



Practice, Policy & Education

Impact of coronavirus disease 2019 (COVID-19) outbreak on radiology research: An Italian survey



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ABSTRACT

Purpose: To understand how COVID-19 pandemic has changed radiology research in Italy.

Methods: A questionnaire ($n = 19$ questions) was sent to all members of the Italian Society of Radiology two months after the first Italian national lockdown was lifted.

Results: A total of 327 Italian radiologists took part in the survey (mean age: 49 ± 12 years). After national lockdown, the working-flow came back to normal in the vast majority of cases (285/327, 87.2%). Participants reported that a total of 462 radiological trials were recruiting patients at their institutions prior to COVID-19 outbreak, of which 332 (71.9%) were stopped during the emergency. On the other hand, 252 radiological trials have been started during the pandemic, of which 156 were non-COVID-19 trials (61.9%) and 96 were focused on COVID-19 patients (38.2%). The majority of radiologists surveyed (61.5%) do not conduct research. Of the radiologists who carried on research activities, participants reported a significant increase of the number of hours per week spent for research purposes during national lockdown (mean 4.5 ± 8.9 h during lockdown vs. 3.3 ± 6.8 h before lockdown; $p = .046$), followed by a significant drop after the lockdown was lifted (3.2 ± 6.5 h per week, $p = .035$). During national lockdown, 15.6% of participants started new review articles and completed old papers, 14.1% completed old works, and 8.9% started new review articles. Ninety-six surveyed radiologists (29.3%) declared to have submitted at least one article during COVID-19 emergency.

Conclusion: This study shows the need to support radiology research in challenging scenarios like COVID-19 emergency.

1. Introduction

The worldwide spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has led the World Health Organization to declare the related syndrome, namely coronavirus disease 2019

(COVID-19), as a pandemic on March 11th 2020.¹ Italy was the first European country facing COVID-19 outbreak, with Northern regions being massively involved in this emergency.² National governments implemented several measures to contain the spread of infection, ultimately leading to the national lockdown, which in Italy was imposed

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from 9th March until 4th May 2020.³ As a matter of fact, healthcare institutions were forced to change dramatically their daily organization to harmonize the working-flow and to guarantee inpatient and outpatient activity, improving safety at work and limiting cross-infections within hospitals.⁴ These measures mostly consisted of access restrictions, drastic drop of outpatient activities, different paths for COVID-19 and non-COVID-19 patients, increased availability of sanitizers, disinfectants and personal protective equipment (PPE).^{3–9} As reported by a recent study, COVID-19 emergency has completely changed the working activity of Italian radiology departments during the national lockdown.⁵ Indeed, a massive drop of imaging volumes has been observed throughout the country, particularly in private institutions with some of them having been forced to completely stop their activity.^{5,10}

Over the last few months, a huge amount of papers concerning diagnostic and prognostic value of imaging of COVID-19 has been published.^{11–21} This proves that radiology research has not stopped during COVID-19 pandemic and that this emergency has become a main topic of several trials and research activities. Nevertheless, the impact of COVID-19 outbreak on radiology research has been scarcely considered. Most universities across the world have modified, postponed, or canceled their activities, including lessons, workshops, and conferences to protect students and university staff from the spread of infection, with transferring most education to online delivery mode.²² Further, the rapid increase of infection and deaths, with the subsequent extreme restrictive measures, may have impacted on clinical and imaging trials, mostly due to the access restrictions of both patients and researchers to healthcare institutions. Indeed, as shown by a recent study, about 80% of Italian oncologists involved in breast cancer research reported a substantial decrease of research activities (e.g. enrolment of patients in clinical trials, opening new clinical trials) and scientific activities such as writing research projects, papers and applying for grants.²³

Therefore, we promoted a national survey to assess the impact of COVID-19 outbreak on Italian radiology research. We intentionally preferred to conduct an overall assessment of radiology research activity as opposed to research specifically related to COVID-19.

2. Materials and methods

2.1. Study design

This article reports the results of a national survey, which has been launched, with the cooperation of the Italian Society of Medical and Interventional Radiology (Società Italiana di Radiologia Medica ed. Interventistica, SIRM), to retrieve data about how COVID-19 pandemic has changed radiology research in Italy. As already done in previous studies, the questionnaire was built up and sent out using the free online tool “Google Forms”(Google LLC, Mountain View, CA, USA).^{24–27} The survey was supported by the Young SIRM Working Group and approved by SIRM Board Committee on July 6th, 2020 and an email was sent out to all 10,071 SIRM members on July 7th. We informed all participants that data would have been managed in aggregated form to ensure anonymity. After eight days, on July 15th another email was sent as a reminder and the survey was closed on July 20th. The survey was open two months after the first Italian national lockdown was lifted, when the whole country was trying to get back to normality.

The questionnaire was composed of 19 questions: 8 closed answers with single ($n = 6$) or multiple-choice selections ($n = 2$) and 11 open questions with free-text response. The list of questions and answers is reported in Table 1. Institutional Review Board approval was not needed, as no patients were involved.

2.2. Data analysis

Answers were analyzed by two radiologists with more than 5 years' experience in medical research (D.A.,C.M.). Data and response rates

Table 1
Full list of questions and answers.

Question	Answer
1) How old are you?	Mean: 49.2 ± 12; range: 27–83 years
2) Gender?	Male: 168 (51.4%) Female: 153 (46.8%) I prefer to not specify: 6 (1.8%)
3) What's your Radiology Subspecialty?	Emergency: 91 (27.8%) Ultrasound: 91 (27.8%) Oncology: 90 (27.5%) Gastroenteric: 71 (21.7%) Musculoskeletal: 70 (21.4%) Chest: 67 (20.5%) Neuroradiology: 45 (13.8%) Genitourinary: 41 (12.5%) Interventional: 31 (9.5%) Cardiac: 29 (8.9%) Breast: 28 (8.6%) Head and neck: 19 (5.8%) Pediatric: 14 (4.3%) Radioprotection and radiobiology: 8 (2.4%) Informatic: 5 (1.5%) Forensic and Ethical: 3 (0.9%) None: 31 (9.5%) See Table 2
4) Which region did you work in during COVID-19 lockdown?	
5) Are you working for or in agreement with an Italian or foreign University?	No: 245 (74.9%) Yes: 82 (25.1%)
6) What's your role?	Hospital staff radiologist: 222 (67.9%) Resident: 23 (7.0%) Full or associate professor: 12 (3.7%) Assistant professor: 9 (2.8%) PhD candidate: 7 (2.1%)
7) What type of hospital do you work in?	Public: 231 (70.6%) Private: 73 (22.3%) Freelance doctor or consultant: 54 (16.5%) Both: 22 (6.7%) I don't know: 1 (0.3%)
8) Your institution is:	General hospital/local health service/ accredited medical facility: 188 (57.5%) University hospital: 86 (26.3%) Private clinic: 54 (16.5%) IRCCS: 45 (13.8%)
9) How is the working-flow at your institution	Unchanged: 285 (87.2%) Unchanged but with possibility and advice to work at home: 18 (5.5%) Health-work personnel must stay at home without paid leave: 4 (1.2%) Health-work personnel must stay at home with paid leave: 4 (1.2%) University personnel must work at home: 1 (0.3%) University personnel must stay at home without paid leave: 0 (0%) University personnel must stay at home with paid leave: 0 (0%) Other: 15 (4.6%)
10) How many radiological trials were recruiting patients before COVID-19 lockdown?	Mean: 1.4 ± 3; range: 0–20
11) How many radiological trials have been stopped during COVID-19 lockdown?	Mean: 1 ± 2.5; range: 0–20
12) How many radiological trials have been started during COVID-19 lockdown?	Mean: 0.8 ± 1.8; range: 0–15
13) How many non-COVID radiological trials have been started during COVID-19 lockdown?	Mean: 0.5 ± 4; range: 0–50
14) How many hours per week did you use to spend for research purposes before COVID-19 national lockdown?	Mean: 3.3 ± 6.8; range: 0–60
15) How many hours per week had you spent for research purposes during COVID-19 national lockdown?	Mean: 4.5 ± 8.9; range: 0–60

(continued on next page)

Table 1 (continued)

Question	Answer
16) How many hours per week have you spent for research purposes after COVID-19 national lockdown?	Mean: 3.2 ± 6.5 ; range: 0–50
17) During lockdown, did you begin to write new review articles or did you complete old articles?	No: 201 (61.5%) Yes, I started new review articles and completed old works: 51 (15.6%) Yes, I completed old works: 46 (14.1%) Yes, I started new review articles: 29 (8.9%)
18) How many scientific articles did you submit during COVID-19 pandemic?	Mean: 0.9 ± 1.9 ; range: 0–13
19) Please provide up to 3 words or sentences to explain the impact of COVID-19 pandemic to research activity at your institution:	

Note – IRCCS = Istituto di Ricovero e Cura a Carattere Scientifico.

were expressed as mean \pm standard deviation and percentages. Mann Whitney *U* test was used to compare differences in mean hours spent on research. The SPSS (v.26, IBM, Armonk, NY) was used for statistical analysis. A *P*-value $< .05$ was considered statistically significant.

Answers with possibilities to write free text were evaluated qualitatively.

3. Results

A total of 327/10,071 (3.2%) SIRM members took part in the survey (mean age: 49 ± 12 years; range: 27–83 years). Geographical distribution of participants is resumed in Table 2.

Among radiology subspecialties, those mostly reported were Emergency ($n = 91$), Ultrasound ($n = 91$), Oncology ($n = 90$), Gastroenteric ($n = 71$), and Musculoskeletal ($n = 70$). Most participants (245/327, 74.9%) were not working for or in agreement with a University and most of them were hospital staff radiologists (222/327, 67.9%). More than two-thirds of surveyed radiologists (231/327, 71%) was working in a public institution, which mostly was a general hospital (188/327, 57.5%); 86/327 (26.3%) participants declared to work in a university hospital. After the national lockdown was lifted, the working-flow came back to normal in the vast majority of cases (285/327, 87.2%). Participants reported that a total of 462 radiological trials were recruiting patients at their institutions before the national lockdown, of which 332 (71.9%) were stopped during the national lockdown. On the other hand, 252 radiological trials have been started during the national lockdown,

Table 2

Geographical distribution of Italian radiologists who took part in the survey.

Region	Number of answers	Percentage of answers
Lombardia	70	21%
Lazio	42	13%
Emilia-Romagna	30	9%
Toscana	27	8%
Veneto	24	7%
Puglia	23	7%
Campania	22	7%
Piemonte	22	7%
Sicilia	18	6%
Marche	11	3%
Friuli Venezia Giulia	8	2%
Liguria	5	2%
Sardegna	4	1%
Trentino Alto Adige	4	1%
Basilicata	3	1%
Calabria	3	1%
Abruzzo	2	1%
Umbria	2	1%
Foreign country	2	1%
Molise	1	0%
Valle d'Aosta	0	0%
No answer	4	1%
Total	327	

of which 156 were non-COVID-19 trials (61.9%) and 96 were focused on COVID-19 patients (38.2%). Notably, the majority of radiologists surveyed (61.5%) do not conduct research. Of the radiologists who carried on research activities, participants reported a significant increase of the number of hours per week spent for research purposes during the national lockdown (mean 4.5 ± 8.9 h during lockdown vs. 3.3 ± 6.8 h before lockdown; $p = .046$), followed by a significant drop after the national lockdown was lifted (3.2 ± 6.5 h per week, $p = .035$).

During the national lockdown, 15.6% of participants both started new review articles and completed old papers, 14.1% completed old works, and 8.9% started new review articles. Ninety-six surveyed radiologists (29.3%) declared to have submitted at least one article during the national lockdown. The majority of participants reported high levels of stress and anxiety during lockdown, as expected.

4. Discussion

The main finding of this nationwide survey is that COVID-19 outbreak drastically impacted on Italian radiology research. Most ongoing radiological trials have been stopped during the first national lockdown, although researchers have pushed forward many other trials, spending even more time on radiology research.

Scientists have been strongly committed to face the emergency, searching for diagnostic and therapeutic solutions to contain this pandemic. By November 23rd, 2020, almost 80,000 papers have been published on PubMed on COVID-19 during only few months. This is the result of a large-scale effort to understand how to manage this unprecedented health emergency. Radiology examinations, specifically computed tomography and plain radiography, are essential to assess lung disorders.^{28–32} This is crucial in COVID-19 management, particularly to assess the extension of lung parenchymal involvement. However, radiology research has also investigated the role of both imaging modalities as screening tools, to detect the infection, to monitor COVID-19 pneumonia, and to potentially predict clinical outcome.^{20,33–37} Indeed, as reported by the participants in our study, more than one-third of their radiology trials that started during the national lockdown were focused on COVID-19 imaging. Thus, this pandemic has been the driving force of new research lines in radiology. This is also proven by the significant increase of time spent for research purposes and the high number of papers that were written and submitted by Italian radiologists during the national lockdown. During the national lockdown, given the substantial drop of imaging volumes in radiology departments,⁵ Italian radiologists had probably more time to spend in writing new articles and completing old papers. Nevertheless, this is not in line with what reported by a recent survey by Italian oncologists involved in breast cancer research, who reported a substantial decrease of research activities, including writing scientific papers.²³ As a consequence of the extraordinary ferment of the scientific community, radiology journals have received an unpredictable high number of submissions about COVID-19 imaging, which in some cases have been subjected to ultra-rapid peer review. In this setting, Hope et al. have argued that the rush to report positive results has led to the overestimation of data concerning COVID-19 imaging with several CT-oriented articles that have been recently published; indeed, the authors concluded recommending “Don’t Rush the Science” in the new COVID-19 era.³⁸ On the other hand, it should be noted that most non-COVID-19 radiology trials carried on by the participants in our study prior to the pandemic were put on hold, although almost one third carried on as intended. This should be considered in light of the fact that many Italian hospitals were understaffed and overwhelmed by COVID-19 workload at pandemic peak. The priority was rightly given to support clinical activity and management of COVID-19 inpatients and emergency procedures, strongly limiting other activities.⁵ However, the confusion caused by the impressive number of infected patients and deaths probably led to overlook radiological trials that could have been somewhat pushed forward. Data of the current study highlights the importance of being prepared to carry on imaging

trials during the current second wave of COVID-19 emergency or during future pandemics. New research modalities and environments may be implemented to be dedicated to radiological activities. Furthermore, it should be noted that radiologists were inspired to devote more time to research during the pandemic which underscores the importance of scientific activity to prevent disease and improve health care.

Some limitations of the present study should be considered. First, the relatively low percentage of radiologists who responded to the survey, particularly regarding university staff. Higher number of university radiologists involved in this study would have given more data regarding radiology research in Italy, given that they conduct more research than radiologists at a general hospital. On the other hand, the statistically significant increase in the hours spent on research during the national lockdown by radiologists at a general hospital is even more impressive and another strength of this research. Second, we could not compare the answers of radiologists working in University institutions with those from participants working in general hospitals or private clinics as several participants work simultaneously in both type of institutions. Last, some Italian regions were under-represented in this survey, making a regional-based comparison of collected data not reliable. However, a strength of this study is that the greatest percentage of radiologists responding to the survey were from Lombardia, which was so significantly impacted by the pandemic.

5. Conclusions

This ever-changing pandemic has relevantly changed our routine clinical practice and research activity in radiology departments. This study is a snapshot of the situation of Italian radiology research during COVID-19 emergency and confirms the need to be prepared for future similar challenging scenarios to support radiology researchers. This may allow them pushing forward their activity, which is more essential than ever in such a historic moment when physicians and scientists are under great pressure to provide clarity and answers. Our study also demonstrates how radiologists may be uniquely positioned to devote more time to research during a national crisis compared with colleagues in other medical disciplines, and how radiologists in a myriad of practice settings are important contributors to the scientific community.

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