0% (6/46) were redeployed into nonclinical roles outside of the department of radiology, 46.6% (21/46) into clinical roles outside of the department of radiology, and 41.3% (19/46) into other roles within the department of radiology. The perceived resident morale of the respondents reporting resident redeployment into clinical roles outside of the radiology department is significantly worse ($p = 0.008$) than the perceived morale of the residents from programs reporting no resident redeployment or redeployment into nonclinical roles outside of

the radiology department. Of the 21 respondents reporting resident redeployment into clinical roles outside of the department of radiology, 57.1% (12/21) reported either moderate or marked decrease perceived sense of morale, 4.8% (1/21) with no perceived change, and none with any degree of perceived increased sense of morale. On the other hand, of the 86 respondents with either no resident redeployment or resident redeployment into nonclinical roles outside of the department, 41.9% (36/86) reported either moderate or marked decrease perceived sense of morale, 8.1% (7/86) no change, and 8.1% (7/86) either minimal or moderate increased perceived sense of morale.

Respondents overwhelmingly report adequate resident access to mental health resources during the acute phase of the pandemic (Table 5). Table 6 offers innovative solutions reported by the respondents to foster resident well-being.

Regarding morale of program directors, over 61% (65/106) report either mild or marked decreased morale resulting from the COVID-19 pandemic (Fig 4). Factors influencing morale are shown in Table 7.

DISCUSSION

Clinical and educational impacts of COVID-19 described in several publications in the radiology literature have been based upon anecdotal experience from single or small groups of 2–5 institutions (1–8). Our study is the first to report broadly the experiences and perceptions of program directors and to specifically focus upon the well-being of radiology residencies during

COVID-19 Pandemic Impact on Residents' Participation in the Clinical Mission of the Radiology Department

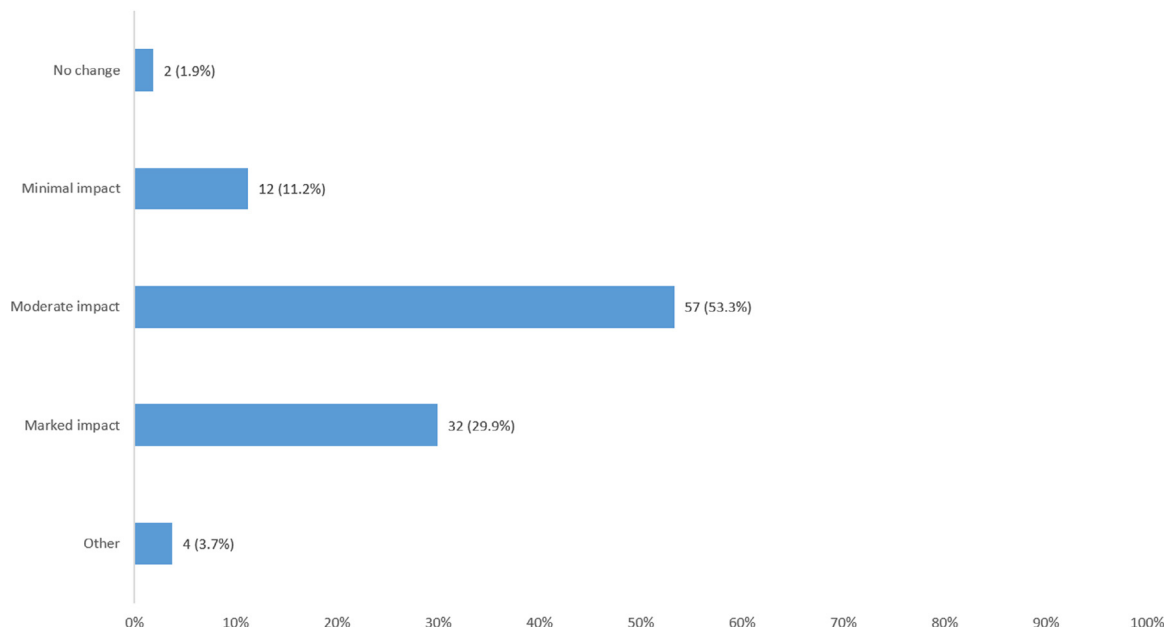


Figure 2. Impact of COVID-19 pandemic upon residents’ participation in the clinical mission of the radiology department. 107 respondents completed this question. All of the free-text responses associated with the response of “other” indicated the pandemic has had a mixed impact upon the residents’ participation in the clinical mission of the radiology department. (Color version of figure is available online.)

this pandemic. In keeping with recent publications, our survey confirms that 75% of respondents believe the educational mission of their radiology department has been negatively impacted to a moderate or marked degree or has essentially ceased, with 84% of respondents indicating resident involvement in the clinical mission has been moderately to markedly negatively impacted or has essentially ceased.

TABLE 2. Impact of the COVID-19 Pandemic on Resident Education and Clinical Activities

Educational Sessions	
Didactic, case-based and hot-seat conferences are web-based/streamed, but presented in real-time by local faculty	80.4% (86/107)
Prerecorded conferences and live webinars available through radiology societies and the APDR	79.4% (85/107)
Prerecorded didactic conferences available for review by residents at their leisure	36.5% (39/107)
Didactic conferences on hold indefinitely	7.5% (8/107)
Other	9.4% (10/107)
Clinical Activities	
Clinical-related, nonimage-based activities	35.5% (38/107)
Interpret clinical studies from home	29.0% (31/107)
Sent home and not helping clinically	24.3% (26/107)
Redeployed	22.4% (24/107)

In light of social distancing mandates, the traditional didactic conference has been impacted, with survey respondents incorporating prerecorded material; it remains to be seen if using prerecorded lectures for didactic content, supplemented with subsequent video conference-based case sessions translates into improved educational content retention by radiology residents. Lectures administered via interactive video conferencing have been shown to be as effective or more effective than traditional in-person lectures in preparing medical students for objective structured clinical examination type tests (16,17). Radiology residents have reported recorded didactic lectures are extremely useful, and faculty report that the preparation time compared to traditional lectures is similar (18). The combined use of enduring learning materials, such as prerecorded lectures, question banks, and video conference-based case conferences resembles the concepts of “flipped learning” (19,20). Flipped learning is a technique whereby concepts are introduced to learners outside of the classroom space through asynchronous educational materials and the in-personal educational time is dedicated to an in-depth exploration and application of the topic(s). Flipped learning techniques are integrated from grade schools through college and graduate programs and are also finding traction in undergraduate medical education (19,20). Specifically related to undergraduate medical education in radiology, flipped learning and blended learning techniques have been shown to increase academic achievement compared to traditional didactic lectures in a radiology clerkship (19).

TABLE 3. Innovative Solutions to Maintain the Educational Mission of the Department. Themes Extracted From-Free-Text Survey Responses. Associate of Program Directors in Radiology (APDR), Radiologic Society of North America (RSNA), American Roentgen Ray Society (ARRS), Picture Archiving and Communication System (PACS)

Educational Initiatives	
Residents creating teaching material	<ul style="list-style-type: none"> Create educational content for junior residents and medical students Present virtual tumor boards Compile and organize interesting cases Develop videos to orient residents to new clinical rotations Virtual journal clubs
Social media	Faculty and residents utilize social media to create and collaborate on educational conferences
Timing	Increase flexibility in conference start times to boost attendance and engagement of the residents
Gamification and nonlecture educational projects	<ul style="list-style-type: none"> Flipped classroom Virtual escape rooms and educational puzzles Team-based educational challenges
National curricula	Online resources from APDR, RSNA, ARRS and subspecialty societies
Clinical Teaching	
Clinical-related, nonimage-based activities	<ul style="list-style-type: none"> List of curated cases from PACS to mirror cases that would typically be seen on the specialty rotation. Home study curricula Distribution of shared interesting cases of the day/week
Virtual face to face clinical instruction/readout	<ul style="list-style-type: none"> Utilize video conferencing platforms for virtual read outs Utilize screen sharing or embedded PACS software to facilitate remote review of cases Daily check-ins and huddles with attendings/fellows/residents on service
Monitor educational activity/progress	<ul style="list-style-type: none"> Documentation of activities through activity logs integrated into websites Educational management software to distribute and document required educational activities

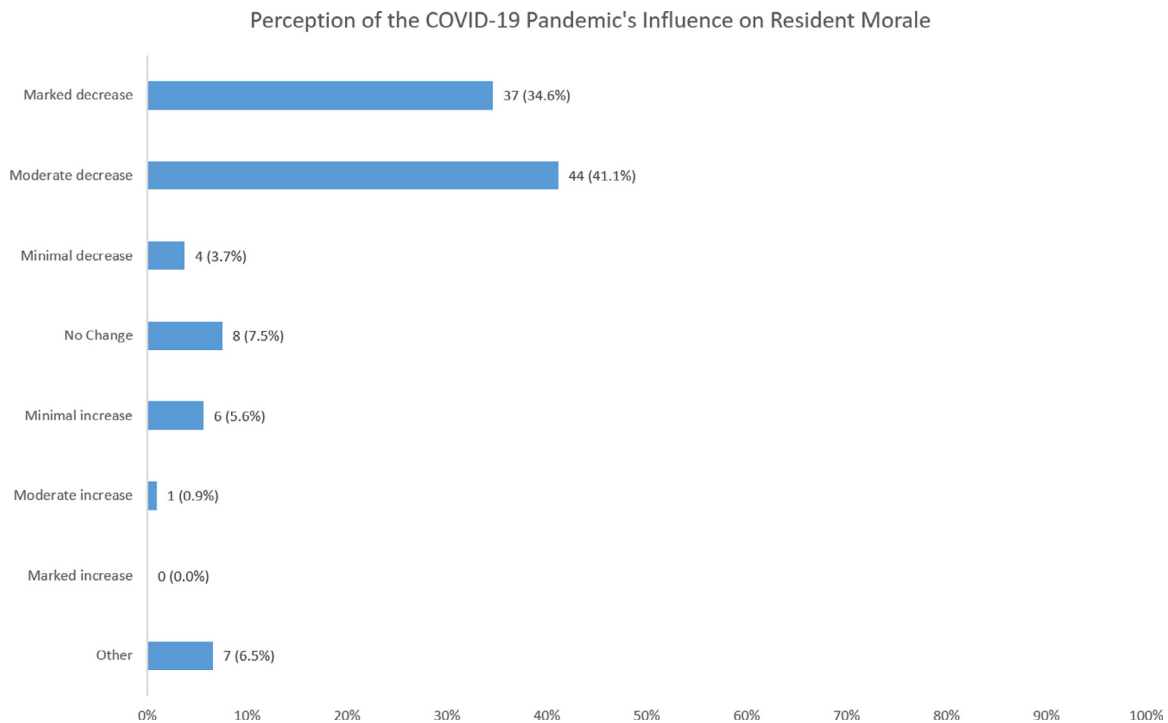


Figure 3. Perception of the COVID-19 pandemic’s impact on resident morale. One hundred and seven respondents completed this question. All of the free-text responses associated with the response of “other” indicated that it was difficult to perceive resident morale or the respondents felt that there was a mixed impact on resident morale. (Color version of figure is available online.)

TABLE 4. Factors Influencing Resident Morale During the COVID-19 Pandemic. Respondents Were Asked to Select All That Apply

Survey Choices	
Fear of contracting the virus	78.5% (84/107)
Fear of loved ones contracting the virus	75.7% (81/107)
Feelings of isolation	74.8% (80/107)
Sorrow for lost block or elective opportunities	63.6% (68/107)
Increased sense of camaraderie	15.9% (41/107)
Desire to have more direct impact on clinical care of patients	19.6% (17/107)
Other	10.3% (13/107)
Free-Text Responses	
Delay in ABR Core exam	
Lost educational opportunities due to decreased clinical volumes	
Uncertainty about the future	
Cancellation of in-person graduation ceremonies	
Concern about job prospects	
Anxiety about potential redeployment (redeployment not yet in place)	
Unfairness of redeployment of radiology residents but not faculty	

Since residents are participating in fewer clinical examinations/procedures during the pandemic, many respondents innovated by tasking the residents with creating novel teaching materials. Solutions include creation of a resident-authored library of basic lectures to be used in future introductory months for first-year radiology residents and medical students and assignment of residents to create exam questions based upon review articles. These educational activities engage residents in the academic mission in ways they may not otherwise have had opportunities to participate. Guenette et al showed that radiology residents in New England scored higher in measures of personal accomplishment when they felt the skills and knowledge being built are important to society (21). While our study was not designed to measure residents' sense of personal accomplishment, one might conjecture that these alternative educational activities impart a sense of personal accomplishment through contribution to local educational landscapes; these activities come at a time when residents may otherwise feel that they have fewer contributions in the clinical realm.

Our survey was not designed to measure burnout, but respondents overwhelmingly perceive decreased resident morale, with the majority also relating personal diminished morale. The long-term psychological toll of COVID-19 is likely to be profound. Post-traumatic stress symptoms (PTSS) ensue after a traumatic event(s) beyond the normal range of common human experience. During the severe acute respiratory syndrome (SARS) outbreak of 2003, up to 50% of healthcare workers experienced PTSS (22). A study of residents of Hubei Province, including its capital city, Wuhan,

TABLE 5. Mental Health and Well-Being Resources. Respondents Were Asked to Select All That Apply

Access	
Adequate	88.8% (95/107)
Limited	9.4% (10/107)
Inadequate	0% (0/107)
Unsure	1.9% (2/107)
Mental Health Resources Available	
Access to virtual counseling	83.2% (89/107)
Counseling on site	67.3% (72/107)
Formal institutional peer support	46.7% (50/107)
Counseling outside the health system	40.2% (43/107)
Other	3.7% (4/107)
Free-Text Responses	
App-based mental health resources	
Resources posted to an internal website	
Professional coaches	
Well-Being Resources Available	
Guided meditations and/or breath-work podcasts	71.4% (65/91)
On-line individual fitness resources	49.5% (45/91)
On-line group fitness resources	48.4% (44/91)
Estate planning resources	14.3% (13/91)
Other	12.1% (11/91)
Free-Text Responses	
Financial well-being and career planning lectures by faculty	
Free yoga by video conference, 3x per week, led by a faculty member	
Department wellness coordinator emails suggestions and resources	
Institutional wellness team	

the region of China hardest hit by the COVID-19 pandemic found that 7% of 285 assessed individuals experienced PTSS in the acute phase of the study; the authors postulate that this number will become higher as the pandemic carries on and through the recovery process (23). Though it is encouraging that our survey shows widespread access to mental health services for residents, we do not know if the resources are being used. We found that the perceived morale of residents was worse in programs whose residents were deployed to clinical roles outside of the radiology department. The risk of PTSS may be heightened in those residents redeployed to clinical work outside of radiology, those in hospitals with large numbers of COVID patients who may have experienced repeated codes, and those who contracted, or whose loved ones contracted, the virus.

Cultivating gratitude and resilience may mitigate the effects of PTSS; this has been demonstrated when young adults experience traumatic events such as a campus shooting (24). In addition to its potentially therapeutic effects, gratitude has long been felt to play a crucial role in building interpersonal relationships (25). Bartlett et al found supporting evidence that gratitude enhances inclusive community building (25). Activities promoting gratitude may be impactful in the near term by helping our radiology departments build and

TABLE 6. Resident Well-Being Concerns and Solutions. Themes Extracted From Free-Text Survey Responses. Program Director (PD), Graduate Medical Education (GME), Accreditation Council for Graduate Medical Education (ACGME), Personal Protective Equipment (PPE)

Communication	
Virtual PD-resident meetings	Routine check-ins between Residents and PD allow residents to hear most up-to-date information and serves as a forum to allow residents to bring up issues and concerns
E-mail	Combats feeling of isolation for those on home isolation or quarantine Disseminate meeting minutes from virtual PD resident meeting
Employee health	Share various well-being support thoughts, ideas, websites, and software apps Partner with GME to ensure frequent posting and resident access to employee health Team with Psychiatry department in hosting resident-led support groups.
Fears	
Graduation requirements	Share and discuss most up-to-date information and communications from the ACGME Work with department leadership, section heads, and residents to provide additional opportunities to meet graduation targets
Resident redeployment	Partner with GME to ensure radiology residents are appropriately utilized, supervised, and provided PPE to perform redeployment tasks Work with GME to protect high risk or remediating residents from redeployment
Unique resident situations	
childcare	Ensure residents have knowledge of and access to childcare support by the hospital and community Maintain maximum flexibility regarding rotations and call to minimize the impact of resident's loss of childcare
Pregnancy	Adhere to national, state, and hospital guidelines regarding pregnancy and patient exposure Provide ample emotional support and rotation flexibility for pregnant residents to minimize patient exposure

maintain a sense of community and in the long term by mitigating the emotional impact of potential PTSS resulting from the COVID-19 pandemic. In the current survey, some programs endorse this practice of gratitude by providing free food and acknowledging the positive aspects of residents'

personal lives via daily photos of residents with their pets, children, and being otherwise engaged in cherished activities.

Open communication between institution and staff was successful during the SARS outbreak (26). In the aftermath of Hurricane Katrina, open and regular communication

Perception of the COVID-19 Pandemic's Influence on PD's Morale

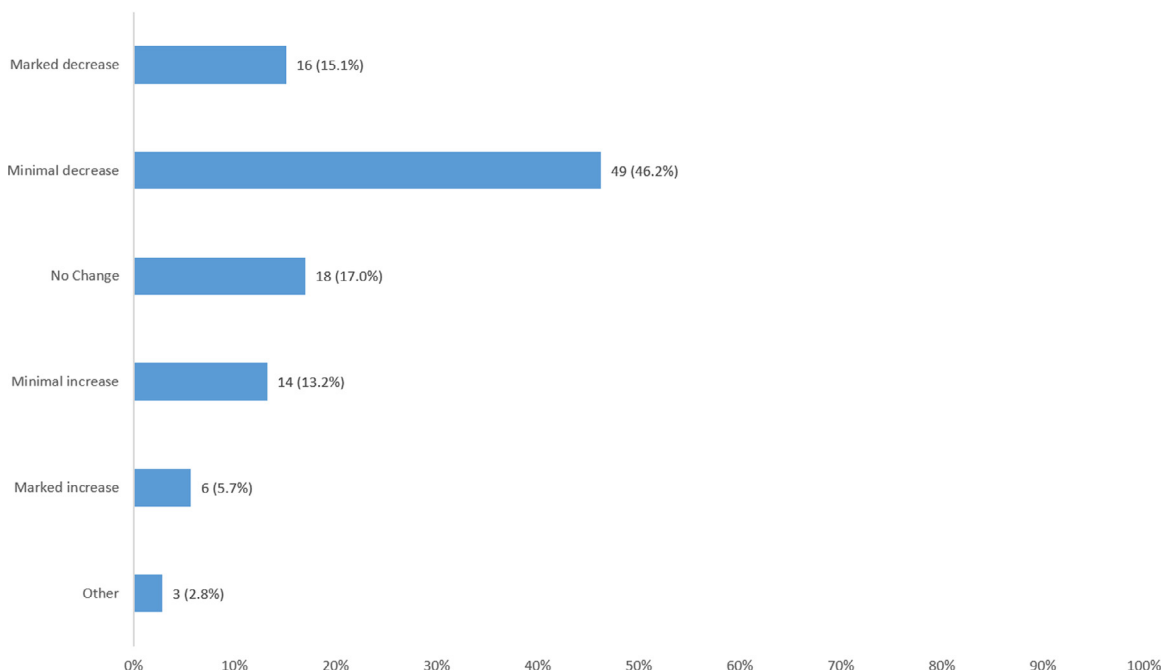


Figure 4. Impact of COVID-19 pandemic upon program director's (PD) morale. One hundred and six respondents completed this question. (Color version of figure is available online.)

TABLE 7. Factors Influencing Program Director (PD) Morale During the COVID-19 Pandemic. Respondents Were Asked to Select All That Apply

Factors Negatively Influencing PD Morale	
Fear of loved ones contracting the virus	75% (78/104)
Fear contracting the virus	56% (58/104)
Feelings of isolation	52% (54/104)
Feeling disproportionate burden as PD	39% (41/104)
Feeling of guilt of not being front line provider	29.8% (31/104)
Lack of adequate public health measures	22.1% (23/104)
Lack of guidance from departmental leadership	18.2% (19/104)
Lack of guidance from institutional leadership	12.5% (13/104)
Other	9.6% (10/104)
Factors Positively Influencing PD Morale	
Support and resolve of family/friends	74.5% (79/106)
Internal motivation to lead in difficult times	74.5% (79/106)
Personal efforts toward well-being	68.9% (73/106)
Support and resolve of community	62.3% (66/106)
Support and guidance from departmental leadership	57.6% (61/106)
Solidarity and resolve of residents	51.9% (55/106)
Other	7.6% (8/106)

helped maintain continuity and community within a psychiatry residency program at Louisiana State University (27). Spalluto et al discuss the importance of regular, bi-directional, transparent communication between leadership and all radiology department members in engendering trust and decreasing stress during the COVID-19 pandemic (28). Daily command center briefings are included among the policies successfully implemented at the University of Washington during their pandemic acute phase response (8). Since transparent communication by institutional leaders has been correlated with decreased physician burnout and increased workplace engagement (29), it is likely that a recurring opportunity for trainees in the department of radiology to hear updates from departmental and institutional leaders and to ask questions serves to mitigate some of the pandemic negative impacts upon well-being. England et al describe implementing frequent virtual huddles between program leadership and residents to keep residents apprised of departmental and institutional operations during the COVID-19 (4). The need to maintain frequent open communication between the institution and department and its residents may be one way to mitigate decreasing morale. Many of our survey respondents report they have incorporated regular meetings to discuss the state of the response with their residency training programs.

Maintaining a sense of community and co-resident social support is important to radiology resident well-being (21,30).

Video conferencing was a successful means to maintaining morale in the wake of Hurricane Katrina (27). In addition to recreating conventional side-by-side image read-outs within the constraints of social distancing, video conferencing is a common theme employed by responding program directors to virtually check in with the resident cohorts and facilitate various virtual social gathering amongst the trainees. In those 33% of programs whose residents were deployed, 43% report negative impact on resident well-being; this underscores the importance of maintaining a sense of community for residents redeployed from their routine environments. Similarly, of the features positively impacting morale, 20% of respondents perceive an increased sense of camaraderie influencing residents' morale during the COVID-19 pandemic with a sense of being part of the greater community.

The pandemic's impact on program directors' well-being must not be overlooked. Previously published studies of anesthesia, surgery, and radiation oncology indicate PDs have a high level of burnout and emotional exhaustion (31–33). In our survey, nearly two-thirds of PDs report diminished morale; one half of respondents also reported feeling isolated. PDs found support by looking inward (75%), to loved ones (74%), community (62%), department leadership (57%), and residents (51%).

While members of radiology departments have maintained connection via video conferences to conduct meetings, virtual social gatherings, real-time teaching sessions and multidisciplinary conferences, it is important to remain cognizant of the limitations of these technologies. For instance, video conferencing can introduce distortions into routine interpersonal interactions, particularly with respect to nonverbal cues we are unconsciously accustomed to receive such as direction of gaze and eye contact (34). When we try to mentally reconcile altered gaze and eye contact, video conferencing results in a higher cognitive load than traditional face-to-face conversations. Additionally, interruptions in video feeds and incongruities between video and audio feeds occur during video conferencing (34). Taken in sum, the various distortions and altered nonverbal cues have been found to negatively impact trust formation (34). While widely-used video conferencing is reported by many survey respondents as solution for hurdles they encountered in clinical case read-outs, educational conferences, multidisciplinary tumor boards, and social community-building, we must recognize that this very solution may also introduce emotional fatigue.

This study has several limitations. As with any survey study, the response rate directly affects the survey's generalizability of findings. The 34.6% response rate is in line with other APDR surveys (35,36). Small residency programs and residency programs outside of academic medical centers may be underrepresented. This survey was distributed in the midst of the acute phase of the COVID-19 pandemic, which may have precluded some PDs from responding. As the pandemic continues, programs are likely to evolve the reported coping strategies and devise additional innovations. Because

geographic location of the respondents was not collected, it is not possible to draw conclusions about the impact of local pandemic severity.

In sum, the COVID-19 pandemic has markedly impacted the perceived well-being and educational missions of radiology residencies across the United States. The well-being of the residents who have been redeployed into clinical roles outside of the radiology department may be more significantly negatively impacted. We have identified themes of innovative solutions radiology residencies have implemented to mitigate the negative effects on our trainees and discuss some potential pitfalls to these solutions. Although we may be emerging from the acute phase of the first wave of the COVID-19 pandemic, the themes and lessons herein remain applicable.

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APPENDIX: SURVEY QUESTIONS

1. What best describes your practice environment?
 - a. Academic medical center
 - b. Hospital affiliated
 - c. Community based
 - d. Other (free text)
2. What best describes your role?
 - a. DR Program Director
 - b. Integrated DR/IR Program Director
 - c. DR Associate Program Director
 - d. Integrated DR/IR Associate Program Director
 - e. Other (free text)
3. What is the size of your radiology residency program (inclusive of DR and integrated DR/IR)?
 - a. Small (≤ 12 residents)
 - b. Medium (13–35 residents)
 - c. Large (\geq residents)
4. What is the current GME level classification at your institution?
 - a. Stage 1 (“Business as Usual”)
 - b. Stage 2 (Increased Clinical Demands Guidance)
 - c. Stage 3 (Pandemic Emergency Status Guidance)
 - d. I don’t know
5. How has COVID-19 impacted the educational mission of your radiology department?
 - a. No change
 - b. Minimal negative impact
 - c. Moderate negative impact
 - d. Marked negative impact
 - e. Educational activities have essentially ceased
 - f. Minimal positive impact
 - g. Moderate positive impact
 - h. Marked positive impact
 - i. Other (free text)
6. How are you managing didactic educational conferences in light of social distancing (choose all that apply)?
 - a. Continue with the status quo; in person didactic conferences remain unchanged
 - b. Didactic conferences are now web-based/streamed, but are presented in real-time by local faculty
 - c. Previously recorded didactic conferences are available for review by residents at their leisure.
 - d. Residents are directed to prerecorded conferences and live webinars available through radiology societies (eg: SSR, STR, APDR-sponsored Zoom conferences)
 - e. Didactic conferences are on hold indefinitely
 - f. Other (free text)
7. How are you managing case-based or hot-seat conferences in light of social distancing (choose all that apply)?
 - a. Continue with the status quo; in person case conferences remain unchanged
 - b. Case-based conferences are now web-based and presented real-time by local faculty
 - c. Residents are directed to use on-line question banks
 - d. Case conferences are on hold indefinitely
 - e. Other (free text)
8. What are innovative solutions your department has developed to maintain the educational mission of your radiology department during the COVID-19 pandemic? (Free text answer)
9. To what degree has COVID-19 impacted the residents’ participation in the clinical mission of your radiology department?
 - a. No change
 - b. Minimal impact
 - c. Moderate impact
 - d. Marked impact
 - e. Resident clinical activities in radiology have essentially ceased
 - f. Other (free text)
10. How have you adapted your clinical coverage in the COVID-19 pandemic? (choose all that apply)
 - a. No change to routine rotations and resident coverage
 - b. Residents read clinical studies from home
 - c. Residents assist with clinical-related, nonimage-based, activities (such as phone consultations, study protocoling, etc)
 - d. Residents have been sent home and are not helping clinically
 - e. Residents were redeployed
 - f. Other (free text)
11. Regarding resident redeployment, where have your residents been placed? (choose all that apply)
 - a. No redeployment
 - b. Into nonclinical roles within the department of radiology
 - c. Into nonclinical roles outside the department of radiology
 - d. Into clinical roles outside the department of radiology
12. If your residents have been redeployed or are imminently awaiting redeployment, to what degree do you perceive that their redeployment onto clinical services is impacting their current wellbeing?
 - a. No change
 - b. Minimal negative impact
 - c. Moderate negative impact
 - d. Marked negative impact
 - e. Minimal positive impact
 - f. Moderate positive impact
 - g. Marked positive impact
 - h. Other (free text)
13. Do your residents have adequate access to mental health resources during the acute phase of the COVID-19 pandemic?
 - a. Yes, access is adequate
 - b. Some, but limited/inadequate access
 - c. No, access is inadequate
 - d. Do not know/unaware

14. What mental health resources are available to your residents during the COVID-19 pandemic? (choose all that apply)
- On-site counseling
 - Outside of the residency's health system counseling
 - Virtual/phone-based counseling service
 - Peer support (formal program sponsored by institution)
 - Do not know/unaware
 - Other: (free text)
15. Do your residents have adequate access to other wellbeing resources (healthy lifestyle, financial advice, estate planning, etc) during the COVID-19 pandemic? (choose all that apply)
- Yes, access is adequate
 - Some, but inadequate access
 - No, access is inadequate
16. What self-care, fitness, and other resources are available to your residents during the COVID-19 pandemic? (choose all that apply)
- Guided meditations and/or breath-work podcasts
 - On-line individual fitness resources (i.e. subsidized/free membership to fitness websites, institutional fitness resources, etc)
 - Group on-line fitness resources (i.e. group yoga class by web-chat client, etc)
 - Estate planning resources
 - Other (free text)
17. What is your perception of the COVID-19 pandemic's influence upon resident morale in your department?
- No change
 - Perceived minimal decreased sense of morale
 - Perceived moderate decreased sense of morale
 - Perceived marked decreased sense of morale
 - Perceived minimal increased sense of morale
 - Perceived moderate increased sense of morale
 - Perceived marked impact increased sense of morale
 - Other (free text)
18. What do you think are the factors influencing resident morale during the COVID-19 pandemic? (choose all that apply)
- Fear of contracting the virus
 - Fear of loved ones contracting the virus
 - Feelings of isolation
 - Sorrow for lost elective opportunities
 - Desire to make more of an impact upon the clinical mission of direct patient care
 - Increased sense of comradery
 - Renewed sense of purpose for the practice of medicine
 - Other (free text)
19. Regarding YOUR morale, what is your perception of the COVID-19 pandemic influence?
- Perceived marked increased sense of morale
 - Perceived mild increased sense of morale
 - No perceived difference in morale
 - Perceived mild decreased sense of morale
 - Perceived marked decreased sense of morale
- Comment box:
- What are the factors negatively influencing your morale during the COVID-19 pandemic? (choose all that apply)
 - Fear of contracting the virus
 - Fear of loved ones contracting the virus
 - Feeling of isolation
 - Lack of guidance from departmental leadership
 - Lack of overall public health planning
 - Feeling of disproportionate burden on you as a program director
 - Other (free text)
 - What are the factors positively influencing your morale during the COVID-19 pandemic? (choose all that apply)
 - Support and resolve of community
 - Support and resolve of family and/or friends
 - Support and guidance from departmental leadership
 - Solidarity and resolve of residents
 - Internal motivation to lead in difficult times
 - Efforts at maintaining personal wellbeing, eg. Exercise, hobbies, time with family, etc.
 - Other (free text)
 - Please share additional thoughts you may have regarding resident wellbeing during the COVID-19 pandemic. Have wellbeing issues arisen that you or your program didn't anticipate? What advice do you have for other programs? (free text)