



# Current situation and trends of online academic activities for oncologists during the COVID-19 pandemic: a multicenter survey

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**Background:** The present study aimed to investigate the current situation and future trends of online academic activities for oncologists during the coronavirus disease 2019 (COVID-19) pandemic.

**Methods:** From April 22 to May 5, 2020, a multicenter survey was conducted using an online questionnaire platform. To compare categorical variables,  $\chi^2$ -test, the kappa consistency analysis, and Wilcoxon rank sum test were applied. For all statistical hypotheses,  $P < 0.05$  was considered significant.

**Results:** In the present study, 2,120 oncologists participated in the survey. Of these, 2,035 respondents participated in online academic activities. During the pandemic, online academic activities significantly increased [oncologists who participated in online academic activities  $\geq 60\%$ : 64.58% (during the pandemic) vs. 10.90% (before the pandemic), Cohen's kappa coefficient = 0.0499,  $P < 0.001$ ]. The findings indicated that 90.6% of respondents considered that the online academic activities would become a future trend. The main reason for the increase in online academic activities was due to in-person academic conferences and diagnoses/treatment being affected by the pandemic. Both speakers/chairs and audiences agreed that online academic activities resulted in reduced stress (61.15% vs. 67.26%, respectively;  $\chi^2 = 7.009$ ,  $P = 0.03$ ). In the present study, 62.21% of audiences considered that the recording function of online activities was very important (score 5), while only 53.86% of the speakers had the same opinion ( $Z = -3.5340$ ,  $P < 0.001$ ). Compared with provincial capital cities and other cities, the participants from first-tier cities thought that online academic activities required significant physical energy ( $\chi^2 = 6.41$ ,  $P = 0.040$ ), and were more reluctant for the playback of activity contents ( $\chi^2 = 9.33$ ,  $P = 0.002$ ) and the screenshot of activity contents ( $\chi^2 = 41.99$ ,  $P < 0.001$ ).

**Conclusions:** During the COVID-19 pandemic, online academic activities have become the main form of academic exchanges for oncologists. Taking full advantage of online academic activities and paying adequate attention to the participants' requirements with different roles and titles, and from different cities, are key to

improving the quality of and involvement in online academic activities.

**Keywords:** Coronavirus disease 2019 (COVID-19); online academic activities; oncology; multicenter survey

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## Introduction

Since the first reported outbreak in December 2019, coronavirus disease 2019 (COVID-19) has become a global pandemic (1). Since June 13, 2020, COVID-19 has spread to over 214 countries with over 7,553,182 confirmed cases, posing a major public health challenge worldwide (2). Global governments have imposed strict travel restrictions and social distancing rules to flatten the curve of the contagion (3).

To reduce gatherings and avoid cross-infection, the number of offline domestic and international academic activities has significantly decreased, which has had a significant impact on academic exchanges and oncology diagnosis and treatment. Based on this, online academic activities have become an accessible and cost-effective alternative to traditional offline academic activities (4), and this platform has become a new model of academic exchange for oncologists. On March 17, *Nature* published an online article on 2020 being a year without in-person academic activities (5). The pandemic has encouraged researchers to share academic findings and exchanges online, highlighting online academic activities' importance. In the present multicenter survey study, we investigated online academic activities and analyzed the differences in participants with different roles and titles, and from different cities, to improve these specialists' quality and involvement in online academic activities.

We present the following article in accordance with the Quality assessment criteria for survey research reports Checklist (available at <http://dx.doi.org/10.21037/atm-20-5051>).

## Methods

### Respondents

Oncologists currently working in hospitals from national medical centers were invited to participate in our study from April 22 to May 5, 2020 via an online questionnaire platform called Oncologynews (a large, comprehensive

medical media platform). The present study's inclusion criterion was oncologists currently working in hospitals; the exclusion criterion was questionnaires with incomplete information. All respondents understood and agreed that their answers to the questionnaires would be used for the analyses and reports. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). No other personal information was collected in the questionnaire. All participants in this survey have individual consent. The Research Ethics Committee of Cancer Hospital, Chinese Academy of Medical Sciences indicated that no ethics approval was required.

The participants were divided into the following groups, based on their roles: speakers, chairmen, audiences, and organizers. The groups were divided into first-tier cities, provincial capital cities, and other cities in China, based on the participants' locations. First-tier cities were defined as metropolises. In the present study, first-tier cities were Beijing, Shanghai, Guangzhou, and Shenzhen. The participants were divided into chief physician/associate chief physician, attending physician, and resident physician/student physician, based on their job titles. Student physicians were defined as postgraduate medical students, majoring in oncology. The behavioral patterns and evaluation of the online academic activities were respectively analyzed between different subgroups.

### Questionnaire design and implementation

The electronic questionnaire was designed by Delphi method. The questionnaire contained the following parts: (I) basic information, including the city, hospital, department, professional title, and role; (II) frequency of participation in online academic activities before and during the pandemic; (III) investigation of advantages and disadvantages of online academic activities; (IV) analysis of online academic activities, including the style, frequency, time interval, and duration of each activity; and (V) evaluation of the energy consumption, stress, and functional requirements associated with online academic activities. For some questionnaire

**Table 1** Characteristic of respondents

Items	Respondents (n=2,120), n (%)
City	
First-tier cities	185 (8.73)
Provincial capital cities	534 (25.19)
Other	1,401 (66.08)
Hospital category	
Special oncology hospitals	241 (11.37)
Grade III level A hospitals	1,189 (56.08)
Other hospitals	690 (32.55)
Department	
Medical oncology	1,480 (69.81)
Oncology surgery	243 (11.46)
Radiation oncology	203 (9.58)
Other	194 (9.15)
Job title	
Chief physician/associate chief physician	789 (37.22)
Attending physician	946 (44.62)
Resident physician/student physician	385 (18.16)
Participation in online academic activities	
No	85 (4.01)
Yes	2,035 (95.99)
Status*	
Speakers	438 (21.52)
Chairmen	15 (0.74)
Audiences	1,564 (76.86)
Organizers	18 (0.88)

\*, only 2,035 people involved in online activities during the pandemic.

entries (style of academic activities, time interval, and academic activities sponsor), respondents could provide multiple responses. For other questionnaire entries, respondents could only provide one response.

According to the Kendan sample size estimation method, the sample size was 10 times that of the number of questionnaire entries. Taking into account the effectiveness of the sample, the sample size increased by a further 15%. There was a total of 19 questionnaire entries in the present study. The minimum sample size of this study was 219 [ $19 \times 10 \times (1 + 15\%)$ ]. Convenience sampling was

used to reduce sample bias. A total of 2,120 participants were included, and the sample size was large enough. The electronic questionnaire was designed in advance, and was uploaded onto the Oncologynews questionnaire platform. We sent the questionnaire to participants through the Oncologynews WeChat platform, and the respondents completed the questionnaire using this. After completion of the survey, data were collected directly through the questionnaire platform.

### Statistical analysis

Statistical analyses were performed by the SAS 9.4 software. Qualitative data were described as frequencies and percentages.  $\chi^2$ -test was applied to compare categorical variables. Kappa consistency analysis was used to detect changes in online academic activities before and during the pandemic. Participants rated the software's functional requirements on a 1–5-point range, with 5 points indicating that it was very important; these were compared between groups using Wilcoxon rank sum test.  $P < 0.05$  was considered significant.

## Results

### Basic information

The total number of the respondents in the study was 2,120 (response rate: 100%). Of these, 2,035 respondents responded that they participated in online academic activities. The present study aimed to investigate the current situation of oncologists who participated in online academic activities. Therefore, the 85 participants who did not participate in online academic activities were considered invalid, and these respondents were not included in the subgroup analysis. The effective response rate was 95.99% (2,035/2,120).

Among the respondents, 69.81% were oncology medicine clinicians. All oncologists were chief physicians/associate chief physicians (37.22%), attending physicians (44.62%), or resident physicians/student physicians (18.16%). A total of 241 respondents (11.37%) were from specialist oncology hospitals; 1,189 respondents (56.08%) were from grade III, level A hospitals; and 690 respondents (32.55%) were from other hospitals. Also, the 2,035 respondents who participated in online academic activities included 438 speakers, 15 chairs, 1,564 audiences, and 18 organizers (Table 1).

**Table 2** Changes in the online academic activities before and during the pandemic

During the COVID-19 pandemic	Before the COVID-19 pandemic					Total	Cohen's Kappa coefficient	P
	Never attend	Less than 20%	20–40%	40–60%	More than 60%			
Never attend	24	38	11	5	7	85	0.0499	<0.001
Less than 20%	8	69	21	5	8	111		
20–40%	5	95	56	7	8	171		
40–60%	14	221	91	33	25	384		
More than 60%	97	789	235	65	183	1,369		
Total	148	1,212	414	115	231	2,120		

### *Changes in online academic activities before and during the pandemic*

During the pandemic, the number of online academic activities significantly increased [oncologists who participated in online academic activities  $\geq 60\%$ : 64.58% (during the pandemic) *vs.* 10.90% (before the pandemic); 40–60%: 18.11% (during the pandemic) *vs.* 5.42% (before the pandemic), Cohen's kappa coefficient = 0.0499,  $P < 0.001$ ] (Table 2). The main reason for increased online academic activities was in-person academic conferences and diagnoses/treatment being affected by the pandemic (Figure 1A). Analysis of the advantages and disadvantages of online academic activities indicated that reduction of cost and physical activities, flexibility of time, and convenience in attending conferences were the main advantages of online academic activities (Figure 1B). At the same time, lack of post-meeting communication and high demand for access to the internet were the main disadvantages (Figure 1C).

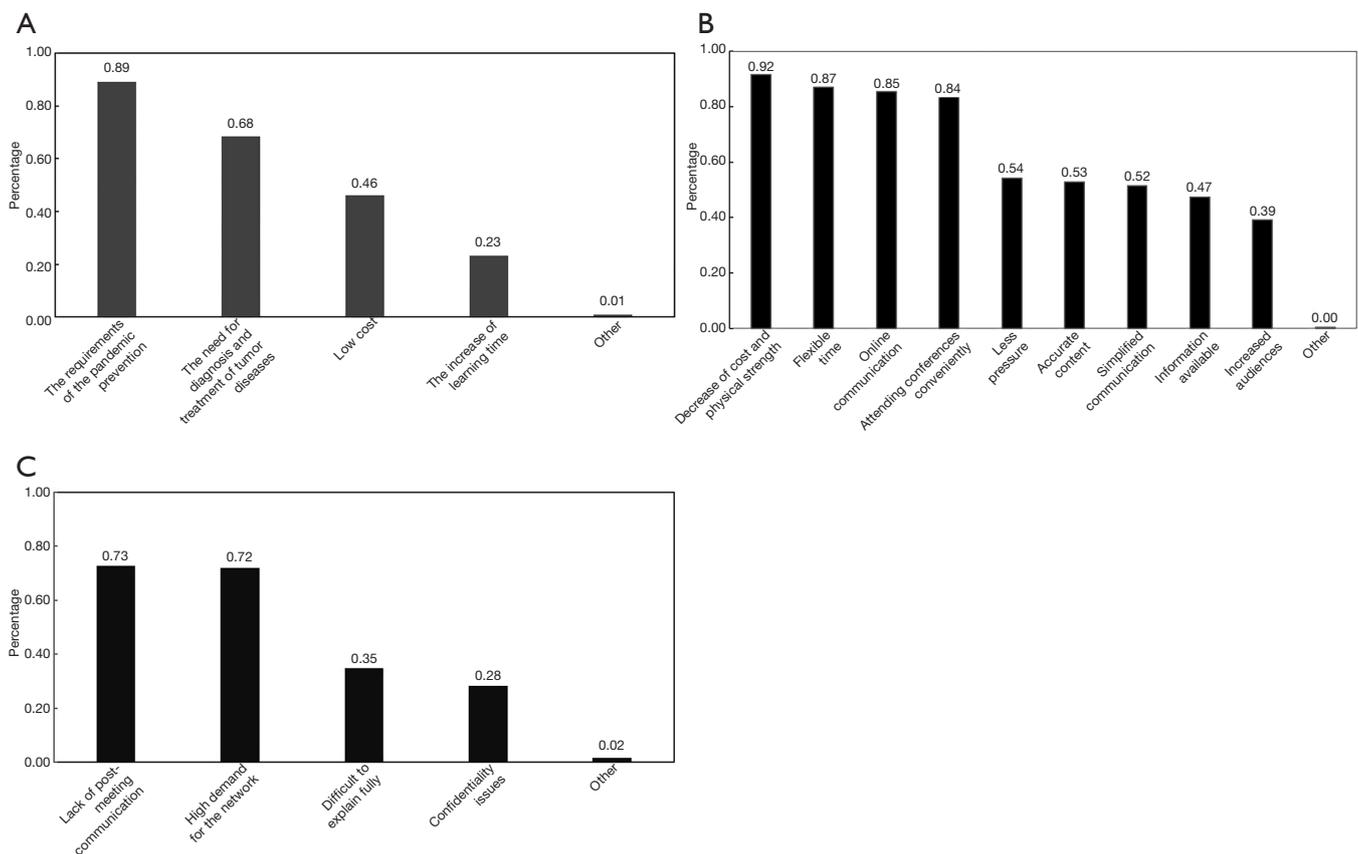
### *Differences between speakers/chairs and audiences in online academic activities*

During the pandemic, a total of 2,035 respondents stated that they had participated in online academic activities (438 speakers, 15 chairmen, 1,564 audiences, and 18 organizers). Because chairs are also speakers, they were allocated to the speakers/chairmen group for the subgroup analysis. The number of organizers was only 18 and they could not be classified as speakers or audiences, so they were not included in the subgroup analysis. Compared to audiences, the frequency of speakers/chairmen who participated in online academic activities was significantly highest in the “1–3 times a week” option ( $\chi^2 = 4.26$ ,  $P = 0.038$ ) (Table 3).

Both speakers/chairs and audiences agreed that online academic activities resulted in reduced stress (61.15% *vs.* 67.26%, respectively;  $\chi^2 = 7.009$ ,  $P = 0.03$ ). A total of 91.88% of audiences and 86.09% of speakers/chairs thought that online academic activities would become a future trend ( $\chi^2 = 13.78$ ,  $P < 0.001$ ). Participants rated the software's functional requirements on a 1–5-point range, with 5 points indicating that it was very important. A total of 62.21% of audiences considered that the recording function of online activities was very important (score 5), while only 53.86% of speakers/chairs had the same opinion (Wilcoxon rank sum test,  $Z = -3.5340$ ,  $P < 0.001$ ). There was no significant difference between speakers/chairs and audiences in the function requirements of high-speed internet access, screen sharing, and esthetic features (Table 4).

### *Differences between participants from different cities in online academic activities*

Compared with respondents from provincial capital cities and other cities, the proportion of respondents from first-tier cities who participated in online academic activities on working days was higher ( $\chi^2 = 38.70$ ,  $P < 0.001$ ). In first-tier cities, the frequency of participants who participated in online academic activities was significantly higher in the “1–3 times a week” option ( $\chi^2 = 13.62$ ,  $P < 0.001$ ) (Table 5). Compared with provincial capital cities and other cities, participants from first-tier cities considered that online academic activities required significant physical energy ( $\chi^2 = 6.41$ ,  $P = 0.040$ ), and they were more reluctant for the playback of activity contents ( $\chi^2 = 9.33$ ,  $P = 0.002$ ) and the screenshot of activity contents ( $\chi^2 = 41.99$ ,  $P < 0.001$ ) (Table 6).



**Figure 1** Survey of characteristics of online academic activities during the pandemic. (A) Reasons for increase in online academic activities during the pandemic; (B) advantages of online academic activities; (C) disadvantages of online academic activities.

### *Differences between participants with different professional titles in online academic activities*

The proportion of resident physicians/student physicians who participated in online academic activities on working days was higher ( $\chi^2=7.17$ ,  $P=0.027$ ) than the physician/associate chief physicians and attending physicians. Resident physicians/student physicians who participated in online academic activities was significantly higher in the “1–3 times a week” option ( $\chi^2=4.55$ ,  $P=0.032$ ) (Table 7). Compared with the physician/associate chief physicians and attending physicians, the frequency of student physicians who participated in online academic activities was significantly higher in the “1–3 times a week” option ( $\chi^2=4.26$ ,  $P=0.038$ ).

### **Discussion**

The results of the survey, which was completed by 2,120 oncologists from all over China, revealed that online

academic activities have become the main form of academic exchanges during the COVID-19 pandemic, and the proportion of online academic activities has increased significantly compared to before the pandemic, which is consistent with another online survey results (6). Oncologists from grade III, level A hospitals, from the medical oncology department, with a job title of chief physician or associate chief physician, and as speakers/chairmen, were more likely to participate in online academic activities (change  $\geq 40\%$ ) during the pandemic (Table S1). Also, Reasons for the significant increase in online academic activities are varied. First, the outbreak of the COVID-19 pandemic led to strict government restrictions, which resulted in a significant increase in online academic activities; second, academic exchanges and sharing of research findings have increased in the frequency of online academic activities, particularly in the context of the diagnosis and treatment of cancer patients during the pandemic.

**Table 3** Differences of situation in the online academic activities between speakers/chairmen and audiences

Item	Speakers/chairmen, n (%)	Audiences, n (%)	$\chi^2$	P
Total	453	1,564		
Style of academic activities			-	-
Academic conference	435 (96.03)	1,408 (90.03)		
Online consultation	67 (14.79)	327 (20.91)		
Online teaching	95 (20.97)	510 (32.61)		
Other	6 (1.32)	5 (0.32)		
Time interval			-	-
8 am–12 am	26 (5.74)	149 (9.53)		
2 pm–6 pm	209 (46.14)	589 (37.66)		
6 pm–10 pm	250 (55.19)	846 (54.09)		
After 10 pm	0 (0.0)	28 (1.79)		
All time	61 (13.47)	275 (17.58)		
Date			1.0185	0.6009
Working days	38 (8.39)	148 (9.46)		
Saturdays and Sundays	109 (24.06)	347 (22.19)		
All time	306 (67.55)	1,069 (68.35)		
Weekly participation frequency			4.2633	0.0389
1–3 times	354 (78.15)	1,147 (73.34)		
More than 4 times	99 (21.85)	417 (26.66)		
Length of each activities			3.776	0.2867
Less 1 hours	30 (6.62)	143 (9.14)		
1–2 hours	358 (79.03)	1,208 (77.24)		
3–4 hours	59 (13.02)	184 (11.76)		
More than 4 hours	6 (1.32)	29 (1.85)		
Academic activities sponsor			-	-
Unit/department	199 (43.93)	615 (39.32)		
Professional society/association	360 (79.47)	1,262 (80.69)		
Corporate organization	290 (64.02)	717 (45.84)		
Media	53 (11.7)	396 (25.32)		
Other	23 (5.08)	127 (8.12)		

During the pandemic, online academic activities have provided oncologists a platform to diversify academic exchanges, continuing education, and telemedicine. The Chinese Anti-cancer Association encouraged various branches to carry out various online academic activities,

such as work meetings, seminars, training courses, and public popular science activities, to build a diversified platform for oncologists in different professions. On April 13, 2020, more than 30 oncology hospitals and a total of more than 1,000 oncologists participated in the large-scale

**Table 4** Evaluation of the online academic activities between speakers/chairmen and audiences

Item	Speakers/chairmen, n (%)	Audiences, n (%)	$\chi^2/Z$	P
Total	453	1,564		
Energy consumption			$\chi^2=4.3942$	0.1111
Decrease	332 (73.29)	1,217 (77.81)		
No change	81 (17.88)	242 (15.47)		
Increase	40 (8.83)	105 (6.71)		
Pressure			$\chi^2=7.0095$	0.0301
Decrease	277 (61.15)	1,052 (67.26)		
No change	143 (31.57)	397 (25.38)		
Increase	33 (7.28)	115 (7.35)		
Choice of online activities in the future			$\chi^2=3.2019$	0.0736
Unwilling	0 (0.00)	11 (0.70)		
Willing	453 (100.00)	1,553 (99.30)		
Future prevalence judgment			$\chi^2=13.7801$	0.0002
No	63 (13.91)	127 (8.12)		
Yes	390 (86.09)	1,437 (91.88)		
The software function requirements of online academic activities for different status*				
Internet access	363 (80.13)	1,272 (81.33)	Z=-0.7277	0.4668
Recording function	244 (53.86)	973 (62.21)	Z=-3.5340	0.0004
Screen sharing	294 (64.9)	1,050 (67.14)	Z=-1.0312	0.3024
Beauty features	99 (21.85)	398 (25.45)	Z=-1.1936	0.2326

\*, the table showed the number and percentage of respondents with a score of 5, and Wilcoxon rank-sum test was used to compared between groups.

online Q&A session to guide the diagnosis and treatment of tumors during the pandemic (7). Online academic activities have provided a platform for clinicians in various countries to exchange anti-pandemic experiences, management measures for cancer patients, and the latest anti-pandemic research findings. On April 1, 2020, an international online forum attracted experts and scholars from countries, such as China, France, Spain, and Brazil to share their experiences on how to work together to cope with the COVID-19 pandemic and how to adjust the diagnostic and treatment strategies of cancer patients (8).

Compared with traditional in-person academic activities, online academic activities have unique advantages. First, traditional academic activities require in-person attendance at a particular location. This interferes with clinicians' work schedules and requires travel, which takes

time and involves costs for flights and accommodation. Some clinicians, especially young clinicians, may not attend in-person activities due to lack of funds or visas. Online academic activities have the advantages of low cost, flexibility of time, and convenience in participation. These advantages effectively solve the problems mentioned above of traditional in-person academic activities and were particularly highlighted in the respondents' present study. Second, during traditional academic activities, some audiences may not be able to see or hear the speakers when in a big lecture hall; audiences usually only have 1 opportunity for communication and discussion, which is not conducive to repeated learning after the meeting. Online academic activities allow audiences to meet with speakers face-to-face, which makes audiences feel closer to speakers, while the recording function of online academic

**Table 5** Differences of situation in the online academic activities between participants from different cities

Item	First-tier cities, n (%)	Provincial capital cities, n (%)	Other, n (%)	$\chi^2$	P
Total	174	519	1,342		
Style of academic activities				–	–
Academic conference	155 (89.08)	486 (93.64)	1,219 (90.83)		
Online consultation	44 (25.29)	119 (22.93)	236 (17.59)		
Online teaching	62 (35.63)	172 (33.14)	377 (28.09)		
Other	1 (0.57)	3 (0.58)	7 (0.52)		
Time interval				–	–
8 am–12 am	25 (14.37)	57 (10.98)	94 (7.00)		
2 pm–6 pm	76 (43.68)	199 (38.34)	526 (39.2)		
6 pm–10 pm	81 (46.55)	298 (57.42)	731 (54.47)		
After 10 pm	2 (1.15)	5 (0.96)	21 (1.56)		
All time	32 (18.39)	83 (15.99)	221 (16.47)		
Date				38.7016	<0.0001
Working days	32 (18.39)	65 (12.52)	94 (7.00)		
Saturdays and Sundays	27 (15.52)	98 (18.88)	335 (24.96)		
All time	115 (66.09)	356 (68.59)	913 (68.03)		
Weekly participation frequency				13.6228	0.0002
1–3 times	110 (63.22)	380 (73.22)	1,028 (76.6)		
More than 4 times	64 (36.78)	139 (26.78)	314 (23.40)		
Length of each activities				3.9708	0.2646
Less 1 hours	10 (5.75)	50 (9.63)	114 (8.49)		
1–2 hours	139 (79.89)	389 (74.95)	1,055 (78.61)		
3–4 hours	20 (11.49)	68 (13.1)	155 (11.55)		
More than 4 hours	5 (2.87)	12 (2.31)	18 (1.34)		
Academic activities sponsor				–	–
Unit/department	75 (43.1)	220 (42.39)	532 (39.64)		
Professional society/association	137 (78.74)	416 (80.15)	1,081 (80.55)		
Corporate organization	83 (47.7)	267 (51.45)	666 (49.63)		
Media	44 (25.29)	102 (19.65)	305 (22.73)		
Other	9 (5.17)	37 (7.13)	106 (7.9)		

activities enables play back at a later stage. Third, good communication is not always achieved in traditional academic activities due to the physical spaces' variability and constraints. Moreover, the physical dimensions of the venue often restrict the number of audiences. While

communication in online academic activities is no longer restricted geographically, each audience can ask questions to speakers, and even discuss with other audiences during the activities, which enhances the interaction between speakers and audiences.

**Table 6** Evaluation of the online academic activities between participants from different cities

Items	First-tier cities, n (%)	Provincial capital cities, n (%)	Other, n (%)	$\chi^2$	P
Total	185	534	1,401		
Energy consumption				6.4166	0.0404
Decrease	128 (69.19)	401 (75.09)	1,087 (77.59)		
No change	36 (19.46)	96 (17.98)	213 (15.2)		
Increase	21 (11.35)	37 (6.93)	101 (7.21)		
Pressure				3.5927	0.1659
Decrease	108 (58.38)	348 (65.17)	928 (66.24)		
No change	59 (31.89)	143 (26.78)	370 (26.41)		
Increase	18 (9.73)	43 (8.05)	103 (7.35)		
Playback of the activity contents				9.3326	0.0023
Unwilling	16 (8.65)	20 (3.75)	45 (3.21)		
willing	169 (91.35)	514 (96.25)	1,356 (96.79)		
Screenshot of the activity contents				14.9929	0.0001
Unwilling	12 (6.49)	36 (6.74)	39 (2.78)		
willing	173 (93.51)	498 (93.26)	1,362 (97.22)		
Choice of online activities in the future				1.5777	0.2091
Unwilling	0 (0.00)	2 (0.37)	9 (0.64)		
willing	185 (100.00)	532 (99.63)	1,392 (99.36)		
Future prevalence judgment				0.3499	0.5542
No	22 (11.89)	46 (8.61)	131 (9.35)		
Yes	163 (88.11)	488 (91.39)	1,270 (90.65)		

Despite the many advantages of online academic activities, the study revealed that most participants considered that online academic activities have some shortcomings, including a lack of continuous communication with speakers after academic activities and the high demand for internet access. Post-conference interaction is important when participating in the academic activities, particularly for meeting potential collaborators and learning about new professional orientations to promote career development (9). Online academic activities only establish a video chat window, making it difficult to establish long-term and sustained communication opportunities. As a result, it is important to provide speakers and audiences with one-on-one discussions to promote exchanges and provide opportunities for collaborations. Additionally, extending communication time through the website, email, or phone after academic activities further promotes exchanges and

collaborations opportunities. In response to the high internet demand for online academic activities, Gichora *et al.* recommended that recording speeches at least 2 weeks before the start of the activity, making them available to the conference team in the appropriate video format, and dealing with software compatibility issues promptly, can effectively prevent potential technical problems during online academic activities (4). Simultaneously, with the advent of the 5G era, constantly improving online academic software function can also effectively alleviate network congestion.

The subgroup analysis between speakers and audiences showed that online academic activities resulted in reduced stress. This could be due to the low cost, flexibility of time, and convenient participation in online academic activities, with some speakers attending more online academic activities. However, a considerable number of respondents

**Table 7** Differences between participants with different professional titles in the online academic activities

Items	Chief physician/associate chief physician, n (%)	Attending physician, n (%)	Resident physician/student physician, n (%)	$\chi^2$	P
Total	772	907	356		
The Style of academic activities				-	-
Academic conference	732 (94.82)	823 (90.74)	305 (85.67)		
Online consultation	125 (16.19)	198 (21.83)	76 (21.35)		
Online teaching	188 (24.35)	291 (32.08)	132 (37.08)		
Other	6 (0.78)	3 (0.33)	2 (0.56)		
Time interval				-	-
8 am–12 am	58 (7.51)	74 (8.16)	-		
2 pm–6 pm	335 (43.39)	334 (36.82)	132 (37.08)		
6 pm–10 pm	440 (56.99)	491 (54.13)	179 (50.28)		
After 10 pm	6 (0.78)	17 (1.87)	5 (1.40)		
All time	110 (14.25)	166 (18.3)	60 (16.85)		
Date				7.1714	0.0277
Working days	50 (6.48)	84 (9.26)	57 (16.01)		
Saturdays and Sundays	183 (23.7)	198 (21.83)	79 (22.19)		
All time	539 (69.82)	625 (68.91)	220 (61.8)		
Weekly participation frequency				4.5553	0.0328
1–3 times	564 (73.06)	667 (73.54)	287 (80.62)		
More than 4 times	208 (26.94)	240 (26.46)	69 (19.38)		
Length of each activities				0.8889	0.8281
Less 1 hours	37 (4.79)	96 (10.58)	41 (11.52)		
1–2 hours	623 (80.7)	690 (76.07)	270 (75.84)		
3–4 hours	97 (12.56)	107 (11.8)	39 (10.96)		
More than 4 hours	15 (1.94)	14 (1.54)	6 (1.69)		
Academic activities sponsor				-	-
Unit/department	253 (32.77)	401 (44.21)	-		
Professional association	656 (84.97)	720 (79.38)	258 (72.47)		
Corporate organization	417 (54.02)	460 (50.72)	139 (39.04)		
Media	140 (18.13)	222 (24.48)	89 (25.00)		
Other	49 (6.35)	62 (6.84)	41 (11.52)		

considered that their physical energy consumption in online academic activities significantly increased; speakers have to deliver more diversified and in-depth lectures, which increases energy consumption, especially for speakers in first-tier cities. Second, online activities based on network

video software require the speakers to debug the network in advance and to pay attention to the internet connection, rather than the live audiences, resulting in increased psychological stress (6). The present study showed that many speakers were reluctant to accept the recording

function of online video compared to audiences, especially for speakers in first-tier cities who indicated that they were more reluctant. One possible reason for this is that some academic findings are still in the research stage, and intellectual property issues, such as confidentiality or patents, should not be discussed publicly or published. Therefore, for speakers, especially those in first-tier cities, more attention should be paid to adjusting the level of stress and intellectual property protection to promote the quality of online academic activities.

Our survey study had some limitations. First, all respondents in this survey were oncologists from national medical centers in China. The results could represent the current situation of online academic activities for oncologists to some extent, but the sample size was still insufficient. Further studies should be conducted with larger sample sizes from more nationwide centers. Second, the COVID-19 pandemic created significant difficulties for research, and convenience sampling was considered a relatively efficient sampling method in the current context. However, convenience sampling may lead to selection bias. Multicenter randomized controlled studies are warranted to confirm the reliability of our results further.

With the continuous global spread of COVID-19, online academic activities will become the main form of academic exchanges among oncologists in the future (10). The present study's findings indicated that 99% of respondents would choose online academic activities in the future, and 90.6% thought online academic activities would become a popular trend in the future. Oncologists should take full advantage of online platforms to share the latest technologies in the fields. Improving online academic activity platforms and paying more attention to participants' requirements with different roles and title, and from different cities, are key to improving the quality of, and participation in, online academic activities.

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## Footnote

*Reporting Checklist:* The authors have completed the Quality assessment criteria for survey research reports Checklist.

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*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). No other personal information was collected in the questionnaire. All participants in this survey have individual consent. The Research Ethics Committee of Cancer Hospital, Chinese Academy of Medical Sciences indicated that no ethics approval was required.

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**Table S1** The association between influence factors and the change in the proportion of the online academic activities during the pandemic

Items	OR (95% CI)*
City	
First-tier cities	1.089 (0.778–1.524)
Provincial capital cities	0.932 (0.749–1.158)
Other	Reference
Hospital category	
Special oncology hospitals	1.351 (0.971–1.88)
Grade III level A hospitals	1.474 (1.202–1.808)
Other hospitals	Reference
Department	
Medical oncology	1.629 (1.183–2.243)
Oncology surgery	1.607 (1.072–2.409)
Radiation oncology	1.252 (0.823–1.904)
Other	Reference
Job title	
Chief physician/associate chief physician	1.358 (1.032–1.788)
Attending physician	1.095 (0.85–1.409)
Resident physician/student physician	Reference
Status	
Speakers/chairmen	1.759 (1.382–2.239)
Audiences	Reference

\*, positive outcome was defined as an increase of more than 40% in the proportion of online academic activity during the pandemic of COVID-19.