



The impact and collateral damage of COVID-19 on prostate MRI and guided biopsy operations: Society of Abdominal Radiology Prostate Cancer Disease-Focused Panel survey analysis

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Abstract

The Coronavirus disease 2019 (COVID-19) pandemic has significantly affected health care systems throughout the world. A Qualtrics survey was targeted for radiologists around the world to study its effect on the operations of prostate MRI studies and biopsies. Descriptive statistics were reported. A total of 60 complete responses from five continents were included in the analysis. 70% of the responses were from academic institutions. Among all participants, the median (range) number of prostate MRI was 20 (0, 135) per week before the COVID-19 pandemic versus 10 (0, 30) during the lockdown period; the median (range) number of prostate biopsies was 4.5 (0, 60) per week before the COVID-19 versus 0 (0, 12) during the lockdown period. Among the 30% who used bowel preparation for their patients prior to MRI routinely, 11% stopped the bowel preparation due to the pandemic. 47% reported that their radiology departments faced staff disruptions, while 68% reported changes in clinic schedules in other clinical departments, particularly urology, genitourinary medical oncology, and radiation oncology. Finally, COVID-19 pandemic was found to disrupt not only the clinical prostate MRI operations but also impacted prostate MRI/biopsy research in up to 50% of institutions. The impact of this collateral damage in delaying diagnosis and treatment of prostate cancer is yet to be explored.

Keywords MRI · COVID-19 · Pandemic · Collateral damage · Prostate cancer · Prostate biopsy

Introduction

The pandemic caused by a novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS CoV-2), was first identified in December 2019 and designated coronavirus disease 2019, or COVID-19 [1]. It has severely paralyzed the health care system and economy all around the world. There are 76,238,296 confirmed cases and 1,684,816 global deaths according to the COVID-19 dashboard by the Center for Systems Science and Engineering at Johns Hopkins University as of December 19, 2020 [2]. While COVID-19 directly affects the patients, families, and healthcare workers, it indirectly causes disruptions and delays in health care in multiple settings. There are case reports describing the delays in medical care and cancer diagnosis [3, 4]. The healthcare system changes have also threatened the delivery of trauma and acute stroke care due to the diversion of resources [5, 6]. Besides, public health interventions like screening programs have also been impacted and hence there is a need to develop best practices to allow the screening programs to

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protect all the stakeholders [7]. To safely improve access to healthcare, most clinical practices have switched to telemedicine [8]. One of the potential areas of collateral damage includes prostate-related diagnostic imaging and interventions. Delayed diagnosis risks the progression of disease, which in turn may impact the long-term survival of patients. The primary objective of this online survey is to analyze the operational changes, including the volume of cases and departmental policy changes made during the initial few months of the COVID-19 pandemic.

Material and methods

This HIPAA-compliant prospective survey-based study received institutional review board approval from the research ethics committee at The University of Texas MD Anderson Cancer Center, Houston, United States. Answering “Yes” to the first question served as consent to participate in the study. The authors developed the study as an initiative of the Society of Abdominal Radiology Prostate Cancer Disease-Focused Panel (SAR PC DFP). The Qualtrics survey consisting of 30 questions, was distributed electronically to radiologists around the world. The source of the targeted radiologists consisted mainly of the membership of SAR PC DFP, which includes radiologists from both within and outside the United States. In total, the survey was e-mailed individually to 150 radiologists with a unique link which could not be forwarded to others. To increase participation, a survey link was also posted on the official Twitter account of SAR PC DFP (https://twitter.com/SAR_ProstateDFP). The links were kept active during various time-points from July to August 2020, and the survey was closed after a month. The questionnaire included practice type, location, dates and duration of lockdown, number of

cases before, during, and after the lockdown, protocols and COVID-19 specific questions (Appendix). The term “lockdown” refers to the period of mass quarantine or stay at home orders when the outpatient and non-emergent studies were cancelled. No patient health information was collected in the survey. The principal investigator’s institutional Qualtrics account was used to prepare and distribute the survey. Categorical variables were summarized using frequency and percentage. Continuous variables were summarized using mean ± SD, range, and IQR. Bar plots and pie charts were used to depict the distribution of participants responding to the survey.

Results

The data set included 74 responders, of which 66 answered, “I agree to take the survey” and completed the survey. Six duplicate records were excluded and the final number of unique records was 60. Among these, 70% (n = 39) were from an academic setting, 12% (n = 7) from the community, 11% (n = 6) from private practice, and 7% (n = 4) others. The distribution by continents was 65% (n = 34) from North America, followed by 21% (n = 11) from Europe, 8% (n = 4) from South America, 4% (n = 2) from Asia, and 2% (n = 1) from Australia. Within North America, the distribution of respondents according to region included 22.6% (n = 7) each from Canada, US-Northeast and US-South, 16.1% (n = 5) each from US-West and Mid-west (3 respondents did not choose a state) (Fig. 1).

Among the 60 participants, 55% (n = 33) used fusion biopsy in their institution. Among these, 73% (n = 24) and 24% (n = 8) of fusion biopsies were performed by Urology and Diagnostic Radiology, respectively. 64% (n = 21) of the biopsies were transrectal, 3% (n = 1) were transperineal, and

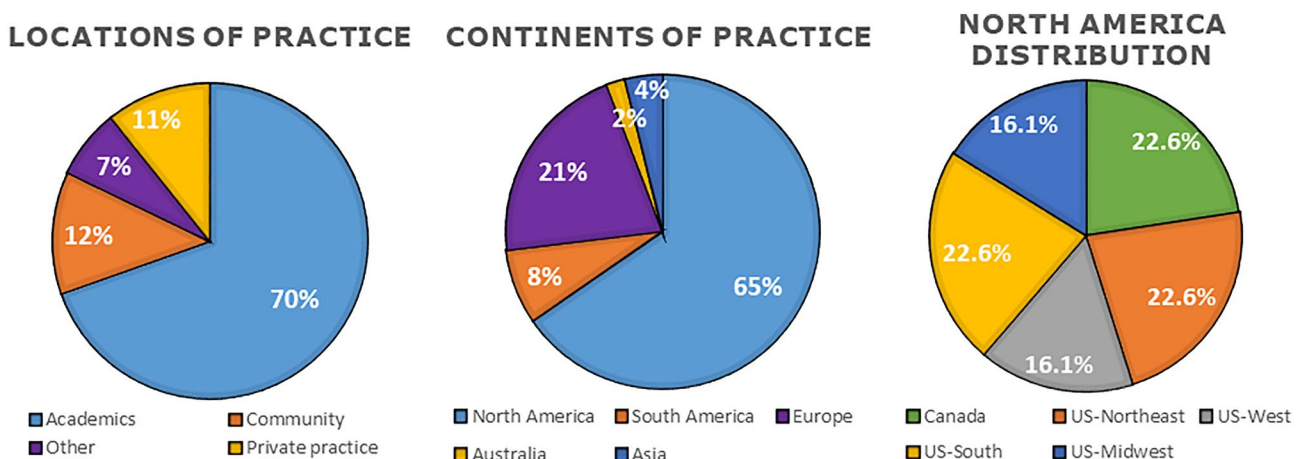


Fig. 1 Pie chart depicting the locations, continents, and North America distribution of the survey participants

30% ($n = 10$) were both. Also, among these, 45% ($n = 15$) of the fusion biopsies were performed in the hospitals, 39% ($n = 13$) were performed in outpatient clinics, and 15% ($n = 5$) were performed in both settings.

Prostate MRI and biopsy case volumes

Among all participants, the median (range) number of prostate MRI scans was 20 (0, 135) per week before the COVID-19 pandemic vs. 10 (0, 30) during the lockdown period; the median (range) number of prostate biopsies was 4.5 (0, 60) per week before the COVID-19 pandemic vs. 0 (0, 12) during the lockdown period. 70% of the participants responded that the lockdown had finished at the time of this survey (July–August 2020). Among these, the median (range) number of prostate MRI was 15 (0, 125), and the median (range) number of prostate biopsies was 10 (0, 30) after lockdown (Table 1).

MRI protocol and patient preparation

Eight different combinations of the protocol based on magnet strength, use of contrast, and endorectal coil were provided (Question 10 of the questionnaire). The most commonly used protocol (28.3%, $n = 17$) was “mpMRI without an endorectal coil at 3 T”, followed by “mpMRI without an endorectal coil at 1.5 T” (11.7%, $n = 7$). 23% ($n = 14$) of the participants answered that more than one MRI protocol was used. Among the 60 participants, 30% ($n = 18$) responded that they used bowel preparation routinely prior to prostate MRI and 11% ($n = 2$) stopped bowel preparation due to the pandemic. 30% ($n = 18$) responded that they routinely use anti-spasmodic and none of them stopped anti-spasmodic due to the pandemic.

Changes in workflow within radiology and other departments

68% ($n = 41$) of survey participants reported that other clinical departments, particularly Urology, GU Medical Oncology, and Radiation Oncology canceled or limited their clinics during the lockdown, and 47% ($n = 28$)

reported that their department faced staff disruptions. 30% ($n = 18$) of the prostate MRI interpretations were performed at hospital/outpatient imaging, 17% ($n = 10$) remotely from home, and 22% ($n = 13$) were performed both ways. In regard to safety precautions, 60% ($n = 36$) answered that precautions/changes were implemented in the MRI/Biopsy suites, and 65% ($n = 39$) reported that technologist/nursing staff received COVID-19 precautions training.

COVID-19 test positivity and regulatory COVID-19 safety protocols

7% ($n = 4$) of survey participants responded that MRI staff members tested positive for COVID-19 and 5% ($n = 3$) responded that ‘patients’ scanned/biopsied tested positive for COVID-19. In most places, 62% ($n = 37$) required that patients and staff wear masks at all times. Patients were subjected to temperature checks in 45% ($n = 27$), routine COVID-19 testing in 25% ($n = 15$) and a 14-day period of self-quarantine after COVID-19 test positivity in 13% ($n = 8$) of the institutions. Overall, 50% of the participants responded that two or more COVID-19 protocols were implemented at their workplace (Table 2).

Impact of COVID-19 on prostate MRI/biopsy research

COVID-19 pandemic had a negative impact on prostate MRI and biopsy research in 50% ($n = 30$) and 47% ($n = 28$) of the participants respectively. For the last question anticipating the duration of the COVID-19 pandemic effect on the MRI and biopsy schedules, the answers varied greatly; 20% ($n = 12$) answered 1–3 months, 18% ($n = 11$) answered 4–6 months, 10% ($n = 6$) answered 7–9 months, and 20% ($n = 12$) answered 10–12 months.

The distribution of the percentage of participants answering Questions 10–19 and Questions 20–30 of the questionnaire is summarized in Figs. 2 and 3 respectively.

Table 1 Summary of number of studies performed per week

| Questions | N | Mean \pm SD | Median (Range) | IQR |
|-----------------------------------|----|-----------------|----------------|-----------|
| Prostate MRI before COVID-19 | 41 | 26 \pm 26 | 20 (0, 135) | (10, 30) |
| Prostate MRI during lockdown | 32 | 11.6 \pm 8.2 | 10 (0, 30) | (5.5, 15) |
| Prostate biopsies before COVID-19 | 40 | 7.9 \pm 11.7 | 4.5 (0, 60) | (0.1, 10) |
| Prostate biopsies during lockdown | 32 | 2.3 \pm 3.3 | 0 (0, 12) | (0, 5) |
| Prostate MRI after lockdown | 27 | 21.3 \pm 25.3 | 15 (0, 125) | (4, 28) |
| Prostate biopsies after lockdown | 23 | 9.6 \pm 8 | 10 (0, 30) | (3, 14) |

Table 2 COVID-19 protocols in the Department

| Patients and staff wear masks at all times | Patients are subjected to temperature checks | Patients are routinely tested for COVID-19 | Patients confirm 14 days self-quarantine after COVID-19 test positivity | Frequency | Percentage |
|--|--|--|---|-----------|------------|
| No answer | No answer | No answer | No answer | 22 | 37 |
| No | No | Yes | No | 1 | 2 |
| Yes | No | No | No | 7 | 12 |
| Yes | No | No | Yes | 1 | 2 |
| Yes | No | Yes | No | 2 | 3 |
| Yes | Yes | No | No | 13 | 22 |
| Yes | Yes | No | Yes | 2 | 3 |
| Yes | Yes | Yes | No | 7 | 12 |
| Yes | Yes | Yes | Yes | 5 | 8 |

Summary of Survey Q10 – Q19

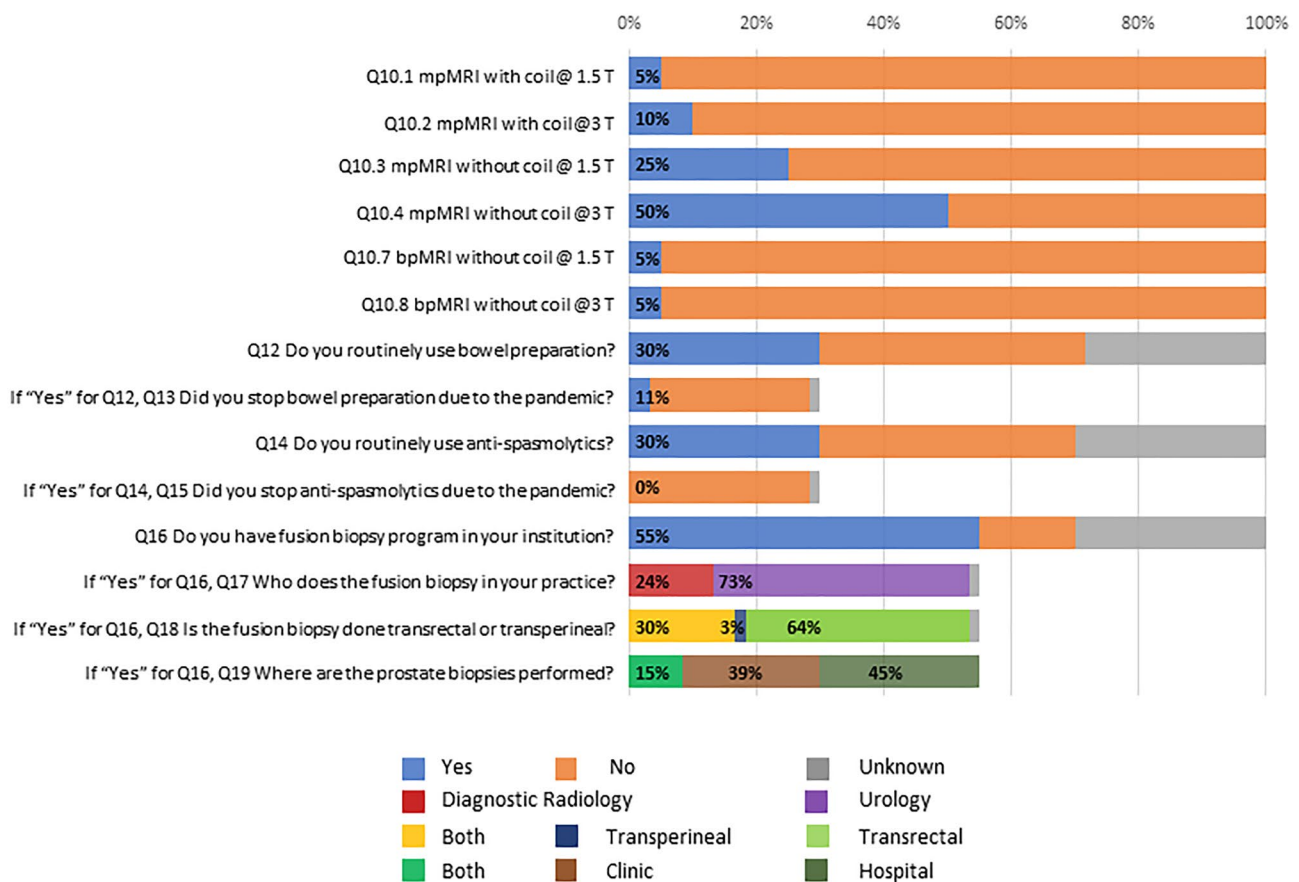


Fig. 2 Bar graph depicting the percentage of survey participants responding to Questions 10–19

Discussion

The COVID-19 pandemic has caused significant disruptions in the health care systems throughout the world. In an attempt to flatten the curve, there were cancellations of the

non-emergent imaging procedures, outpatient clinics, and surgeries. Most of these changes were implemented to control the surge of new cases and preserve resources to treat COVID-19 positive cases. While some of the steps were necessary to achieve this goal and direct the health care providers' attention to acute and critically ill patients, it

Summary of Survey Q20 - Q30

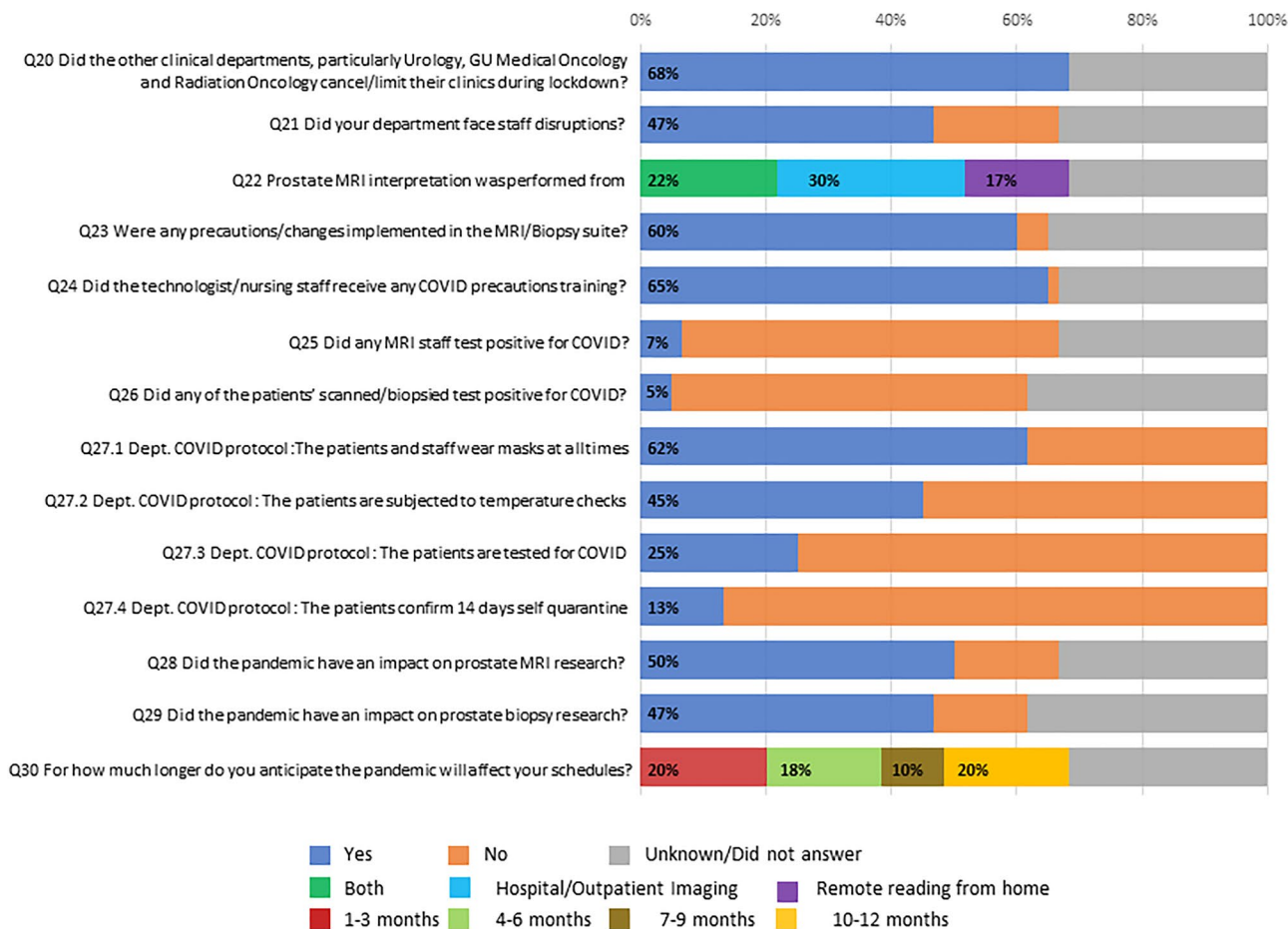


Fig. 3 Bar graph depicting the percentage of survey participants responding to Questions 20–30

has also led to collateral damages, including delayed prostate cancer diagnosis and potentially long-term financial implications. The online survey ran among world-wide radiology departments has enabled us to learn about the impact of the COVID-19 pandemic on the operations of prostate MRI studies and biopsies. The survey included representation from 5 continents, with 65% from North America. 70% of the survey respondents were from academic institutions.

Many radiology departments have witnessed a significant decrease in imaging volumes, particularly in the high surge areas [9]. As expected, the case volumes of prostate MRI and biopsies had decreased during the lockdown, with the case numbers almost catching up after the lockdown ended. Of the 30% participant radiologists who used bowel preparation routinely in their patients, 11% stopped it due to the pandemic. This could potentially impact prostate MRI quality in a negative way with suboptimal imaging results and misdiagnosis [10, 11]. Additionally, other clinical departments which are crucial in referring patients for prostate

MRI and biopsies, including Urology, GU Medical Oncology, and Radiation Oncology canceled or limited their clinics during the lockdown in 68% of the centers, and in the short term, this would likely result in significant case backlogs, and at mid-term, delays in diagnosis and management can be expected.

One other aspect of the challenges is staff disruptions, which were noted in 47% of the radiology departments. The pandemic has forced radiology departments to change from a hospital-based setting to a home setting with home workstations, enabling the radiologists to practice from home [12, 13]. In the current survey, the respondents reported a combination of working from both the hospital and home setting. Additionally, amongst the departmental COVID-19 safety protocols, 62% enforced the mask policy for patients and staff at all times. Overall, 50% of the participants responded that two or more COVID-19 safety protocols were implemented at their workplace. As a possible result of these safety measures implemented in radiology clinics, only less than 10% of the respondents reported COVID-19 positive cases in the MRI

staff members and patients who underwent MRI scans, biopsies. Finally, the impact of COVID-19 was seen not only on clinical operations but also on research efforts, with approximately half of the survey participants responding that there has been an impact on prostate MRI and biopsy research. In some institutions, a few internal funding mechanisms were halted along with closure of research facilities. Scarcity of resources for research can not only cause a financial impact but also lead to delays in innovation.

The survey was conducted in the months of mid-July to August when there was an improvement in the number of new cases. 70% reported that the lockdown had ended, and we were able to document the impact of the initial lockdown process in the earlier months of the COVID-19 pandemic. At the time of submission of this manuscript, a few states within the United States and a few European countries were subjected to a second lockdown, and this would further the impact shown in this study.

Guitron et al. detailed the development of three complementary recovery models for radiology departments to plan and recover from the unpredictable impact of the pandemic [14]. A long-term volume model, estimating a swift, gradual, or muted recovery of imaging volumes; a short-term volume model predicting recovery volumes on a supply and demand basis and a next-wave model forecasting the impact of future surges on imaging volumes.

The limitations of the study include relatively low response rates from both individual email contacts and social media. The majority of the survey participants were academic physicians, and thus the results predominantly reflect the clinical operations in an academic setting but not the community as much. The survey was administered during the months of July and August 2020, and the results cannot be generalized with the changing surges of the COVID-19 pandemic and different levels of severity and coping mechanisms in the respondent institutions.

In conclusion, COVID-19 pandemic has significantly impacted many health care systems. As the pandemic continues with an increase in the number of new cases, the negative impact of the pandemic will continue with expected collateral damages, including prostate MRI and biopsy practices. The oncologic outcomes of pandemic related disruptions are currently unknown, and future studies will be needed to explore them. But hopefully, with the wider availability of the vaccine, continued safety precautions, and innovations in radiology operations, we can return to usual diagnostic volumes.

Appendix: Survey questionnaire

| | |
|-----|--|
| Q1 | Do you agree to take the survey? |
| Q2 | Which one of the following best describes your practice? a. Academics b. Community c. Private practice d. Other |
| Q3 | In which country do you currently reside? |
| Q4 | In which state do you currently reside? |
| Q5 | Please enter the province/state |
| Q6 | When did the lockdown start for your location (mm/dd/yyyy)? |
| Q7 | Is the lockdown finished? Yes/No |
| Q8 | How many studies were done per week before the COVID-19 situation and during lockdown? a. Prostate MRI b. Prostate biopsies |
| Q9 | Approximately how many studies are being done now per week after the lockdown? a. Prostate MRI b. Prostate biopsies |
| Q10 | What is your current MRI protocol? a. mpMRI with an endorectal coil @ 1.5 T b. mpMRI with an endorectal coil @ 3 T c. mpMRI without an endorectal coil @ 1.5 T d. mpMRI without an endorectal coil @ 3 T e. bpMRI with an endorectal coil @ 1.5 T f. bpMRI with an endorectal coil @ 3 T g. bpMRI without an endorectal coil @ 1.5 T h. bpMRI without an endorectal coil @ 3 T |
| Q11 | Did you stop using the coil due to the pandemic? Yes/No |
| Q12 | Do you routinely use bowel preparation? Yes/No |
| Q13 | Did you stop bowel preparation due to the pandemic? Yes/No |
| Q14 | Do you routinely use anti-spasmodics? Yes/No |
| Q15 | Did you stop anti-spasmodics due to the pandemic? Yes/No |
| Q16 | Do you have fusion biopsy program in your institution? Yes/No |

- Q17 Who does the fusion biopsy in your practice?
a. Diagnostic Radiology
b. Interventional Radiology
c. Urology
- Q18 Is the fusion biopsy done transrectal or transperineal or both?
- Q19 Where are the prostate biopsies performed?
a. Clinic
b. Operating room
c. Both
- Q20 Did the other clinical departments, particularly Urology, GU Medical Oncology and Radiation Oncology cancel/limit their clinics during lockdown? Yes/No
- Q21 Did your department face staff disruptions? Yes/No
- Q22 Prostate MRI interpretation was performed from
a. Hospital/Outpatient setting
b. Home
c. Both
- Q23 Were any precautions/changes implemented in the MRI/Biopsy suite? Yes/No
- Q24 Did the technologist/nursing staff receive any COVID-19 precautions training? Yes/No
- Q25 Did any MRI staff test positive for COVID-19? Yes/No
- Q26 Did any of the patients' scanned/biopsied test positive for COVID-19?
- Q27 What is your Dept. COVID-19 protocol?
a. The patients and staff wear masks at all times
b. The patients are subjected to temperature checks
c. The patients are tested for COVID
d. The patients confirm 14 days self-quarantine
- Q28 Did the pandemic have an impact on prostate MRI research? Yes/No
- Q29 Did the pandemic have an impact on prostate biopsy research? Yes/No
- Q30 For how much longer do you anticipate the pandemic will affect your schedules?
a. 1–3 months
b. 4–6 months
c. 7–9 months
d. 10–12 months

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Data availability All data and materials support the published claims and comply with field standards.

Declarations

Conflict of interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

Ethical approval This prospective survey-based study received institutional review board approval from the research ethics committee at The University of Texas MD Anderson Cancer Center, Houston, United States.

Informed consent Answering “Yes” to the first survey question served as a consent to participate in the study. The authors affirm that human research participants provided informed consent for publication.

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