



# A web-based survey of educational opportunities of medical professionals based on changes in conference design during the COVID-19 pandemic

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Received: 3 January 2022 / Accepted: 28 March 2022 / Published online: 18 April 2022

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## Abstract

Owing to the coronavirus disease 2019 (COVID-19) pandemic, understanding how to hold future online academic conferences effectively is imperative. We assessed the impact of COVID-19 on academic conferences, including facilities and settings for attendance, participation status, cost burden, and preferences for future styles of holding conferences, through a web-based questionnaire survey of 2,739 Japanese medical professionals, from December 2020 to February 2021. Of the participants, 28% preferred web conferences, 60% preferred a mix of web and on-site conferences, and 12% preferred on-site conferences. Additionally, 27% of the presenters stopped presenting new findings at web conferences. The proportion of participants who audio-recorded or filmed the sessions, despite prohibition, was six times higher at web than face-to-face conferences. Since the COVID-19 outbreak, the percentage of participants attending general presentations decreased from 91 to 51%. While web conferencing offers advantages, these are offset by a decrease in presentations pertaining to novel findings and data.

**Keywords** Distance education · Online learning · Adult learning · Lifelong learning

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## 1 Introduction

In 2020, coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2, spread worldwide (Bedford et al., 2020; Ong et al., 2020), showing no signs of diminishing even after a year. In Japan, a state of emergency was declared on April 7, 2020 (Japan Society of Health Evaluation and Promotion [JHEP], 2020), after several people were infected and the disease eventually spread throughout the country. As a result, avoiding the “3 Cs”—closed spaces, crowds, and contact—became standard, causing considerable change in individual lifestyles. One such common change is the web conferencing system. The increasing number of COVID-19 cases led to a rapid increase in non-face-to-face communication via web conferencing systems (Gates, 2020; Porpiglia et al., 2020). Moreover, the use of such systems is also increasing in medical care (Gunasekeran et al., 2020; Lonergan et al., 2020; Salisbury et al., 2020; Vandekerckhove et al., 2020; Yagi et al., 2020).

It has become difficult to conduct academic conferences with a large number of people using the conventional face-to-face method because such events involve all 3 Cs. Given that many types of medical professionals participate in medical care-related academic conferences, the number of participants tends to be large. There are many instances where participation is required for gathering information and certification; thus, such conferences should be regularly conducted for maintaining high standards of medical care and facilitating essential certifications. If participation in academic conferences can lead to the spread of the infection, restrictions on medical workers' employment can result in hospital closures, which in turn will lead to inadequate maintenance of the healthcare system. Therefore, academic conferences have been held via the Internet. Methods of holding these conferences vary depending on the type, and appropriate methods—such as question and answer (Q&A) sessions—for conducting conferences during the pandemic period have not yet been identified. There are various problems that may arise when conducting online academic conferences (Angeli et al., 2003; Fulcher et al., 2020; Kies et al., 1997; Salomon & Feldman, 2020). Although there have been reports on the outcomes of several academic conferences (Antonoff et al., 2021; Castillo-Vilcahuaman et al., 2020; Forrest et al., 2020), no survey to date has investigated format preferences for academic conferences during a pandemic among medical professionals who have attended multiple academic conferences. It is not clear whether participants, including speakers, will prefer to conduct conferences online. Therefore, it is critical to clarify what measures are necessary to hold future online academic conferences effectively.

There have been studies on teaching in online environments, especially using Q&A sessions, which have been compared with online discussion forums (Jansson et al., 2021; Smith IV et al., 2020). Q&A sessions are shown to be helpful not only to the students asking questions, but also to their peers who review answers while problem-solving (Huang & Law, 2018). Q&A interaction has been found to be student-initiated (Smith IV et al., 2020). Additionally, it has been shown that excessive instructor assistance may hinder student learning (Mazzolini &

Maddison, 2003, 2007). It is clear, therefore, that Q&A sessions help improve learning effectiveness. These effects can be achieved regardless of whether students actively participate in Q&As (Bozkurt et al., 2020; Smith IV et al., 2020). There have been various reports on the effects of learning when there is a clear distinction between the instructor and learners. In contrast, participants in Q&A sessions at academic conferences are often each other's peers; however, only a few Q&A sessions have been conducted in an online environment. As a result, few surveys have been administered to elicit participants' opinions at online academic conferences. Additionally, since it is not possible to access previous material from face-to-face Q&A sessions, it is unclear whether the conference participants sought access to answers later. The extent to which this type of online environment will be adopted, willingness to participate, and the problems involved remain unknown as few surveys have been conducted in this regard.

To conduct a web conference, it is essential that a basic environment comprising the Internet and related devices be created. The cost of such implementation is not small. Compared with traditional face-to-face learning, online environments offer more convenience and flexibility for learners. The flexibility is beneficial for people working full time or joining work after a career break due to other responsibilities, such as raising children (Barratt & Duran, 2021). Academic conferences, however, offer more than just learning opportunities. The most important aspects of a face-to-face format differ depending on the participants, and there is insufficient information available on the requirements for online conference environments due to the lack of relevant research. Web conferencing is still in its infancy, and various problems related to this have been highlighted (Angeli et al., 2003; Gates, 2020; Kies et al., 1997); however, no useful countermeasures have yet been identified. Web-based academic conferences may continue to be held even after the end of the COVID-19 pandemic. There are advantages and disadvantages to holding web-based academic conferences (Bottanelli et al., 2020; Sarani et al., 2021); thus, it is necessary to collect comprehensive data on web-based academic conferences to improve future events. In addition, medical-related academic conferences often provide training credits related to qualifications required for practicing medicine. Consequently, people who do not conduct research in academic areas often attend such conferences; moreover, the background of participants in healthcare-related academic conferences may differ from that of those in general academic conferences. For this purpose, we surveyed medical professionals from a variety of backgrounds and with diverse licensures, who participated in academic conferences, to gain information for future event planning.

In addition to determining whether holding web-based academic conferences is desirable in the future, this survey clarifies the environments made possible by such web-based conferences, such as chat communication and the protection of rights through recording and videotaping sessions. Furthermore, as this is a large-scale survey, we investigate the issue of cost burden among participants, which has not been explored in the case of web-based events and due to the lack of survey data regarding this issue.

## 2 Material and methods

### 2.1 Questionnaire survey for medical professionals

We conducted a fact-finding survey using a web-based questionnaire about academic conferences on the Internet. The respondents were healthcare workers. Participants gave informed consent by completing a form before receiving the questionnaire. The survey was conducted approximately one year after the novel coronavirus was first reported (from the end of December 2020 to February 2021). The questionnaire used in this survey was created using Microsoft Forms, and the majority of the questions were choice-based to avoid variations in opinions. Additionally, a free-response text field was provided to collect the opinions of participants.

We contacted 73 academic societies, comprised of more than 1,000 members registered with the University Hospital Medical Information Network, asking that they send out the survey request to medical workers via email, academic society websites, and postal mail. We also used social networking services (Facebook, Twitter, and Instagram) to spread information about the survey. Since various media were used to request response, the number of potential respondents contacted could not be calculated, and the response rate is unknown. All responses received were suitable for use. A total of 2,739 individuals participated, and the average time to complete the survey was 12 min and 3 s. No respondent was excluded from the analysis due to missing data. Table 1 presents the respondents' information.

This survey did not require institutional review board approval because none of the questionnaire items involved personal information. This was not a randomized controlled trial, and the Ethical Guidelines for Medical and Health Research Involving Human Subjects of the Japanese Government did not apply to this study.

### 2.2 Analysis

The period before March 2020 was defined as the “pre-outbreak period,” and the period from March 2020, when the Act on the Special Measures against new coronavirus variants was enacted in Japan, was defined as the “post-outbreak period.” Although there was a significant difference between this study and existing methods, we cannot declare that this method is optimal for all academic conferences, as is the case with clinical trials. Fisher's chi-square test was used for statistical analysis. To prevent statistical significance tests from omitting minority opinions and leading to arbitrary results, descriptive statistics were used for presenting most of the results.

**Table 1** Demographic characteristics of the respondents (N = 2,739)

	n (%)
<b>Age range (years)</b>	
20–24	10 (0.4)
25–29	82 (3.0)
30–34	223 (8.1)
35–39	378 (13.8)
40–44	471 (17.2)
45–49	479(17.5)
50–54	443(16.2)
55–59	347 (12.7)
60–64	195 (7.1)
65–69	71 (2.6)
≥ 70	30 (1.1)
None	10 (0.4)
<b>Organization</b>	
University hospital	436 (15.9)
University (academic)	113 (4.1)
Hospital (≥ 600 beds)	234 (8.5)
Hospital (400–599 beds)	437 (16.0)
Hospital (200–399 beds)	489 (17.9)
Hospital (≤ 200 beds)	391 (14.3)
Clinic	335 (12.2)
Pharmacy	48 (1.8)
Convalescent home	11 (0.4)
Public organization (health center, ministry, and others)	24 (0.9)
Other	221 (8.1)
<b>Medical license</b>	
Doctor	817 (29.8)
Dentist	226 (8.3)
Pharmacist	267(9.7)
Nurse	391 (14.3)
Clinical laboratory technician	877 (32.0)
Radiology technician	62 (2.3)
Nutritional therapist	30 (1.1)
Others	69 (2.5)

### 3 Results

#### 3.1 Participation and environment for web-based academic conferences

We asked whether the participants needed to prepare their Internet environment to join web conferences (N = 2,394). Approximately 78% of the participants were

able to participate in the conference without purchasing any equipment or setting up an Internet environment. Moreover, approximately 77% of the participants were able to attend the conference using their own devices (Table 2). Some respondents selected more than one participating device, resulting in a total of over 100%. There were many different combinations of responses, however, from those who had selected more than one participating device, 8% of respondents purchased the minimum necessary devices for participation, such as personal computers (PCs) and tablets, approximately 20% purchased peripherals such as earphones and microphones. Evidently, a greater number of people purchased new peripherals compared with those who purchased participating devices.

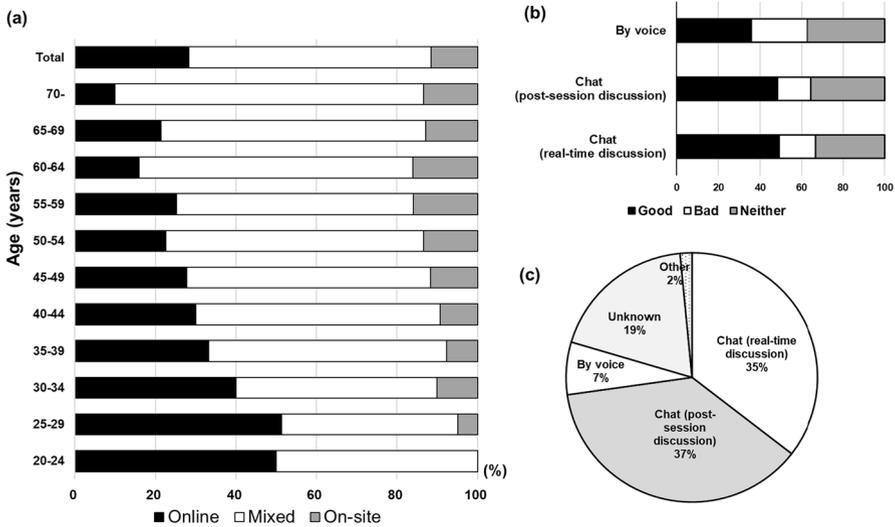
### 3.2 Preferred method of holding future academic conferences

Of all respondents, 28% preferred web conferences, 60% preferred a mix of online and on-site sessions, and 12% preferred on-site conferences. The answers differed depending on the age of the participants. The majority of participants (51%), who preferred web conferences, were aged 25–29 years, whereas 10% of the participants who preferred web conferences were aged over 70 years (Fig. 1a).

Next, we investigated the best method of Q&A (i.e., the most effective method for session-related discussion) for web-based sessions. The percentage of respondents who preferred to use the chat format was about 50% for discussion. In contrast, the percentage of respondents who preferred the voice dialogue format was 36%, which was much lower than those who preferred the chat format (Fig. 1b). Therefore, the majority of participants answered that the chat format was the most appropriate for the current Q&A method compared with face-to-face discussion and would be suitable for future use (Fig. 1c). Overall, 72% of the respondents preferred the chat format, and 19% were undecided about a preferred method.

**Table 2** Participation method and environment for web conferences

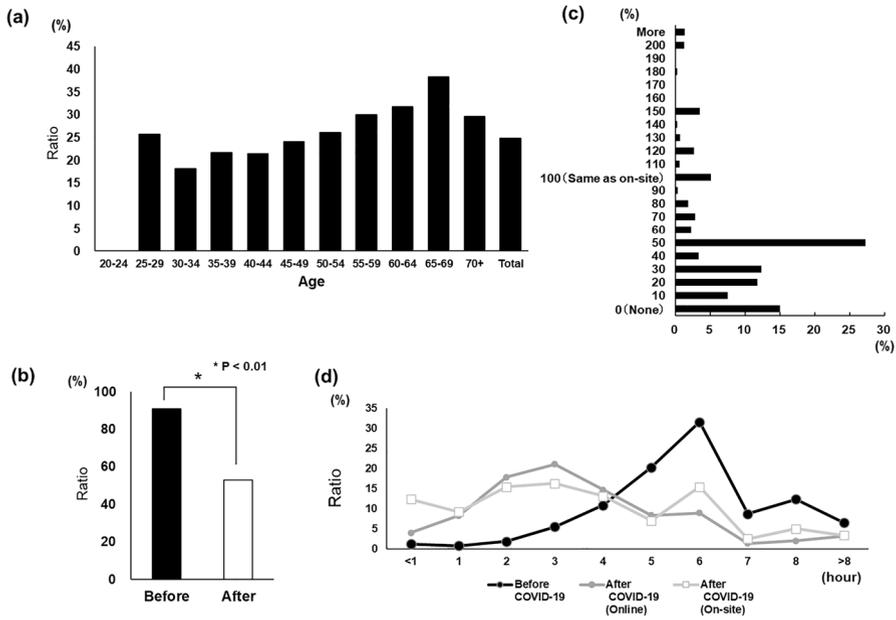
Device purchased to participate	
Did not buy	1878 (78.4)
Mobile phone	29 (1.2)
Tablet	51 (2.1)
Personal computer	118 (4.9)
Web camera	106 (4.4)
Microphone	91 (3.8)
Earphones (headphones)	281 (11.7)
Maintenance of home Internet environment	79 (3.3)
Other	16 (0.7)
Device for participation	
Office PC*	768 (32.1)
Own PC	1852 (77.4)
Tablet	388 (16.2)
Mobile phone	482 (20.1)
Other	9 (3.8)



**Fig. 1** Desired method of holding academic conferences in the future. **a** Preferred method of holding future academic conferences. Participants who preferred to hold conferences online are shown in black, on-site are shown in gray, and a hybrid of the two methods are shown in white. **b** Ease of asking questions in the online Q&A session: Usability of Q&A in online conferences in an interactive or chat format compared with Q&A held on-site before the COVID-19 pandemic. **c** Desired Q&A method in the future

### 3.3 Participation problems during academic conferences

In total, approximately 25% of the participants reported that they would have been unable to participate if the conference had not been held online (Fig. 2a). We investigated attendance rates for general sessions and changes in general abstract attendance before and after the COVID-19 outbreak from the same respondents. Before the outbreak, 91% of the participants attended general sessions. However, this decreased to about 50% post-outbreak. The percentage of those who did not attend the general sessions increased significantly from 8% before COVID-19 to 40.6% for online sessions and 29.5% for on-site sessions after the COVID-19 outbreak. In addition, the percentage of scientific conferences that did not have a general abstract session was increased fivefold for online conferences and 15-fold for on-site conferences compared to before COVID-19 pandemic (Fig. 2b). Compared to on-site scientific conferences, only about 9.2% of respondents increased their participation in sessions they did not plan to attend and about 15% completely stopped attending except for scheduled sessions (Fig. 2c). The median time to attend the conference also decreased by half, from 6 to 3 h before and after the outbreak, respectively (Fig. 2d).



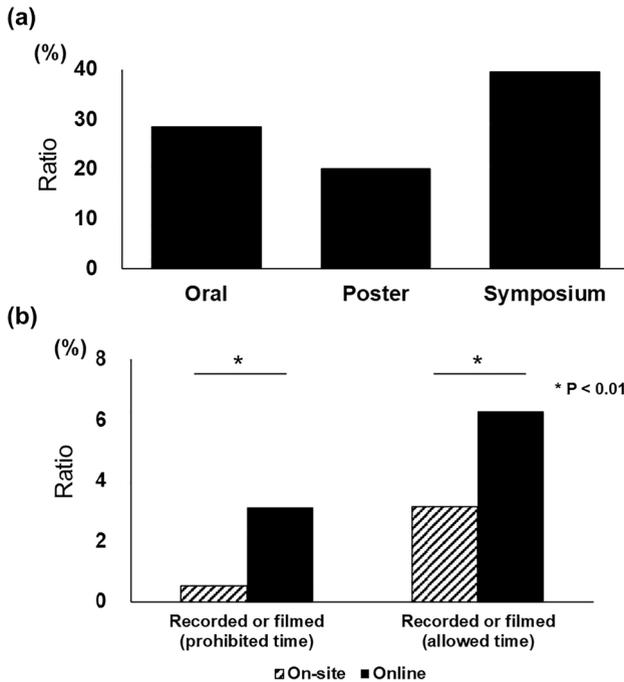
**Fig. 2** Changes among conference participants before and after COVID-19. **a** Proportion of respondents who could only participate in on-site events. **b** Changes in the audience for regular presentations. **c** Increase or decrease in time for sessions attended (Participation in sessions that were not scheduled in advance). **d** Duration of participation in conferences

### 3.4 Problems when presenting at a scientific conference

In web conferences, 27% of the presenters chose not to disclose new data (Fig. 3a). The proportion of participants who did not present new data differed depending on the presentation format, with the symposium being the format in which participants engaged most frequently (40%). In addition, for web conferences, 3% of the participants reported audio recording or filming the presentations, even when such recording was not allowed. This figure was six times higher than that of those who recorded or filmed the presentations during face-to-face conferences. In instances when recording was allowed, twice as many people recorded sessions online (Fig. 3b).

### 3.5 Characteristics of participants attending conferences

Of the total participants, 93.8% attended scientific conferences to obtain the latest information, and 77.3% attended to obtain certification credits. However, 36% of the participants, who attended conferences to socialize with professionals from other facilities, reported that academic conferences play a role beyond self-study. In addition, 12.8% of the participants intended to travel. Although participants were allowed to select multiple options, at least one in three attended academic conferences for purposes other than studying, such as obtaining the latest information or

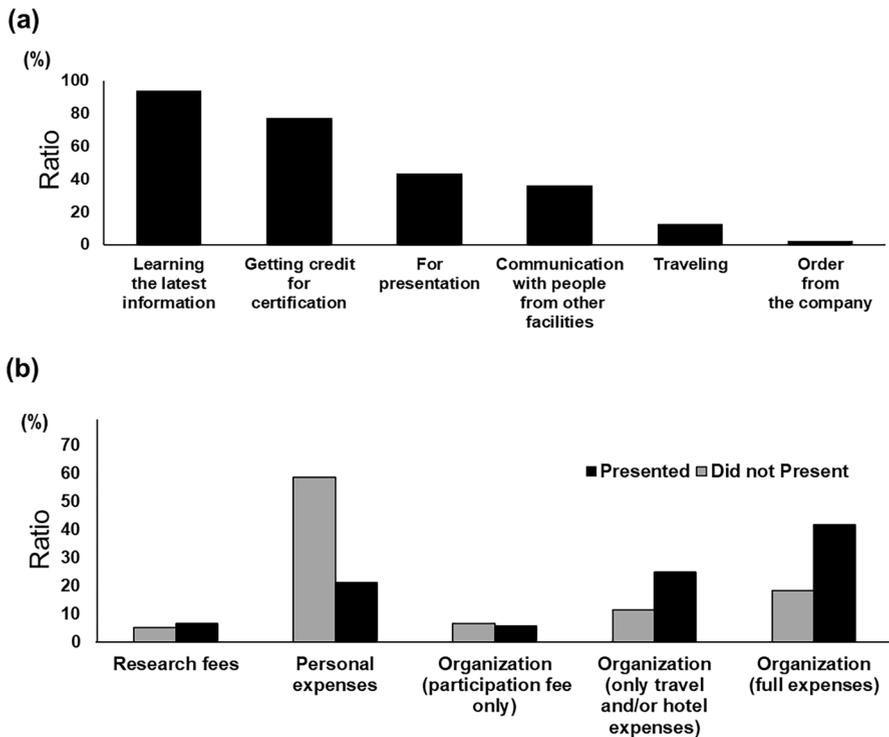


**Fig. 3** Problems that occur when presenting at a scientific conference. **a** Proportion of respondents who did not present new data because the academic conferences were held online. **b** Proportion of respondents who recorded the sessions

earning certification credits (Fig. 4a). In addition, 52% and 77% of the participants who did or did not present their study at a conference, respectively, had to bear at least some travel and accommodation expenses. The percentage of respondents who used research funds to pay for travel and accommodation expenses was low in both cases, that is, 6.4% if they had a presentation and 5.1% if they did not. This may be related to the fact that most respondents were medical professionals and few were researchers. The percentage of respondents whose organizations paid for all expenses was 41.8% if the respondent presented and 18.3% if they did not, which was less than the majority in both cases (Fig. 4b).

## 4 Discussion

In this study, we identified problems that need to be addressed for improving the implementation of web-based academic conferences in Japan. This study was the largest survey conducted in Japan to assess the impact of COVID-19 on academic conferences. We comprehensively collected the opinions of medical professionals, achieving a total response time exceeding 500 h. Respondents of this study belonged to a wide range of institutions, ages, and occupations. The generous



**Fig. 4** Participation characteristics of conference attendees. **a** Purpose of respondents attending a scientific conference (multiple choices allowed). **b** Expense burdens of participants attending an academic conference

collaboration of academic societies across many disciplines facilitated our obtaining information from respondents with a wide variety of backgrounds in response to our requests. Institution types ranged from university hospitals to clinics and businesses, and the demographics of the respondents, such as age group and occupation, were diverse. The main age groups and occupations of the participants also differed depending on the type of academic conference. Therefore, further analysis of the data obtained from this survey for each background factor may be useful as a reference point in determining the optimal reporting for each academic conference. Furthermore, a participation device and an Internet environment were required to participate. As 78% of the participants did not need to pay “out of pocket” to participate, and 97% of the participants had an Internet environment (Table 2), it can be inferred that the necessary equipment to participate in a web-based academic conference was already in place.

We found that some medical professionals preferred future academic conferences that would combine web and face-to-face meetings, whereas younger individuals preferred online conferences. This is similar to data shown by the Ministry of Internal Affairs and Communications’ “Survey of Telecommunications

Usage Trends,” which reported that smartphone usage differed by age, indicating a possible relationship between age and preference for digital devices and applications. Additionally, most respondents from our survey participated using either an office PC, their own PC, a tablet, or a cell phone, although the percentage of use varied by age (data not provided). Currently, only a few participants used tablets and cell phones. Although the organizers of online academic conferences mainly target PC users, as the number of users of these devices increase in the future, further research on this subject may be necessary. However, whether this difference is dependent on affinity for digital devices or on age requires further study as the current, younger generation ages. The web facilitates on-demand delivery of content. The chat format was preferred for the Q&A sessions (Fig. 2c), although the request ratio for receiving answers in real time or at a later date was the same. The number of respondents who found the voice dialogue format for Q&A sessions inconvenient was approximately 10% higher than those who found the chat format inconvenient. The results of this study suggest that voice interaction is not always necessary, although the decision on when to respond to real-time chat needs to be made in consultation with the speaker and management. However, by holding Q&A sessions via chat, people who were previously unable to participate now may do so, which may contribute to increasing both the number of questions from new perspectives and useful opinions for the presenter’s future research. As it is not necessary to allot additional time for Q&A sessions, this above recommendation can contribute to the smooth operation of the conference. In addition to controlling infection rates by preventing overcrowding, web conferences allow people to participate from anywhere, reducing travel time and cost, especially for those living in rural areas. For several participants, it enabled participation in new groups, such as those in locations with poor access to such venues and those who cannot leave home for long periods (e.g., those raising children).

Approximately 75% of web conference participants reported they could not participate in on-site conferences. These results indicate that web conferences can increase the number of medical professional attendees who previously were hindered from participating. Nevertheless, web conference attendance has inherent problems. The number of people who attended general presentations and poster sessions decreased by 51% in web-based conferences post-outbreak than before the COVID-19 outbreak (Fig. 2b). A decrease was observed in the ratio of participants who attended a conference for a session other than the one they had intended to attend (Fig. 2c) and in the amount of time spent attending academic conferences (Fig. 2d). Thus, while web conferences do not exclude anyone from main lectures, attention to posters and other media by those normally excluded from on-site conferences declined. This is an important issue that needs to be addressed when discussing the future of web-based academic conferences. However, as the number of people who viewed general and poster presentations in face-to-face meetings has also decreased since the COVID-19 outbreak (Fig. 2b), further investigation is needed to determine whether this trend is a feature of all web-based meetings or whether it was specific to those during the COVID-19 outbreak. It is important to tackle these problems comprehensively and maintain the quality of academic conferences even in the online environment. If online academic conference quality can be maintained,

the number of participants—for whom face-to-face participation is difficult—may increase, giving medical professionals more self-study opportunities. Thus, the overall quality of medical care may improve because a greater number of medical professionals may deepen their knowledge by attending more conferences. In fact, because many individuals have given up on their future careers due to family-related factors (Jolly et al., 2014), web conferences could help recover competent medical personnel.

Some researchers reported not presenting data at web conferences. This may be because of anxiety that disclosing data to an unspecified number of people on the web may lead to stolen data or undermine the novelty of individual research. Moreover, it is easy to record web-based events. In particular, for symposiums, 40% of the respondents did not present their data (Fig. 3a). This may be due to the six times more frequent filming and recording during web-based events compared with face-to-face events (Fig. 3b). However, it would be meaningless if presenters decided rarely or never to disclose their data at online academic conferences because of the risk of data leakage. Participants primarily attend conferences to gather the latest information and approaches from other institutions, which are more challenging to access otherwise. A web conference with a large audience and excellent information dissemination capabilities may be suitable for circulating information that has already been published (Forrest et al., 2020). However, we need to find appropriate ways to protect unpublished data. The number of people recording and filming the conference when it was permitted increased to approximately twice as many online compared with on-site. This indicates that the state of being online without the others' physical presence encouraged participants to record and film. It also became clear that recording and filming were occurring even when prohibited. It is impossible, however, to check whether the ban on recording and filming is as strictly enforced online as it is on-site. Therefore, it is necessary to determine which types of data were withheld by data researchers who refrained from disclosing new data in their presentations and to find effective methods that allow safe data disclosure for both online and on-site presentations.

Participants reported attending conferences to obtain certification credits, and a majority attended at their own expense. Maintaining these certifications is often a professional necessity. Thus, academic conference participation may lead to financial burden. It is believed that researchers are required to pay for their own participation in academic conferences (Sarabipour et al., 2021); this study has shown that the same is also the case for medical professionals. Changing this system immediately is difficult but warranted. Furthermore, the fact that travel and participation costs are often paid out-of-pocket in Japan may influence web conference demand. Online academic conferences, which significantly reduce the cost burden on participants and organizers (Bottanelli et al., 2020; Sarani et al., 2021) may be a valuable way to reduce the economic uncertainty related to the cost of attending academic conferences. As the respondents of this survey were medical professionals, the percentage of those who used research funds to pay for their expenses was only 5%. This percentage may change for academic conferences on subjects other than medicine where the majority of participants are researchers. To address these financial problems, further research is needed to determine whether participation in academic

conferences is for self-study purposes or required by an organization as continuing education is considered essential for medical professionals. In addition, nearly half of the participants attended the conference for the purpose of communicating with peers from other institutions (Fig. 4a), which is different from the intention of teaching and learning in an online environment. As the number of web-based academic conferences is likely to increase in the future, it may be necessary to consider the perspective of person-to-person communication in the process of determining the ideal web-based academic conference. Nearly two years have passed since online academic conferences became mainstream. In open-ended responses to this survey, some participants highlighted that personnel exchange has become more difficult owing to the decrease in exchange between facilities. The long-term effects of not holding local academic conferences are unknown. It may be necessary to conduct further research on personnel exchange, which is one of the purposes that academic conferences serve, apart from studying. Research needs to be conducted over time to determine the various issues that may arise because of the change in the design of academic conferences to web-based conferences.

This study clarified medical professionals' preferences for conducting future academic conferences. In addition, we determined which Q&A method would be useful for discussion. Results showed that web-based academic conferences may not protect researchers presenting unpublished data or promote attendance at presentations other than those for important discoveries.

In the future, it is necessary to improve the quality of web-based academic conferences by developing measures to address these problems. It also became apparent that financial burden might be imposed on individuals regardless of the COVID-19 pandemic. In addition, the results of our study can be used as a basis to examine how future academic conferences—both online and offline—can be conducted after the COVID-19 pandemic.

#### 4.1 Study strengths and limitations

Although there are available reports on the status of specific academic conferences under COVID-19, a key strength of this study is its large sample size and the representativeness of the collected data for diverse academic societies, occupations, and regions. This survey was also conducted without funding from any particular organization, which reduces potential biases. Although the survey data were collected from 73 Japanese medical societies and the number of respondents was approximately 2,400 (approximately 0.1% of the total 3 million healthcare professionals), the number of healthcare professionals who attend academic conferences is much smaller than this. Therefore, the actual response rate is unknown; thus, we should be cautious before generalizing the study results to all Japanese healthcare professionals.

In addition, as the evolution of the pandemic was not predictable, it was difficult to collect data on the situation before the outbreak in advance. Therefore, the comparative data before and after the outbreak were collected after the pandemic, raising the possibility of it being biased.

Nonetheless, this study was conducted among medical professionals in Japan. Since conference environments vary by country, findings may not generalize effectively to other locations. Further studies should explore if these findings are applicable to web-based meetings under all conditions or are specific to the COVID-19 outbreak.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s10639-022-11032-5>.

**Acknowledgements** We would like to thank Editage ([www.editage.com](http://www.editage.com)) for editing the English language.

**Authors' contributions** Conceptualization: Kenta Yagi, Ysutaka Sato, and Hiroaki Yanagawa; Methodology: YS, Yuki Izawa-Ishizawa, and Yoshito Zamami; Investigation: Arisa Inoue-Hamano, Toshihide Nishimori, Marina Kanno, Rie Matsuoka-Ando, Toshihiko Yoshioka, Yoshiko Matsubara, Yurika Kuniki, Yoshika Sakamoto, and Sayuri Itobayashi; Visualization: Mayuko Shimizu; Supervision: Akinori Maruo, Rieko Shimizu, and Keisuke Ishizawa; Writing—original draft: Kenta Yagi and Hiroaki Yanagawa. Writing—review & editing: Satoshi Sakaguchi, Mitsuhiro Goda, Hirofumi Hamano, and Fuka Aizawa. All authors read and approved the final manuscript. Each author is a specialist in his/her area of expertise, and we thank them for their efforts in collecting data in their fields, including requesting surveys from academic societies in their areas of expertise attributed to their respective medical licenses, etc.

**Data availability** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

**Ethics approval** This survey did not require institutional review board approval because none of the questionnaire items involved personal information. The Ethical Guidelines for Medical and Health Research Involving Human Subjects of the Japanese Government did not apply to this study.

**Informed consent** All participants gave online informed consent by completing a form.

**Competing interests** The authors have no competing interests to declare that are relevant to the content of this article.

## References

- Angeli, C., Valanides, N., & Bonk, C. J. (2003). Communication in a web-based conferencing system: The quality of computer-mediated interactions. *British Journal of Educational Technology*, *34*(1), 45–56. <https://doi.org/10.1111/1467-8535.d01-4>
- Antonoff, M. B., Mitzman, B., Backhus, L., Bradbury, S. T., Chatterjee, S., Cooke, D. T., Crestanello, J., Goldstone, A. B., Kim, K. M., Nguyen, T. C., Romano, J. C., Vaporciyan, A. A., & Varghese, T. K., Jr. (2021). The Society of Thoracic Surgeons (STS) Virtual Conference Taskforce: Recommendations for hosting a virtual surgical meeting. *The Annals of Thoracic Surgery*, *111*(1), 16–23. <https://doi.org/10.1016/j.athoracsur.2020.10.008>
- Barratt, J. M., & Duran, F. (2021). Does psychological capital and social support impact engagement and burnout in online distance learning students? *The Internet and Higher Education*, *51*, 100821. <https://doi.org/10.1016/j.iheduc.2021.100821>
- Bedford, J., Enria, D., Giesecke, J., Heymann, D. L., Ihekweazu, C., Kobinger, G., Lane, H. C., Memish, Z., Oh, M. D., Sall, A. A., Schuchat, A., Ungchusak, K., Wieler, L. H., WHO Strategic and

- Technical Advisory Group for Infectious Hazards. (2020). COVID-19: Towards controlling of a pandemic. *The Lancet*, 395(10229), 1015–1018. [https://doi.org/10.1016/S0140-6736\(20\)30673-5](https://doi.org/10.1016/S0140-6736(20)30673-5)
- Bottanelli, F., Cadot, B., Campelo, F., Curran, S., Davidson, P. M., Dey, G., Raote, I., Straube, A., & Swaffer, M. P. (2020). Science during lockdown- From virtual seminars to sustainable online communities. *Journal of Cell Science*, 133(15), jcs249607. <https://doi.org/10.1242/jcs.249607>
- Bozkurt, A., Koutropoulos, A., Singh, L., & Honeychurch, S. (2020). On lurking: Multiple perspectives on lurking within an educational community. *The Internet and Higher Education*, 44, 100709. <https://doi.org/10.1016/j.iheduc.2019.100709>
- Castillo-Vilcahuanan, C., Valdivia, C., Osorio-Mogollón, C., Silva-Andrade, C., Puche, R., Ayala-Ruano, S., Cuesta-Astroz, Y., & Parra, R. G. (2020). 4th ISCB Latin American Student Council Symposium: A virtual and inclusive experience during COVID-19 times. *F1000Research*, 9, ISCB Comm J-1460. <https://doi.org/10.12688/f1000research.28330.1>
- Forrest, A., Repetto, G. M., & Reichardt, J. (2020). Human genetics and genomics meetings going virtual: Practical lessons learned from two international meetings in early 2020. *Human Genomics*, 14(1), 27. <https://doi.org/10.1186/s40246-020-00275-3>
- Fulcher, M. R., Bolton, M. L., Millican, M. D., Michalska-Smith, M. J., Dundore-Arias, J. P., Handelsman, J., Klassen, J. L., Milligan-Myhre, K. C., Shade, A., Wolfe, B. E., & Kinkel, L. L. (2020). Broadening participation in scientific conferences during the era of social distancing. *Trends in Microbiology*, 28(12), 949–952. <https://doi.org/10.1016/j.tim.2020.08.004>
- Gates, B. (2020). Responding to COVID-19 - A once-in-a-century pandemic? *The New England Journal of Medicine*, 382(18), 1677–1679. <https://doi.org/10.1056/NEJMp2003762>
- Gunasekaran, D. V., Liu, Z., Tan, W. J., Koh, J., Cheong, C. P., Tan, L. H., Lau, C. S., Phuah, G. K., Manuel, N., Chia, C. C., Seng, G. S., Tong, N., Huin, M. H., Dulce, S. V., Yap, S., Ponampalam, K., Ying, H., Ong, M., & Ponampalam, R. (2020). Evaluating safety and efficacy of follow-up for patients with abdominal pain using video consultation (SAVED Study): Randomized controlled trial. *Journal of Medical Internet Research*, 22(6), e17417. <https://doi.org/10.2196/17417>
- Huang, K., & Law, V. (2018). Learners' engagement online in peer help. *American Journal of Distance Education*, 32(3), 177–189. <https://doi.org/10.1080/08923647.2018.1475982>
- Jansson, M., Hrastinski, S., Stenbom, S., & Enoeksson, F. (2021). Online question and answer sessions: How students support their own and other students' processes of inquiry in a text-based learning environment. *The Internet and Higher Education*, 51, 100817. <https://doi.org/10.1016/j.iheduc.2021.100817>
- Japan Society of Health Evaluation and Promotion. (2020). Declaration of the state of emergency over the novel coronavirus. Retrieved June 25, 2007 from [https://jhpe.jp/jhpe/sisetu/pdf/tokuken2020\\_15.pdf](https://jhpe.jp/jhpe/sisetu/pdf/tokuken2020_15.pdf). Accessed 13 Apr 2021.
- Jolly, S., Griffith, K. A., DeCastro, R., Stewart, A., Ubel, P., & Jagsi, R. (2014). Gender differences in time spent on parenting and domestic responsibilities by high-achieving young physician-researchers. *Annals of Internal Medicine*, 160(5), 344–353. <https://doi.org/10.7326/M13-0974>
- Kies, J. K., Williges, R. C., & Rosson, M. B. (1997). Evaluating desktop video conferencing for distance learning. *Computers & Education*, 28(2), 79–91. [https://doi.org/10.1016/S0360-1315\(97\)00004-3](https://doi.org/10.1016/S0360-1315(97)00004-3)
- Lonergan, P. E., Washington, S. L., III, Branagan, L., Gleason, N., Pruthi, R. S., Carroll, P. R., & Odisho, A. Y. (2020). Rapid utilization of telehealth in a comprehensive cancer center as a response to COVID-19: Cross-sectional analysis. *Journal of Medical Internet Research*, 22(7), e19322. <https://doi.org/10.2196/19322>
- Mazzolini, M., & Maddison, S. (2003). Sage, guide or ghost? The effect of instructor intervention on student participation in online discussion forums. *Computers & Education*, 40(3), 237–253. [https://doi.org/10.1016/S0360-1315\(02\)00129-X](https://doi.org/10.1016/S0360-1315(02)00129-X)
- Mazzolini, M., & Maddison, S. (2007). When to jump in: The role of the instructor in online discussion forums. *Computers & Education*, 49(2), 193–213. <https://doi.org/10.1016/j.compedu.2005.06.011>
- Ong, S., Tan, Y. K., Chia, P. Y., Lee, T. H., Ng, O. T., Wong, M., & Marimuthu, K. (2020). Air, surface environmental, and personal protective equipment contamination by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) from a symptomatic patient. *JAMA*, 323(16), 1610–1612. <https://doi.org/10.1001/jama.2020.3227>
- Porpiglia, F., Checcucci, E., Autorino, R., Amparore, D., Cooperberg, M. R., Ficarra, V., & Novara, G. (2020). Traditional and virtual congress meetings during the COVID-19 pandemic and the post-COVID-19 era: Is it time to change the paradigm? *European Urology*, 78(3), 301–303. <https://doi.org/10.1016/j.eururo.2020.04.018>
- Salisbury, C., Murphy, M., & Duncan, P. (2020). The impact of digital-first consultations on workload in general practice: Modeling study. *Journal of Medical Internet Research*, 22(6), e18203. <https://doi.org/10.2196/18203>
- Salomon, D., & Feldman, M. F. (2020). The future of conferences, today: Are virtual conferences a viable supplement to “live” conferences? *EMBO Reports*, 21(7), e50883. <https://doi.org/10.15252/embr.202050883>

- Sarabipour, S., Khan, A., Seah, Y., Mwakilili, A. D., Mumoki, F. N., Sáez, P. J., Schwessinger, B., Debat, H. J., & Mestrovic, T. (2021). Changing scientific meetings for the better. *Nature Human Behaviour*, 5(3), 296–300. <https://doi.org/10.1038/s41562-021-01067-y>
- Sarani, B., Shiroff, A., Pieracci, F. M., Gasparri, M., White, T., Whitbeck, S., & Gross, R. (2021). Use of the Internet to facilitate an annual scientific meeting: A report of the First Virtual Chest Wall Injury Society Summit. *Journal of Surgical Education*, 78(3), 889–895. <https://doi.org/10.1016/j.jsurg.2020.09.004>
- Smith IV, D. H., Hao, Q., Dennen, V., Dennen, V., Tsikerdekis, M., Barnes, B., Martin, L., & Tresham, N. (2020). Towards Understanding Online Question & Answer Interactions and their effects on student performance in large-scale STEM classes. *International Journal of Educational Technology in Higher Education*, 17(1). <https://doi.org/10.1186/s41239-020-00200-7>
- Vandekerckhove, P., Vandekerckhove, Y., Tavernier, R., De Jaegher, K., & de Mul, M. (2020). Leveraging user experience to improve video consultations in a cardiology practice during the COVID-19 pandemic: Initial insights. *Journal of Medical Internet Research*, 22(6), e19771. <https://doi.org/10.2196/19771>
- Yagi, K., Maeda, K., Sakaguchi, S., Chuma, M., Sato, Y., Kane, C., Akaishi, A., Ishizawa, K., & Yanagawa, H. (2020). Status of institutional review board meetings conducted through web conference systems in Japanese national university hospitals during the COVID-19 pandemic: Questionnaire study. *Journal of Medical Internet Research*, 22(11), e22302. <https://doi.org/10.2196/22302>

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