Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

The Society of Thoracic Surgeons (STS) Virtual Conference Taskforce: Recommendations for Hosting a Virtual Surgical Meeting

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The COVID-19 pandemic is an ongoing pandemic of coronavirus disease 2019 caused by severe acute respiratory coronavirus-2 (SARS-CoV-2). Given the pandemic's impact on large, in-person gatherings, academic conferences need to be reinvented in order to continue to meet the needs of the medical community. Current circumstances limit the safety of congregating in large groups, along with increased difficulty related to travel and funding. Additionally, organizations are restricted in options for venues that might allow for preservation of prior meeting structure and components.

Historically, there have been specific groups of individuals who may have had difficulty attending live, in-person meetings, and an increased emphasis on virtual or hybrid meetings may remove some of those barriers. In particular, individuals practicing in smaller call pools, lacking travel funding, or with family obligations preventing travel may have been disproportionately affected without equal access to the continuing education and networking functions of academic meetings. Moreover, to provide greater inclusivity and diversity, the incorporation of virtual components of a meeting (or transition to completely virtual meetings) will enable the inclusion of physicians and allied health members who may be choosing not to travel due to issues related to childbearing or childrearing. Finally, to support the health and wellness of our workforce, virtual meetings will enable members of the specialty's societies to engage in vital conference components while engaged in parental or medical leave, if they so desire.

The incorporation of virtual meeting components allows for a global reach that spans beyond the knowledge and expertise of North America, enabling attendees to benefit from international expertise as well as to augment the training and education of physicians worldwide. Virtual conferences can significantly increase turnout and global reach compared with in-person meetings.[1]

Virtual meetings are not exact equivalents to live meetings, nor should we intend for them to be. While we strive for virtual conferences to meet many of the same objectives and goals of live gatherings, the pathway and strategy to do so will differ in order to be effective and to take advantage of potential unique strengths of the virtual format. It has been shown that there are clear differences in face-to-face meetings and video conferences in both workflow and information exchange[2]; however, achieving comparable end points is still feasible. It is also important to note that many believe continuing medical education (CME) meetings will likely maintain the virtual format, either in full or in a hybrid manner, beyond the future resolution of the current pandemic. We do not know what the landscape will look like in 5 years.

A rapid expansion of medical knowledge has occurred over the last 2 decades. This growth has led to the compression of information being presented at national meetings. An unfortunate byproduct is the overlap of sessions and the inability of participants to attend all events that interested them. Virtual meetings provide an

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opportunity for increased dissemination of knowledge to our members, despite their ability to physically be present in a live session.

Founded in 1964, The Society of Thoracic Surgeons (STS) is a not-for-profit organization representing more than 7300 surgeons, researchers, and allied health professionals worldwide who are dedicated to advancing cardiothoracic surgeons' delivery of the highest quality patient care. The STS Virtual Conference Taskforce, consisting of Cardiothoracic Surgical Education Content Experts (members with leadership experience as Chairs of CME events, Program Directors, and School of Medicine Leadership positions) was assembled under the auspices of the STS Council on Meetings and Education in May 2020. The goals of the current project were to perform a global assessment of best practices in the conduct of virtual meetings and to outline opportunities for organizations such as the STS to provide leadership in these efforts.

Methods

Search Strategy

A primary literature search was performed of PubMed, MEDLINE, and Web of Science, querying these databases using the Medical Subject Heading key terms "virtual conference" and "webinar." This search was performed June through August 2020. Emphasis was placed on articles published in the prior 12 months to enable highlighting on the most up-to-date technological information. An additional search was performed using "COVID-19" or "coronavirus" as supplemental Medical Subject Heading terms to narrow results to articles directly related to the pandemic. To supplement scientific publications, a manual Google search was performed to find reputable articles from major scientific outlets relating to COVID-19 and the effect on medical society meetings.

Initial screening was performed by the first authors of this work (M.A. and B.M.). Data were extracted, summarized, and reported to the members of the Taskforce. Final recommendations were then determined through an iterative series of conference calls with Taskforce members.

Recommendations

Timing

The following suggestions are based on recommendations from the Taskforce as well as data gathered from meetings outside of the surgical realm. Although we believe the guidance contained here will lead to a successful meeting, the ability to gather real-time data from virtual meetings over the next year will dramatically improve our ability to determine timing and the appropriate length of sessions.ime of day

TIME OF DAY. Timing should be considerate of all North American time zones as well as participants worldwide, although it is understandable that there is no perfect time that is optimal for all locales across the globe (Figure 1). The target audience for a given meeting or session should be considered, and timing should be devised based on expected international attendance. Recognizing that STS Headquarters operates in Central Standard Time (CT), the availability of support staff and associated needs should be considered. It is important to note, however, that only 19% of STS Surgeon Members reside in CT. For live events that are expected to have a large global audience, recommendations are to begin 9 AM CT and complete by 3 PM CT (Table 1). Plenary and high-yield sessions should be focused at the beginning of the morning to enable live participation for those in the Eastern Hemisphere.

For events with an expected large East Asian audience, consideration may be given to starting around 6 PM CT, recognizing that this would likely eliminate attendance from a European audience. However, given that the most of the STS membership includes individuals in North America, the hours of 9 AM to 3 PM CT should be emphasized. In planning social events such as job rooms for North American graduates, organizers may consider evening times, such as 7 PM CT.

CLUSTERING OF SESSIONS. There is an important obligation to balance the challenge of surgeons needing to plan dedicated time away from clinical responsibilities with the potential drawback of virtual meeting burnout. Ideally, components of a meeting would be focused within a 4- to 5-day period, which would include partial weekend as well as weekdays, to facilitate adequate breaks and clinical activities. It is suggested that there be gaps between sessions spanning more than 2 to 3 days, because 5 full days of sequential video conferencing can be exhausting and lead to viewer burnout and attrition. One possible option uses consecutive weekends, with Saturday and Sunday sessions, followed by the subsequent Friday through Sunday. Live events should be focused in the first 2 hours of the day where feasible. Breakout rooms, social/networking events, and virtual poster viewing, as well as viewing of prerecorded at-your-own-pace videos could be left open 24/7 during the designated meeting days.

The concept of an "extended conference" has been described and may be considered when the topics and audience are well-suited for such a format.[3] This may consist of an initial hybrid conference in the first week with in-person and remote participation, followed by several weeks of short lectures, reading materials, simulation, and forum discussions in a forum. Another option is the "Netflix" concept, where several prerecorded episodes (an entire "season") are posted on the same day for viewers to watch at their leisure.

NUMBER OF SESSIONS PER DAY. This will vary depending on the duration of the sessions as well the number of simultaneous sessions and the number of expected

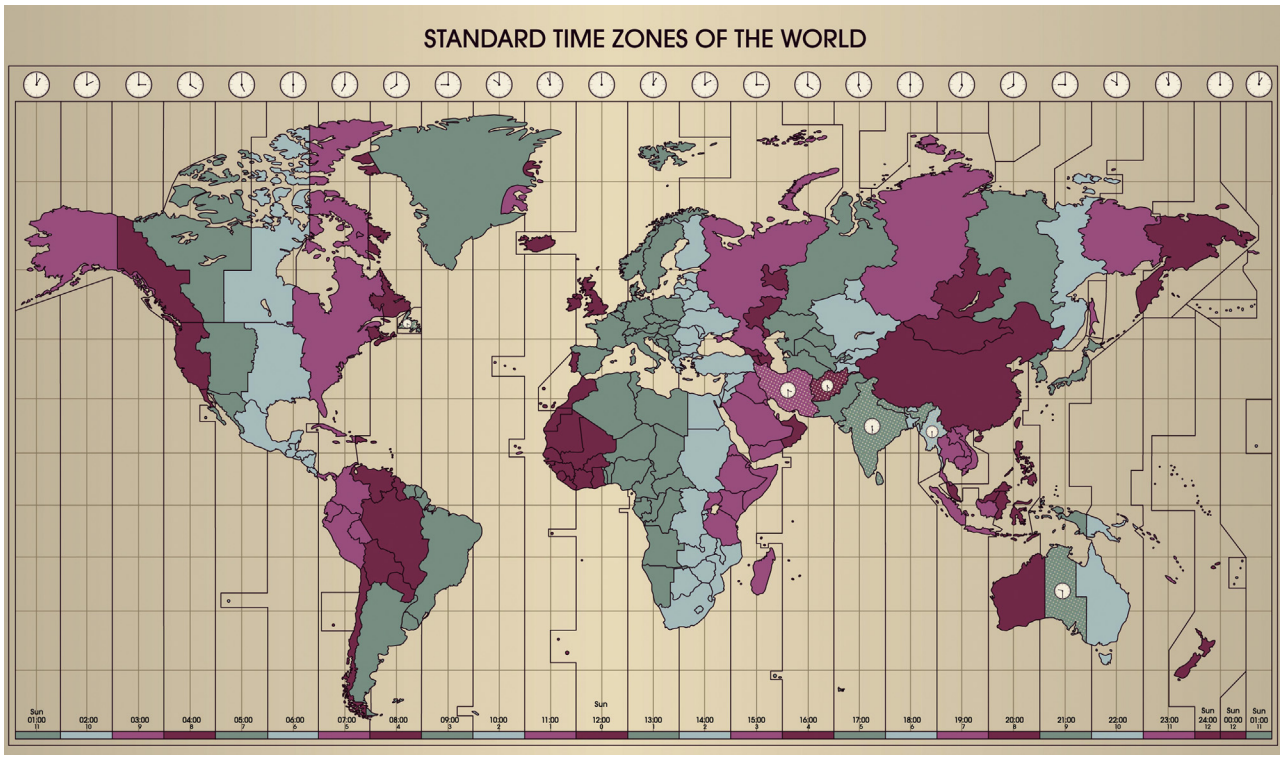

Figure 1. Standard Time Zones of the World. Designed by dalmingo (Image #1002233 at VectorStock.com).

attendees. We recommend against sporadically spread-out sessions with lengthy breaks. This limits the ability of an attendee to complete other administrative, educational, academic, and personal commitments between the sessions.

BREAKS AND SESSION LENGTH. Breaks are recommended at a minimum of every 90 to 120 minutes. Shorter breaks might be considered to enable attendees to consolidate their time committed to the meeting, given that attendees are able to stand, eat, and take other breaks during the virtual meeting without disrupting other attendees. The ratio of meeting time to break time should be no greater than 10 meeting minutes to 1 break minute (eg, 1.5-hour meeting, 10-minute break).

PLENARY SESSIONS. As mentioned earlier, plenary sessions should occur early in the day to maximize participation across as many time zones as possible. Plenary sessions should consider the aims of the conference and the learning objectives for participants.

SMALL GROUP SESSIONS. Breakout rooms should be organized to limit the number of competing events that may be of interest to a specific attendee at any time but creating tracks, such as valve track, esophageal track, trainee track, etc. Breakout rooms may consider more open audience participation to encourage scholarly discourse. Participant activity and interaction with speakers during virtual conferences are priorities, so conference planners should place an emphasis on breakout rooms and smaller sessions.

Another unique feature is the ability for push notifications in the virtual setting. Participants should be able to make a detailed schedule for their day, encompassing various breakout rooms and live sessions. When a specific speaker is about to start, an alert notification can automatically be sent to the participant. This "room hopping" is often unfeasible in a live setting and limits the ability of members to see talks that span a variety of topics.

Audience Participation

While retrospective experiences with virtual meetings are limited, audience desire for increased interactivity has surfaced as a common theme.[4] Moreover, confirmation bias tends to be greater in the virtual setting, in that while more information is often exchanged, participants spend significantly less time processing that information that does not corroborate their prediscussed thoughts/findings.[5] Such challenges can be overcome by creating space for "virtual coffee breaks" and avoiding groupthink by encouraging individuals to share their voices in chat boxes, forums, and polling.[6]

Question/Answer

Emphasis should be placed on live submission to enable audience involvement. However, for short panel discussions in which time may be limited, presubmission of questions can be used to help direct the conversation toward participant interest. It is suggested that a separate

Table 1. Time Zones With High-Volume Participants in Previous Society of Thoracic Surgeons Meetings[a]

Time Zone	Representative City	STS Surgeon Members by Time Zone, %	Time A	Time B	Time C	Time D
Hawaii Standard Time (GMT −10)	Honolulu	1	4 AM	7 AM	10 AM	2 PM
Pacific Standard Time (GMT −7)	Los Angeles	11	7 AM	10 AM	1 PM	5 PM
Mountain Standard Time (GMT −6)	Denver	5	8 AM	11 AM	2 PM	6 PM
Central Standard Time (GMT −5)	Chicago	19	9 AM	12 PM	3 PM	7 PM
Eastern Standard Time (GMT −4)	New York	46	10 AM	1 PM	4 PM	5 PM
Brasilia Standard Time (GMT −3)	São Paulo	1	11 AM	2 PM	5 PM	6 PM
Greenwich Mean Time (+0)	London, Nsukka (Nigeria)	1	3 PM	6 PM	9 PM	1 AM
Central European Time (GMT +1)	Madrid, Paris, Rome	6	4 PM	7 PM	10 PM	2 AM
China Standard Time (GMT +7)	Beijing	2	10 PM	1 AM	4 AM	8 AM
Tokyo Time Zone (GMT +8)	Tokyo	4	11 PM	2 AM	5 AM	9 AM
Australian Eastern Standard Time (GMT +9)	Sydney	1	12 AM	3 AM	6 AM	10 AM

[a]Included are 4 suggested start times of meeting and relative time based on location (Time A, B, C, D). All are taking into account daylight savings time.

GMT, Greenwich Mean Time; STS, The Society of Thoracic Surgeons.

moderator is used to monitor the question panel because this can become very busy during a highly attended session.

Polls and Other Interactivity

Speakers and moderators should be instructed and encouraged to use polling to increase participation. Meeting organizers should determine whether it will be the responsibility of the moderators vs speakers to create poll content for the meeting or for a given session and whether it will vary session by session. Polls should be placed strategically during sessions while a panelist or moderator is speaking so that there is not an extended period of dead space. The technical aspect of the poll should be run by a dedicated administrative member of the conference staff, because the moderators often do not have enough training and their main responsibilities are to monitor content and increase interactivity.

Chat Room

The chat room is an effective way to increase discussion during a presentation. It needs to be monitored closely however. In addition to the main session moderator, at least one moderator should be behind the scenes specifically focused on the chat room. The moderator's goals should include the removal of any inappropriate comments, while ensuring that useful questions are highlighted and potentially presented to the live panel. By requiring audience members to use their entire real name in the chat, unprofessional comments can be kept at a minimum. This registration using participants' STS membership numbers should be required.

Although several options can be used for question submission (audio, question-and-answer, chat room), recent studies have shown that participants prefer to use the chat room and are more likely to go against a majority opinion compared with asking a question by audio or in person at a live conference.[7] It has been observed, as well, that less seasoned faculty and trainees may also more likely to ask questions and get involved in a virtual setting because they do not have to fight for a spot at the microphone.[1] Further, they may find the virtual environment less intimidating and a means of leveling the playing field, providing greater access to experts and societal leadership. Chat room discussions should be transcribed, and participants should be informed of this at the time of registration.

Live vs Recorded Sessions

A format that should be emphasized would include a set of prerecorded talks that should be uploaded in advance, followed by live panel discussion with all of the speakers and moderator(s). This will ensure smooth delivery of the intended talks (both invited and abstracts) and will allow for live discussion and interactivity. Strict time limits can also be followed for prerecorded talks, as is already the practice for surgical video submissions at live meetings. Questions to the panelists should be received by the moderator and asked in real time. Whereas prerecorded sessions remove many unknowns, such as technical issues and running overtime, live sessions allow for the spontaneity and interactivity we are striving for. Debates can include a mixture of these components. Prerecorded opening arguments would allow for a prepared, concise opening speech by each participant. This could be followed by live real-time rebuttals and counter arguments.

Discussants, Moderators, and Invited Speakers

A diverse slate of presenters, including diversity of gender, race, and ethnicity, is expected for any STS organized or sponsored event. Moderators should be selected both for knowledge of the material and ability to navigate the format. If a discussant is to be used for a prerecorded session, it should be prerecorded with the presenter. Moderators should be expected to view all prerecorded talks in advance so that they can focus their

time during the session on the live chat to increase participant interactivity as much as possible. As mentioned earlier, a "technical moderator" should be used to manage polls, question and answer, and other interactive elements. This person would preferably be a member of the administrative staff of the conference.

Strategies to Optimize Opportunities for Participation

Given that there will likely be fewer scheduled live-streamed sessions in a virtual format than in an in-person meeting, consideration should be given to creating additional categories of presentation for both submitted work and invited talks to meet the needs of trainees as well as early-career surgeons.

Virtual platforms enable limitless possibilities in on-demand presentations, such as those that would be pre-recorded and available in a watch-at-your-own-pace repository during the days of the meeting. This format could serve as a new category of abstract acceptance, which would support both inclusivity and the needs of trainees and junior faculty who depend on conference presentation for academic and career advancement. Similar categories could occur for prerecorded video sessions focusing on technical elements of an operation, and likewise, for invited talks that cannot fit into the plenary program or live stream channels.

Opportunities to submit digital posters should still be available, and poster viewing may occur by way of two strategies. Programs may offer dedicated poster sessions with minipresentations, and they may also allow posters to be presubmitted for viewing at one's own pace, either with or without a brief (1-2 minute) audio accompaniment.

Virtual Etiquette

Backgrounds

Backgrounds should be provided for both slide template and virtual meeting background. It should not be mandatory so as not to penalize those who may not have access to adequate supporting equipment. If no virtual background is being used, recommendations regarding how to optimize the room background, including lighting and camera direction, should be provided by the conference host to the presenter.

Professionalism

All presentation content, including that is displayed on the slide as well as verbally orated must be professional and appropriate. Content that contains bullying, disrespectful language or images, or other material of an explicit nature is unacceptable. Content that fails to support the Society's values of diversity and inclusion will not be tolerated. Failure to comply with expectations of professionalism will result in review by societal leadership and potential loss of privileges for future meeting presentation. No patient identifying information should be visible within presentation materials.

Resource Inequality

It is established that discrepancies exist in the resources available to potential participants in internet bandwidth, access to quiet spaces, and computer equipment. These disparities may be greater for trainees, and institutions should consider ways to support individuals in need. This may include the purchase of appropriate audiovisual equipment (microphone, green screen, webcam) and the use of private space for presentations to be shared by members of a department.

Technical Needs

Several different technical aspects need to be considered, including hardware, software, and production value.

Hardware

We are fortunate that in our current era, most attendees will have access to a computer with a built-in webcam and microphone. Internet access is also considered an essential utility in most areas of the developed world. That said, the quality of equipment and speed of internet varies drastically and must be considered. During a live presentation, audiovisual components of a presentation are the duty of the conference host. For a virtual presentation, it falls in the hands of the presenter. It is imperative that audio and video quality is adequate.

Most built-in webcams are currently high quality and more than adequate for virtual presentations. If one is not available, there are numerous inexpensive options. While the STS does not specifically endorse any specific brands or models, we recommend those that can provide 1080p quality, such as the models in the Logitech c920 series (Logitech, Newark, CA) along with many other commercial options available for less than $100 (United States dollars). At this time, the use of an iPhone or iPad (Apple, Cupertino, CA) as the camera source is not recommended due to quality, although this may change over time based on software and hardware specifications. If an iPhone will be used or if the webcam is not built into a monitor, they should be mounted on the computer or on a tripod at eye level to prevent motion.

Audio quality is arguably the most important aspect of a virtual presentation. As with webcams, most desktops and laptops now have built-in microphones. The quality varies quite a bit however. A dominant concern is feedback and echo if using external speakers along with an external microphone. This issue can be counteracted in several ways. A simple solution is to use standard earbuds with a combined built-in microphone. The quality is generally adequate and negates any chance for feedback. A better, albeit more expensive, option is using a condenser microphone. These are high-quality, often professional-grade microphones that have directional controls to prevent feedback from speakers. While the STS again does not endorse any specific brands, there are several options in the $50 to $150 (United States dollar)

range, from brands such as Blue (Westlake Village, CA) and Audio-Technica (Stow, OH).

Finally, internet connection and speed will affect audiovisual quality no matter what expense is paid on equipment. When possible, a wired desktop connection should be used to ensure the most stable connection and fastest speeds. Wi-Fi is acceptable, but the connection should be tested in advance to ensure stability and appropriate speed. Internet connections are separated into upload and download speeds, generally in the megabit range. While most consumers pay for high download speeds, many are unaware of the upload speed, which is the more important variable for a virtual presentation. Many internet providers cap upload speeds, regardless of the expense or tier of internet package purchased. It is recommended that an upload speed of at least 5 mB/s is maintained. Speeds can be checked by typing "speed test" into the Google search bar.

Platform Options

Zoom (Zoom Video Communications, San Jose, CA) has become commonly used for virtual presentations and conferencing during the COVID-19 pandemic. Although Zoom was not initially developed for large conferences, there is now a webinar package offered; however, depending on the size and needs of the conference, there are currently limitations in its capabilities and customization options at the time of this publication. These caveats are all subject to change and evolution with new software releases, and at the same time, numerous competitors continue to enter the market. Two areas, among others, must mandatorily be analyzed before deciding on the correct platform for the groups' needs: server bandwidth/latency and features to boost interactivity.

A key recommendation for hosting live events and allowing appropriate audience participation is the assurance of minimal latency between the live stream presenter and the participants. Most high-end webinar packages provide less than 5 seconds of latency, leading to nearly real-time interaction and virtually no audio/visual delay. Simple features such as chat messaging, polling, and question-and-answer tools are expected. The ability to use title bars and on-screen animations to increase production value, breakout rooms, and even artificial intelligence or gamification features are beneficial to increase interactivity and create a more inclusive environment. When multiple sessions will be held at the same time, having a team to build a user-friendly web interface is a necessity. While costly, the most efficient option requiring the least technical expertise is to outsource hosting and virtual event development to a third party.

For smaller webinars that will not host thousands of attendees and only use single sessions and panels at a time, inexpensive web conferencing software such as Zoom or WebEx (Cisco Systems, San Jose, CA) can meet most needs and do not require a dedicated administrative or information technology team.

Meeting Planning

While in-person logistics and venue selection are no longer necessary, abstract and speaker selection are still time consuming. An appropriate time period of planning for large virtual conferences of up to 6 months should be used. Attendees should have at least 3 months' notice of a "program-at-a-glance" so that operating rooms and clinic schedules can be blocked during the selected time periods. It can be argued that a virtual presentation can take more effort than an in-person presentation, so invited presenters should be given at least 6 weeks to prepare with specific technical guidelines and instructions. It is important to develop a timeline at the start of this process with specific dates for action items such as receiving vendor proposals, selecting a platform, and abstract selection for presentation.

Continuing Medical Education

Many members rely on CME credits from major meetings for credentialing and recertification. It is imperative that appropriate CME credits are provided for attendees in a similar fashion as a live conference, especially if there is a registration cost for the conference.

Global Reach

Global reach of the conference is increased dramatically by hosting an entirely virtual conference. As mentioned previously, the key consideration is timing and ensuring colleagues in distant time zones can participate at reasonable hours of the day. It is recommended to think outside the box when selecting speakers, as well as to try to increase participation from regions not typically involved with the STS, as summarized in Table 1.

Cost Strategy

When a third-party host and platform are being used for a large conference, the cost can still be significant. It is reasonable to expect a registration fee from attendees in this situation. There are several expectations if a registration fee structure is used. CME credit should be provided, the conference should include more than lectures and have interactive elements and networking options, and as with live conferences, there should be a tiered cost structure based on career status. Both live and prerecorded sessions can be made available to those that register for viewing after the meeting is over. An obvious benefit to a virtual meeting is the decrease in expenses (lack of travel and lodging for STS staff), which would lead to lower registration fees for members.

Industry Support

Industry support through an exhibition hall is a cornerstone of surgical conferences. It is recommended that relationships with current vendors be maintained. Prerecorded and live symposia sponsored by industry can be

built into the program, but it is recommended that these are not scheduled to conflict with plenary events or major breakout sessions. With the increase in accessibility to virtual reality, some organizations are experimenting with virtual exhibit halls, allowing for real-time interaction with vendors. The feasibility and usefulness of this has yet to be determined. We must also expect that there will likely be revenue loss due to less industry support, and this should be factored into meeting planning and future budgets.

Diversity and Inclusion

To maintain the viability of our field and to foster innovation and educational discourse through cognitive perspective, the STS is committed to increasing diversity in our specialty and creating an inclusive environment for all members. This includes participants, instructors, and learners that are diverse in gender, sexual orientation, race and ethnicity, religion, practice patterns, geographic background, and other valuable perspectives. A virtual meeting can be value additive in increasing participation of women and other groups underrepresented in surgery.[8]

It is imperative that we continue to increase diversity in our national societies and create an inclusive environment for all members. A virtual meeting provides a unique opportunity to allow those to participate who may not otherwise have a voice as well as those who may not have the ability to travel across country due to family or personal obligations. Strategies suggested may include continuing inclusive parallel gatherings such as the annual Women in Thoracic Surgery reception and the Looking to the Future (LTTF) program. The value of such events with opportunities for networking, engagement with STS leadership, and acknowledgement of outstanding junior faculty and trainees by way of numerous awards cannot be overstated.

We must also be aware that global outreach for major national society meetings is likely to increase dramatically. Surgeon attendance at the major thoracic surgical meetings is often from North America or Western Europe, and English as the primary language, with a default to Western cultures and ideals predominates. While we are still in the planning process of meetings, it is important to engage with voices from other cultures and geographically diverse regions that do not normally attend our meetings in person.

Social Components

Prior reports have concluded that there can be an increase in information sharing and discussion of scientific papers through online education, yet with a worrisome lack of human contact and loss of development of professional networking.[9] However, there are innovative ways to ensure that social components of human interaction continue through virtual meetings. It is important to remember that while the STS supports the use of social media such as Twitter to share key points from presentations, the use of screen capture should be discouraged during social events without the permission of all participating members.

Social Events

Networking and social events are an integral part of live conferences and should be incorporated when possible. Because this switch to virtual platforms is still new, what kinds of social events are effective in this setting is unclear. There are several possibilities that require future exploration. Health and wellness activities, such as a group yoga session through Zoom may potentially be well attended. For those with access to a Peloton stationary bicycle (Peloton, New York, NY), a group ride and competition with prizes by age group could be organized. Resident Jeopardy has been a mainstay of the STS Annual Meeting, and this activity could be developed into a virtual platform. Other possibilities that may be considered include virtual talent shows, such as an "STS has Got Talent" format, virtual karaoke, or trivia. Options are only limited by imagination.

Award Recipients

Recognizing the accomplishments of trainees, junior surgeons, and senior faculty is a cornerstone of all national surgical meetings. It requires continued emphasis. Specific sessions and time should be dedicated to awards and should not be lumped in with other sessions. Being able to see an audiences' faces and smiles is an important component of the emotional experience in receiving an award. Allowing a large cohort of the participants to turn on their video while an award is being given could be beneficial. For awards that require a long time commitment or are significantly labor intensive, allowing a peer or mentor of the recipient to give a few sentences of praise adds to the meaning of the award. The award itself, whether a certificate, trophy, or plaque, should be in the hands of the recipient before the virtual conference.

Leadership Meet-and-Greets

Another element in this theme of networking are the interactions with society leadership during an annual meeting, whether through society-sponsored social events, leadership symposia, or institution-funded "reunion" dinners. Many of the personal connections that are made with leadership lead to appointments to committees, future career opportunities, and research collaboration. Sessions should be kept small, no more than 5 to 10 members per senior leader. If hosting a social event requiring preregistration, shipping food to each attendee to eat during the event could create a unifying experience.

Trainee Needs

Involvement of our trainees (students, residents, and fellows) deserves emphasis. As we have seen in recent months, many virtual conferences have eliminated the social interactive element of live conferences and focused purely on educational lectures. This is a specific

detriment to our trainees. The STS meetings provide unique experiences with trainees to network with each other, find new mentors at distance institutions, and most importantly, explore job opportunities for after fellowship. Without these opportunities, trainee attendance at our meetings will drop off significantly.

Small group sessions imitating previous live lunch sessions for residents are an efficient way to increase interaction between junior and senior members. In those prior sessions, tables were setup with 4 to 5 residents and 1 to 2 senior members. Breakout virtual sessions can be created in a similar manner. Specific topics for discussion among the small groups can be provided ahead of time, and then again discussed as a larger session with all the breakout sessions together. As with previous sessions at the annual meeting, appropriate topics for discussion are leadership, excelling in fellowship, and transitioning to one's first job.

Another option for trainee inclusivity uses the concept of mentor speed matching. Social events at our live conferences provide the opportunity for one-on-one interaction between trainees and senior members, which will now be lost. By using a preregistration system to determine members' interests (thoracic vs cardiac, research interests, etc), virtual sessions can be created that allow for short (3-5 minute) one-on-one sessions between trainees and members with similar interests. Multiple pairings can be created over the session, and the trainees can be provided with contact information for all of the mentors if an appropriate connection was made and the trainee wants to reach out for further mentorship.

The LTTF program was developed in 2006, and to date, 610 scholarships have been awarded. The mentorship and exposure provided to potential future cardiothoracic surgeons has been enormous, and such sessions should not be forgotten when converting to a virtual setting. Similar to a "trainee" track for breakout rooms, a small session only available to those accepted to the LTTF program should be created. This would continue to include mentorship pairing, which could be facilitated by one-on-one video chat session.

Finally, friendships that can span an entire career are often made during the resident- and student-focused lunch sessions sponsored by the Thoracic Surgery Resident Association (TSRA) and the LTTF program of the STS. Again, an opportunity needs to be created for trainees to network with each other in a resident-only setting. Small breakout sessions can be created (5-8 trainees) in which the discussion can focus on unique aspects of each training program, challenges faced, and ideas for future inter-institutional projects.

Limitations

Our recommendations are subject to a number of limitations that must be considered in the interpretation of the recommendations. The COVID-19 pandemic has led to the adoption of a wide range of virtual platforms that have not been in existence for a significant length of time.[10] Hence, the methodology used for the project was a global assessment of initial trends and did not include long-term results. The impact of varying virtual delivery formats on assimilation and retention of knowledge that is available through CME offerings has yet to be determined. Finally, the educators assembled for the project are cardiothoracic surgeons, and hence, their assessment may not necessarily translate to other disciplines outside of the field.

Conclusion

These recommendations are by no means strict regulations for the development of a surgical virtual conference. All ideas and opinions presented here are suggested strategies provided from a diverse panel of surgeon educators on the STS Taskforce for Virtual Meetings and the STS Executive Council. As we adapt to this new world of virtual surgical conferences and experiment with various methods, data will be evaluated to determine the most effective way to disseminate education and research as well as to provide appropriate networking opportunities. Our most important take-away message is that a virtual conference is not capable of mirroring the format of our previous in-person meetings. It is imperative that program committees use intuitive means of developing these virtual conferences and emphasize the interactivity that our members and attendees desire.

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