European Radiology
https://doi.org/10.1007/s00330-022-09083-w

ONCOLOGY

Attitudes and perceptions of radiologists towards online (virtual) oncologic multidisciplinary team meetings during the COVID-19 pandemic—a survey of the European Society of Oncologic Imaging (ESOI)

Nathania Bonanno[1] · Dania Cioni[2] · Damiano Caruso[3] · Clemens C. Cyran[4] · Julien Dinkel[4] · Laure Fournier[5] · Sofia Gourtsoyianni[6] · Ralf-Thorsten Hoffmann[7] · Andrea Laghi[3] · Laura Martincich[8] · Marius E. Mayerhoefer[9,10] · Giulia A. Zamboni[11] · Evis Sala[12] · Heinz-Peter Schlemmer[13] · Emanuele Neri[2] · Melvin D'Anastasi[1]

Received: 13 April 2022 / Revised: 3 July 2022 / Accepted: 4 August 2022

Abstract

Objectives To explore radiologists' opinions regarding the shift from in-person oncologic multidisciplinary team meetings (MDTMs) to online MDTMs. To assess the perceived impact of online MDTMs, and to evaluate clinical and technical aspects of online meetings.

Methods An online questionnaire including 24 questions was e-mailed to all European Society of Oncologic Imaging (ESOI) members. Questions targeted the structure and efficacy of online MDTMs, including benefits and limitations.

Results A total of 204 radiologists responded to the survey. Responses were evaluated using descriptive statistical analysis. The majority (157/204; 77%) reported a shift to online MDTMs at the start of the pandemic. For the most part, this transition had a positive effect on maintaining and improving attendance. The majority of participants reported that online MDTMs provide the same clinical standard as in-person meetings, and that interdisciplinary discussion and review of imaging data were not hindered. Seventy three of 204 (35.8%) participants favour reverting to in-person MDTs, once safe to do so, while 7/204 (3.4%) prefer a continuation of online MDTMs. The majority (124/204, 60.8%) prefer a combination of physical and online MDTMs.

Conclusions Online MDTMs are a viable alternative to in-person meetings enabling continued timely high-quality provision of care with maintained coordination between specialties. They were accepted by the majority of surveyed radiologists who also favoured their continuation after the pandemic, preferably in combination with in-person meetings. An awareness of communication issues particular to online meetings is important. Training, improved software, and availability of support are essential to overcome technical and IT difficulties reported by participants.

✉ Melvin D'Anastasi
melvin.a.danastasi@gov.mt

[1] Medical Imaging Department, Mater Dei Hospital, University of Malta, Msida MSD 2090, Malta

[2] Academic Radiology, Department of Translational Research, University of Pisa, Via Roma 67, 56126 Pisa, Italy

[3] Department of Medical Surgical Sciences and Translational Medicine, Sapienza University of Rome, Sant'Andrea University Hospital, Via di Grottarossa, 1035-1039, 00189 Rome, Italy

[4] Department of Radiology, University Hospital, LMU Munich, Marchioninistr. 15, 81377 Munich, Germany

[5] Radiology Department, Hôpital Européen Georges Pompidou, AP-HP, Université de Paris, 20 Rue Leblanc, F-75015 Paris, France

[6] 1st Department of Radiology, School of Medicine, Areteion Hospital, National and Kapodistrian University of Athens, Athens, Greece

[7] Diagnostische und Interventionelle Radiologie Universitätsklinikum Dresden, TU Dresden, Fetscherstr. 74, 01307 Dresden, Germany

[8] Ospedale Cardinal Massaia Asti, Unit of Radiology, Corso Dante Alighieri, 202, 14100, Asti, Italy

[9] Department of Biomedical Imaging and Image-Guided Therapy, Medical University of Vienna, A-1090 Vienna, Austria

[10] Department of Radiology, Memorial Sloan Kettering Cancer Center, 1275 York Avenue, New York, NY 10065, USA

[11] Department of Diagnostics and Public Health, Institute of Radiology, University of Verona, Policlinico GB Rossi, P.le LA Scuro 10, 37134 Verona, Italy

[12] Department of Radiology Box 218, Cambridge Biomedical Campus Cambridge, Cambridge CB2 0QQ, UK

[13] Department of Radiology, German Cancer Research Center (DKFZ), Im Neuenheimer Feld 280, 69120 Heidelberg, Germany

Published online: 20 August 2022

Key Points

- *Majority of surveyed radiologists reported shift from in-person to online oncologic MDT meetings during the COVID-19 pandemic.*
- *The shift to online MDTMs was feasible and generally accepted by the radiologists surveyed with the majority reporting that online MDTMs provide the same clinical standard as in-person meetings.*
- *Most would favour the return to in-person MDTMs but would also accept the continued use of online MDTMs following the end of the current pandemic.*

Keywords Pandemics · Interdisciplinary communication · Radiologists · COVID-19, surveys and questionnaires

Abbreviations

ESOI	European Society of Oncologic Imaging
MDT	Multidisciplinary team
MDTM	Multidisciplinary team meeting

Introduction

The current COVID-19 pandemic may have initially found health institutions unprepared, but with the readily available teleconferencing technology, implementing a shift of the traditional face-to-face MDTMs to online MDTMs was feasible for many institutions around the globe. This was vital to safeguarding the integrity of the oncological MDTMs and ensuring unimpeded multidisciplinary care of cancer patients, while at the same time endorsing social distancing and quarantine measures to limit the rate of infection and spread of SARS-CoV-2.

In 2020, Neri et al conducted a survey among ESOI members aimed at assessing the quality and amount of radiologists' involvement in MDTMs, their role in it and related issues [1]. The aims of the current survey were (1) to determine whether the radiologists' role and participation within the MDTM have changed on account of the shift from in-person to online MDTMs and (2) to identify the potential benefits and limitations of online MDTMs based on current experience, in order to further improve current practice, and, if possible, to take advantage of the advancements of digitalisation given that online MDTMs are predicted by many to play a central role in future cancer care.

Materials and methods

The first draft of the survey questionnaire was created by the first author (N.B.). The survey questions were amended following review by a supervisor (M.D.) and evaluated by a facilitator (E.N.). The final version was reviewed and approved by a panel of 4 ESOI experts/board members.

The final online survey was created on Google Forms® and circulated to ESOI active full members for 2021. All members were invited to participate with an individual e-mail invitation sent by the ESOI office. The survey was available to ESOI members between 6th September and 21st September 2021, a total duration of 16 days. Two reminders were sent a week and 2 weeks after the first invitation to encourage a maximum number of responses.

The survey comprised 24 questions in total, with a combination of multiple choice and short answer questions. The survey was organised into three sections. The first section included 6 general information questions on country of employment, clinical role, and attendance and participation at oncologic MDTMs. The second section included 15 questions that explored radiologists' opinions on MDTM functioning during the COVID-19 pandemic and sought an in-depth comparison of online MDTMs with conventional in-person MDTMs. Questions targeted the structure of MDTMs as well as changes due to the COVID-19 pandemic. Radiologists were asked about their experience and acceptance of online MDTMs and their potential benefits and drawbacks. The final section had 3 questions that inquired about radiologists' opinions on future directions of online MDTMs and their impact on the role of the Radiologist within the MDTM.

The questions included in the full survey are shown in Table 1.

Final responses from each participant were exported to Microsoft Excel® for data categorisation and analysis. Data was analysed and compiled using descriptive statistics.

Because this study does not involve patient data, it did not require approval by the Research Ethics Committee.

Results

All survey respondents were ESOI members in good standing for the year 2021. We received 204 responses from radiologists in 47 countries. The geographic distribution of respondents is shown in Table 2.

Of the respondents, 28/204 (13.7%) were Departmental Chairs/Directors, 63/204 (30.9%) were Radiology Consultants, 24/204 (11.8%) were Radiology Fellows/Residents, and 89/204 (43.6%) were non-consultant board-certified Radiologists (Fig. 1).

Table 1 Survey questions

General information:

1. Which country do you work in?

2. What is your role in the imaging department?
   a. Chair/Director
   b. Consultant
   c. Radiology Fellow/Resident
   d. Board-certified Radiologist

3. On average per week, how many MDTs do you attend and/or participate in?
   a. <1 per week
   b. 1-3 per week
   c. 3-6 per week

4. Is attendance to MDTs mandatory for the Radiologists in your institution?
   a. Yes
   b. No

5. How much time do you spend preparing for and participating at MDTs?
   a. 1-2 hours per week
   b. 2-4 hours per week
   c. > 4 hours per week

6. Have you participated in any online MDT before the COVID-19 pandemic?
   a. Yes
   b. No

Opinion of MDTs during the COVID-19 pandemic:

7. Did your hospital implement online MDTs after the start of the COVID-19 pandemic (February/March 2020)?
   a. Yes
   b. No – online MDTs were not done before or during the pandemic
   c. No – online MDTs were already being done prior to the pandemic

8. What was your initial reaction when your hospital implemented online MDTs following the COVID-19 pandemic?
   a. Approved it
   b. Neutral
   c. Disapproved it

9. In your opinion, has Radiologists' participation at MDTs increased on account of the meeting being held online?
   a. Yes
   b. No
   c. Maybe

10. In your opinion, has Clinicians' participation at MDTs increased on account of the meeting being held online?
   a. Yes
   b. No
   c. Maybe

11. Do you think the shift to an online meeting affected the standard of the MDT?
   a. Yes, significantly better
   b. Yes, slightly better

c. Yes, slightly lowered standard
d. Yes, significantly lowered standard
e. No, remains the same

12. Are you happy with the depth of discussion happening in the online MDTs compared to conventional face-to-face MDTs?
a. Yes
b. No

13. Do you think the role of the Radiologist at the online MDT has changed?
a. Yes
b. No, remains the same

If answer to the above is 'Yes', please state how:
_____
14. Were you able to interact adequately with other Specialists in the online MDT?
a. Yes
b. No
15. Were you able to access all relevant patient imaging data in the online MDT?
a. Yes
b. No

16. Did you find the viewing of imaging studies to be equal, better, or worse in the online MDT when compared to the physical MDT?
a. Equal
b. Better
c. Worse

17. Which videoconferencing software was used during online MDTs?
a. Zoom Meetings
b. Microsoft Teams
c. GoToMeeting
d. Google Meet
e. Other: _____

18. Where did you participate at the online MDT from?
a. Hospital office
b. Home office
c. Both hospital and home office

19. In your opinion, which of these do you consider important benefits for Radiologists to having the MDT held online?
a. Safer alternative to face-to-face contact between multiple clinical teams thereby minimizing viral transmission/the risk of infection
b. Easier access to the meeting
c. More organised discussion
d. More organised chairing, reducing the number of people speaking at one time
e. Room availability and scheduling no longer a problem as no need for a dedicated large room.
f. Other: _____

You may select more than one answer:
20. In your opinion, which of these do you consider important deficiencies of online MDTs that the radiologist may encounter?
a. Difficulties with technology and connectivity
b. Lack of technical support

c. Difficulties with review of imaging studies online
d. Ineffective communication between radiologist and the other medical teams
e. Missing non-verbal cues may lead to misunderstandings
f. Difficulty in developing a working relationship with new team members due to sole online interaction at MDT
g. Other: _____

You may select more than one answer:
21. Has the number or frequency of meetings changed since the switch to online MDTs?
a. Yes, more meetings/more frequent
b. Yes, fewer meetings/less frequent
c. No change

22. In your opinion do you agree that MDTs should revert to face-to-face group meetings, once it is considered safe to do so?
a. Yes
b. No
c. Combination of physical and online MDTs

23. In your opinion would you support the continued practice of online MDTs following the end of the current pandemic and the ensuing return to normal work?
a. Yes
b. No

24. If online MDTs continue in the future, will this increase or decrease the workload of Radiologists?
a. Increased workload
b. Decreased workload
c. Remains the same

For 127/204 (62.3%) participants, attendance to oncologic MDTs was mandatory at their institution but this was not the case for the rest (77/204; 37.7%).

One hundred twenty-nine of 204 (63.2%) respondents attended, on average, between 1 and 3 MDTs per week and 18/204 (8.8%) attended between 3 and 6 MDTMs per week, whilst 57/204 (27.9%) respondents did not attend MDTMs every week. When asked how much time is spent preparing for and participating in MDTMs, most respondents (110/204; 53.9%) said 1–2 h per week, with 61/204 (29.9%) spending 2–4 h weekly, and 33/204 (16.2%) spending more than 4 h every week.

Seventy-four of 204 (36.3%) radiologists had previously participated in online MDTMs prior to the pandemic.

Opinions regarding MDTMs during the COVID-19 pandemic

One hundred fifty-seven of 204 (77%) respondents reported that the circumstances of the COVID-19 pandemic, and the contact restrictions it brought, have led to a shift to online MDTMs at their hospital. For 12/204 (5.9%), no change was required since online MDTMs were already being done prior to the pandemic. On the other hand, 35/204 (17.2%) respondents reported that online MDTMs were not done before or during the pandemic in their institutions (Fig. 2).

Respondents were asked to describe their initial reaction when their hospital implemented the change from in-person MDTMs to online MDTMs at the start of the pandemic. The majority (141/204; 69.1%) approved the change and 57/204 (27.9%) of respondents remained neutral to the change, whilst a few (6/204; 3%) initially disapproved it.

We received divided opinions regarding radiologists' participation in the MDTMs following the shift to online meetings. Eighty of 204 (39.2%) reported an increased participation rate at the online MDTMs, but another 80/204 (39.2%) suggested that participation at online MDTMs has remained the same or has decreased. Forty-five of 204 (22.3%) were unsure and responded with a 'maybe'. Eighty-two of 204 (40.2%) respondents have observed an increase in

Table 2 Geographic distribution of survey respondents

Country	# of respondents
Italy	34
Germany	15
UK	14
Greece	12
India	9
Ukraine	8
Spain	6
Colombia	5
Denmark	5
Malta	5
Mexico	5
The Netherlands	5
Poland	5
Portugal	5
Switzerland	5
Austria	4
Belgium	4
Chile	4
Kenya	4
Slovakia	4
South Africa	4
Sweden	4
Australia	3
Hungary	3
Latvia	3
Czech Republic	2
Pakistan	2
Peru	2
Slovenia	2
Turkey	2
Uruguay	2
USA	2
Croatia	1
Estonia	1
France	1
Indonesia	1
Israel	1
Jamaica	1
Kazakhstan	1
Malaysia	1
Nigeria	1
Norway	1
Romania	1
Russia	1
Singapore	1
United Arab Emirates	1
Vietnam	1
Total	204

participation by non-radiologist clinical colleagues at online MDTMs (Fig. 3).

One hundred fifty-nine of 204 (77.9%) thought that the role of the radiologist at the online MDTM has not changed, but 45/204 (22.3%) believed otherwise. Various reasons for a change in the role of the radiologist were given: the most common response was that radiologists have an augmented role in the MDT due to sharing the screen, with meetings being more radiology-driven and with radiologists having more control over the discussion and an increased interaction with the other members of the multidisciplinary team. The radiologist is seen to have an even more important role in the multidisciplinary team. Another reason given was that radiologists had to deal with technical difficulties during the online MDTM more often than during an in-person MDTM.

Respondents were asked to give their views on the value of online MDTMs (Fig. 4). We found that 71/204 (34.8%) of those surveyed reported that online MDTMs provide the same standard as in-person MDTs. Seventy of 204 (34.3%) felt that the standard of online MDTMs was lower: 18/204 (8.8%) felt that it was lowered significantly, 52/204 (25.5%) felt it was lowered only slightly. Conversely, 63/204 (30.9%) felt the standard of online MDTMs was improved: 22/204 (10.8%) felt it was significantly improved, 41/204 (20.1%) felt it was only slightly improved.

One hundred twenty-nine of 204 (63.2%) were happy with the depth of discussion happening in the online MDTMs and 165/204 (80.9%) also felt that there was satisfactory interaction between specialists during case discussion. The majority (158/204, 77.5%) did not experience difficulties or issues with accessing patient imaging data during the online MDTMs, and 144/204 (70.1%) found the viewing of imaging studies to be equal or better in the online MDTM when compared to the in-person MDTM. However, 60/204 (29.4%) of respondents said that viewing of imaging studies was suboptimal or problematic during online MDTMs.

The most commonly used software for the hosting of online MDTs was Zoom® (90/204, 44.1%), followed by Microsoft Teams® (60/204, 29.4%). Google Meet® and GoToMeeting® also featured prominently (14/204, 6.9% and 12/204, 5.9%, respectively). The remaining used other software or institutional solutions.

With the advent of online MDTMs, 15/204 (7.4%) of respondents prefer to log on to the meeting from a home office and 94/204 (46.1%) use both a home and hospital office, whereas 91/204 (44.6%) only use a hospital office.

Despite the considerable impact on medical care during the COVID-19 pandemic, the results of our survey show that for 144/204 (70.6%) of respondents, online MDTMs were maintained at the same pre-pandemic frequency during this period. Forty-four of 204 (21.6%) of those surveyed reported an increase in the number and/or frequency of MDTMs, whilst 16/

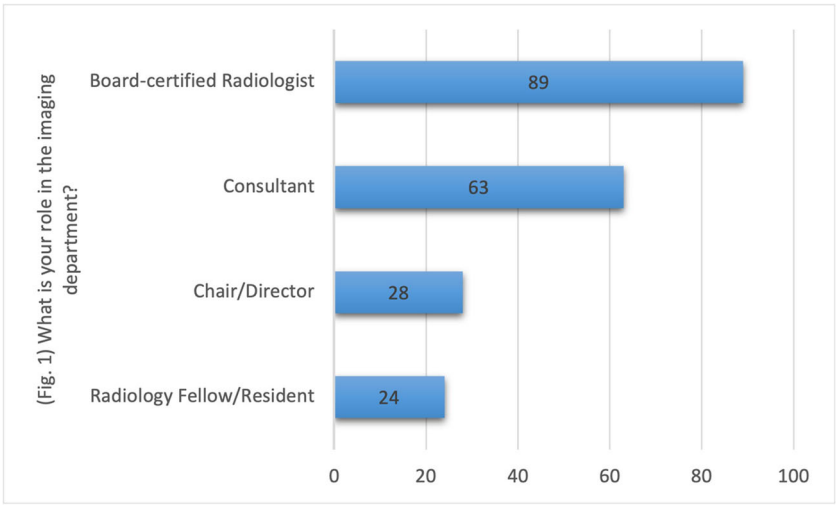

Fig. 1 Survey respondents' role in their imaging department

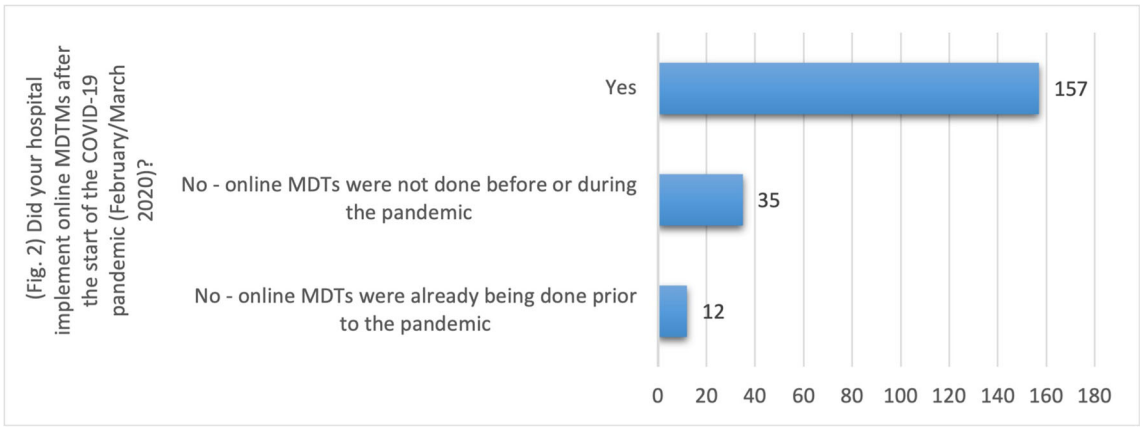

Fig. 2 Implementation of online MDTMs and its timing

204 (7.8%) reported a decrease in the number and/or frequency of MDTMs at their hospital.

Most respondents (164/204; 81.4%) consider the major benefit of online MDTMs to be a safer alternative to face-to-face contact between multiple clinical teams, thereby minimising the risk of infection (Fig. 5). One hundred twenty-one of 204 (57.4%) reported they had easier access to the online MDTM and 53/204 (26%) found that chairing

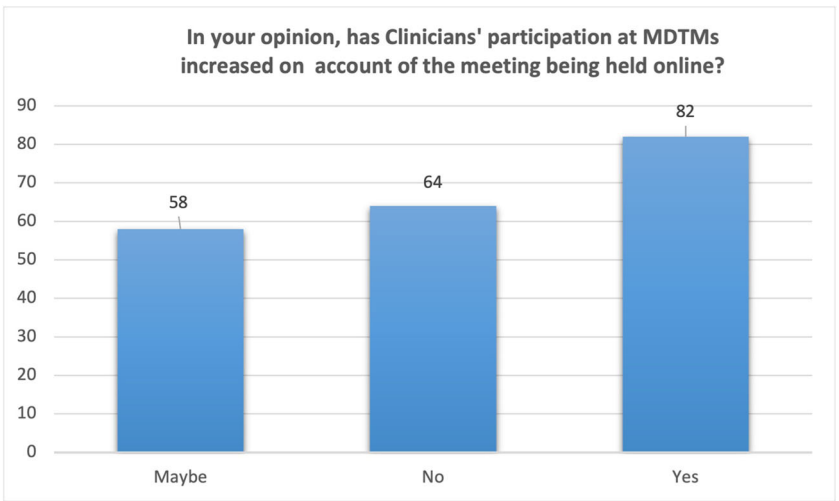

Fig. 3 Has non-radiologist clinicians' participation increased after shift to online MDTMs?

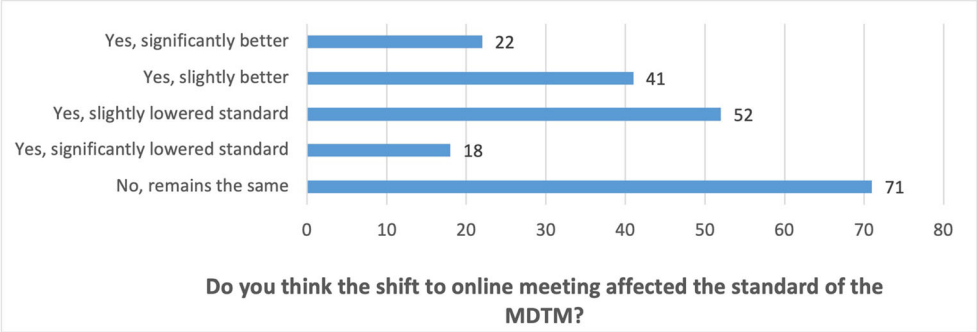

Fig. 4 Has the shift to online meetings affected the standard of the MDTMs?

the MDTM was more organised with a reduction of people speaking at one time, while 45/204 (22.1%) found that in online MDTMs, there is more organised discussion, which allowed better communication among medical colleagues. Ninety-six of 204 (47.1%) observed that online MDTMs solve the issues of room availability and scheduling. One respondent (0.5%) had opposing views and said that there are no benefits for radiologists to having the MDTM held online.

The major obstacle to conducting online MDTMs is perceived by 137/204 (67.2%) of respondents to be the difficulties with technology and connectivity, while 68/204 (33.3%) considered it difficult to review imaging studies online and 88/204 (43.1%) highlighted the lack of technical support, whereas 98/204 (48.0%) identified that missing non-verbal cues may lead to misunderstandings and 48/204 (23.5%) found that there may be ineffective communication between radiologist and the other medical teams. One hundred fourteen of 204 (55.9%) believed that there may be difficulties in developing a working relationship with new team members due to sole online interaction at MDT and considered this a significant deficiency of online MDTMs (Fig. 6).

Opinions on future directions

In our survey, 73/204 (35.8%) of the participants are in favour of reverting to in-person MDTs, once it is considered safe to do so. However, 7/204 (3.4%) were satisfied with the current experience and prefer that MDTMs continue to be held online. The majority (124/204, 60.8%) would be happy with a combination of physical and online MDTMs.

Participants seemed divided over their opinion regarding continued practice of online MDTMs following the end of the current pandemic and the subsequent return to normal work. While 142/204 (69.6%) would be happy to continue attending online MDTMs in the future, the remaining 62/204 (30.4%) would not support the continued practice of online MDTMs once the pandemic is over.

Most radiologists (112/204, 54.9%) predicted that their workload will remain the same if online MDTMs continue in the future and 77/204 (37.7%) felt that their workload would increase, whereas 15/204 (7.4%) thought that workload will decrease.

Discussion

The current COVID-19 pandemic has had an immense impact on healthcare systems and forced strict social distancing and quarantine measures to limit rate of infection and the risk of healthcare professionals contracting the disease. It was recognised early on that essential services, such as cancer care, must continue unhindered, and therefore, maintaining routine

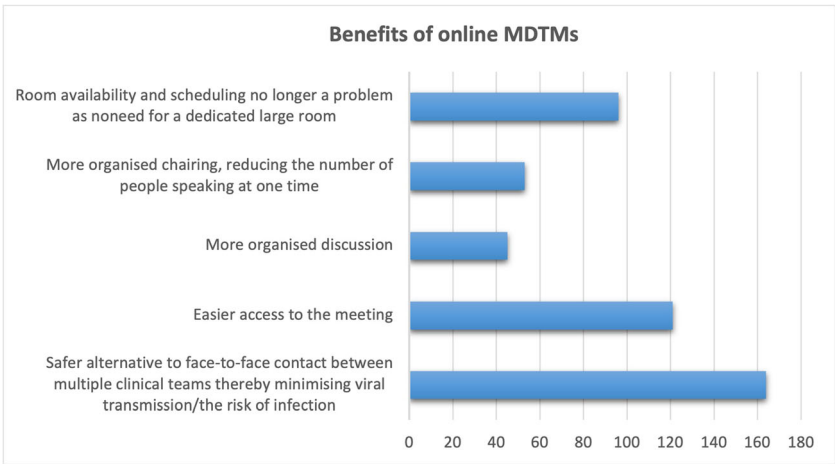

Fig. 5 Benefits of online MDTMs

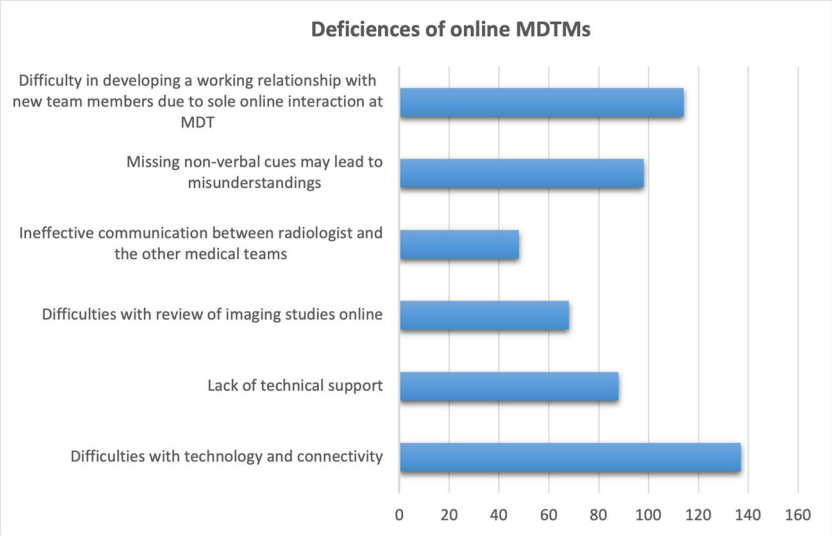

Fig. 6 Deficiencies of online MDTMs

oncologic MDTMs was imperative [2]. Adaptations to standard clinical practice had to be made in order to minimise the risk of infection and spread of disease. The availability of affordable and secure teleconferencing software made it feasible for most healthcare providers to implement a shift from in-person MDTMs, the norm prior to the pandemic, to online MDTMs, thereby allowing essential oncologic services to continue.

Radiologists are pivotal members of the multidisciplinary tumour team and play a central role in the multidisciplinary management of cancer patients [3, 4]. Our survey evaluated the opinions of radiologists, members of the European Society of Oncologic Imaging, who have been working through the pandemic since February–March 2020. We aimed to evaluate their thoughts on the efficacy and quality of the online MDTM, and whether this could represent the future trend in oncologic radiology. To our knowledge, this is the largest survey to evaluate members' experience of virtual oncologic MDTMs.

The vast majority of participants in our survey reported that following the onset of the COVID-19 pandemic and enforcement of social distancing, their hospitals implemented a shift to online MDTMs with MDTMs generally maintained during this period, which was in line with the results of surveys and reports from other specialties and multidisciplinary groups [5–11]. This shows the efforts made by institutions to preserve the normal functioning of the MDTs.

Our study also reveals that multidisciplinary participation remained high, and that online meetings have had a positive effect on attendance with the majority of respondents reporting a similar or increased participation rate by both radiologists and other clinicians. Schäfer et al found that reasons for this may be the fluent transition from in-person meetings to online meetings and the readily available and easy-to-use software which facilitated the integration of online MDTMs in daily practice routines [5]. The virtual nature of the meetings offers a safer alternative to face-to-face contact between multiple clinical teams which may be spread across different sites with easier access to the meetings with no additional travel requirements. Similar results were reported in a recent study by Sidpra et al [11]. Another major reported advantage of online MDTMs is more organised chairing and discussion which allows better time management and helps in reducing the number of participants speaking at any one time, effectively facilitating clinical communication and decision-making. Participants also reported that online MDTMs are more convenient than their physical counterpart because of lack of need for a fixed time and place of meeting, which is a factor that may improve attendance [12].

In addition, the majority of those surveyed reported that online MDTMs perform equal to or better than physical MDTMs and are able to provide a similar standard across various criteria, including depth of discussion and interaction between specialists during case discussion and viewing of patient imaging data, which is in line with previous reports [11, 13, 14]. That said, over a third (34%) of those surveyed showed concern regarding the quality of the online MDTM, stating that the virtualisation of the MDTM has lowered the quality of the meeting. Difficulties with technology and connectivity and lack of technical support were frequently reported as areas of concern in our survey and in other reports [10, 11, 13]. We believe that lack of familiarity with teleconferencing programmes and equipment might have contributed to the technological issues expressed by some radiologists. Suitable training for MDTM members and a standardised approach applied to all teams working at multiple sites, as well as readily available IT support are needed to overcome this difficulty and are critically important to maintain high quality in oncological care [15, 16].

Additional perceived shortcomings of the online MDTM are the communication barriers between radiologist and the other medical teams within the virtual environment, with most preferring in-person communication as it allows detection of non-verbal cues and helps in developing a working relationship with other team members and encourages interdisciplinary exchange. Gross et al found that online meetings carry the risk of loss of relevant information and decreasing meeting discipline which may lead to wrong decisions or recommendations [16]. Therefore, they proposed a set of regulations for online meetings, which included the definition of a 'moderator', one participant speaking at one time, permanently visible and audible participants, meticulous radiological demonstration of imaging studies, and common meeting sign-in and sign-out. However, based on our own experience of online MDTMs, we believe it is preferable to have participants muted when not speaking in order to avoid unpleasant echoes and undesired and distracting background noises. Kerawala et al also recommended the use of a 'users' guide' provided to participants in case of IT problems, the use of an 'MDTM checklist' at the beginning of each meeting to ensure that potential errors in process are minimised, and that outcomes of the online MDT discussions are circulated by e-mail for clinical record-keeping [17]. An awareness of human factors, such as increased difficulty to concentrate during remote meetings, the need for short breaks during longer meetings, and distraction and multitasking, is important in order to mitigate these and enhance the experience of online MDTMs [18]. This approach to online MDTMs should facilitate members' active participation and enable robust interdisciplinary discussions.

As supported by our findings, we understand that the majority of radiologists would favour the return to in-person MDTMs but a large proportion of these would accept the continued use of online MDTMs in combination with in-person MDTMs (be it either a 'hybrid' meeting configuration with simultaneous in-person and virtual audiences or alternating online and in-person meetings) following the end of the current pandemic. These preferences may be influenced by the size and location/s of the respondents' institutions—for example, online MDTMs may be more practical in larger institutions with multiple sites across a city or a country by reducing the need for commuting for each MDTM. The hybrid option would allow participants who are unable to attend a live event to do so virtually. In our view, hybrid meetings may be a cost-effective option featuring the benefits of both in-person and virtual meetings but integrating both platforms may present a unique set of challenges. The biggest challenge facing hybrid meetings are the different environments involved. Whether an entirely virtual audience or a split virtual and in-person audience, the meeting organiser must provide tools for these groups to engage with one another and create an inclusive audience experience. We recommend the following basic tools: the use of a large, high-resolution central screen, ceiling-/desk-mounted or hand-held microphones that are not sensitive to background noise and that can distinguish who is speaking, easy-to-use and secure videoconferencing software that accommodates screen sharing so that every attendee can see the meeting content and contribute to it, meeting room scheduling software to plan the meeting time and schedule in advance, and readily available IT support.

A limitation of our survey is the relatively small cohort given that data was exclusively obtained from a subspecialty radiological society. We find however the results to be reflective of the wider literature on the subject. As all respondents were of varying seniority across the radiological oncologic subspecialties and of varying geographic distribution, we believe our findings to be generalisable to the MDT at large. Another limitation is that a portion of the respondents may be in the early stages of using online MDTMs and their opinions might be influenced by this. With time, participants would be able to gauge their future role better. The subjective nature of the study is an additional limitation; the information recorded was based on recall and thus may have inherent recall bias.

The shift to online oncologic MDTMs was feasible and generally accepted by the radiologists surveyed. Online MDTMs are a viable alternative to in-person meetings enabling continued timely high-quality provision of care with maintained coordination between specialties. Technological shortcomings are the biggest barrier to their widespread acceptance but may be overcome with training, improved software, and readily available in-meeting technical and IT support.

Acknowledgements The authors would like to thank the ESOI Office in Vienna for their logistical support in conducting this survey among ESOI members.

This study was part of Nathania Bonanno's Master thesis at the University of Pisa.

Funding The authors state that this work has not received any funding.

Declarations

Guarantor The scientific guarantor of this publication is Melvin D'Anastasi.

Conflict of interest Clemens Cyran, Marius E. Mayerhoefer, Giulia Zamboni, and Heinz-Peter Schlemmer, are members of the European Radiology Editorial Board. They have not taken part in the review or selection process of this article.

The others authors of this manuscript declare no relationships with any companies whose products or services may be related to the subject matter of the article.

Statistics and biometry No complex statistical methods were necessary for this paper.

Informed consent Written informed consent was not required for this study because this article does not contain any studies directly involving human participants or animals performed by any of the authors.

Ethical approval Institutional Review Board approval was not required because this article does not contain any studies directly involving human participants or animals performed by any of the authors.

Methodology
- retrospective
- observational
- multicenter study

References

1. Neri E, Gabelloni M, Bauerle T et al (2021) Involvement of radiologists in oncologic multidisciplinary team meetings: an international survey by the European Society of Oncologic Imaging. Eur Radiol 31:983–991
2. Gennaro N, Marrari A, Bertuzzi AF, Balzarini L, Santoro A, Politi LS (2021) The radiologist empowerment through virtual multidisciplinary tumor boards: the commitment of oncologic care during COVID-19 pandemic. Clin Imaging 70:49–50
3. Lesslie MD, Parikh JR (2017) Multidisciplinary tumor boards: an opportunity for radiologists to demonstrate value. Acad Radiol 24:107–110
4. European Society of R (2020) The identity and role of the radiologist in 2020: a survey among ESR full radiologist members. Insights Imaging 11:130
5. Schafer N, Bumes E, Eberle F et al (2021) Implementation, relevance, and virtual adaptation of neuro-oncological tumor boards during the COVID-19 pandemic: a nationwide provider survey. J Neurooncol 153:479–485
6. Salari A, Shirkhoda M (2020) COVID-19 pandemic & head and neck cancer patients management: the role of virtual multidisciplinary team meetings. Oral Oncol 105:104693
7. Gebbia V, Guarini A, Piazza D et al (2021) Virtual multidisciplinary tumor boards: a narrative review focused on lung cancer. Pulm Ther 7:295–308
8. Elkaddoum R, Kourie HR, Kassis NE et al (2020) Treating cancer patients in times of COVID-19 pandemic: a virtual women cancers multidisciplinary meeting experience. Bull Cancer 107:738–740
9. Sadeghi AH, Wahadat AR, Dereci A et al (2021) Remote multidisciplinary heart team meetings in immersive virtual reality: a first experience during the COVID-19 pandemic. BMJ Innov 7:311–315
10. Elghobashy M, Wahab L, Gunavardhan A et al (2021) Impact of COVID-19 on the practice of breast pathologists: a survey of breast pathologists in the UK and Ireland. J Clin Pathol. https://doi.org/10.1136/jclinpath-2021-207725
11. Sidpra J, Chhabda S, Gaier C, Alwis A, Kumar N, Mankad K (2020) Virtual multidisciplinary team meetings in the age of COVID-19: an effective and pragmatic alternative. Quant Imaging Med Surg 10:1204–1207
12. Munro AJ, Swartzman S (2013) What is a virtual multidisciplinary team (vMDT)? Br J Cancer 108:2433–2441
13. Rajasekaran RB, Whitwell D, Cosker TDA, Gibbons C, Carr A (2021) Will virtual multidisciplinary team meetings become the norm for musculoskeletal oncology care following the COVID-19 pandemic? - experience from a tertiary sarcoma centre. BMC Musculoskelet Disord 22:18
14. Mohamedbhai H, Fernando S, Ubhi H, Chana S, Visavadia B (2021) Advent of the virtual multidisciplinary team meeting: do remote meetings work? Br J Oral Maxillofac Surg. https://doi.org/10.1016/j.bjoms.2021.05.015
15. Aston SJ, Reade S, Petersen B, Ward C, Duffy A, Nsutebu E (2018) Extraordinary virtual multidisciplinary team meetings - a novel forum for the coordinated care of patients with -complex conditions within a secondary care setting. Future Healthc J 5:218–223
16. Gross MW, Laubli H, Cordier D (2021) Multidisciplinary tumor boards as videoconferences - a new challenge in the COVID-19 era. Ann Oncol 32:572–573
17. Kerawala C, Riva F, Paleri V (2020) Videoconferencing for multidisciplinary team meetings in the coronavirus disease era - human factors awareness and recognition. J Laryngol Otol 134:1118–1119
18. Oeppen RS, Shaw G, Brennan PA (2020) Human factors recognition at virtual meetings and video conferencing: how to get the best performance from yourself and others. Br J Oral Maxillofac Surg 58:643–646