



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.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

Review

Application of human factors at hybrid meetings: facilitating productivity and inclusivity

Ricky Ellis^{a,b,*}, Tim Goodacre^c, Neil Mortensen^c, Rachel S Oeppen^d, Peter A Brennan^e

^a Institute of Applied Health Sciences, University of Aberdeen, Aberdeen, AB24 3FX, UK

^b Urology Department, Nottingham University Hospitals, Nottingham, NG5 1PB, UK

^c Royal College of Surgeons of England, 35/43 Lincoln's Inn Fields, London WC2A 3PN, UK

^d Dept of Clinical Radiology, University Hospital Southampton, SO16 6YD, UK

^e Maxillofacial Unit, Queen Alexandra Hospital, Portsmouth PO6 3LY, UK

Received 16 December 2021; accepted in revised form 23 December 2021

Available online 3 January 2022

Abstract

The COVID-19 pandemic has resulted in the widespread use of virtual meetings and conferences. As the healthcare sector attempts to return to normality, face-to-face meetings have started to resume. However, ongoing travel restrictions, risk of viral transmission, the Omicron variant, and requirements for self-isolation, have necessitated the use of novel hybrid meeting formats. These enable participants to attend either in person or virtually using various online platforms such as Microsoft Teams and Zoom. Well organised and facilitated hybrid meetings can combine the advantages of in-person meetings with virtual participation, although the dynamics of communication between attendees is considerably different. This article discusses the benefits and pitfalls of the hybrid format, the human factors that impact productivity and inclusivity, and how to address them in future meetings.

© 2022 The British Association of Oral and Maxillofacial Surgeons. Published by Elsevier Ltd. All rights reserved.

Keywords: COVID-19; Virtual; Hybrid meeting; Human Factors; performance

Introduction

The COVID-19 pandemic has caused significant disruption to normal working practices in healthcare. To reduce the risk of viral transmission, many meetings and conferences were changed to a virtual format, utilising video teleconferencing software that is now widely available, affordable, and accessible.^{1,2} Commonly used online platforms include Microsoft Teams and Zoom, although there are many others.

The online delivery of meetings has been met with a mixed response. Many have celebrated the change, which has facilitated important multidisciplinary and collaborative

work within the UK and internationally, including the international collaborative efforts to understand and manage COVID-19, as well as the dissemination of knowledge regarding changes to practice in response to the pandemic.³ However, the emergence of virtual meetings has left many missing the social aspects of face-to-face interaction and the networking and collaborative opportunities that often arise from meeting colleagues in person.² The mixing that is almost inevitably a part of meetings in person is felt by many to offer creative opportunities that are rarely replicated in the online virtual format. The long-term impact of lost interpersonal relationships across many aspects of social interaction has yet to be ascertained.

As the medical community attempts to resume normal services in the wake of the first waves of the COVID-19 pandemic and, more recently, the Omicron variant, there has been a rise in the number of hybrid meetings and conferences.⁴ This format enables face-to-face socialisation whilst also including video-conferencing platforms for members who cannot attend in person, which may be due to ongoing travel restrictions, self-isolation, clinical responsibilities, or personal choice. This format of meetings and conferences

* Corresponding author at: Institute of Applied Health Sciences, University of Aberdeen, Aberdeen, AB24 3FX, UK.

E-mail addresses: Ricky.ellis@doctors.org.uk (R. Ellis), tim.goodacre@queens.ox.ac.uk (T. Goodacre), neil.mortensen@nds.ox.ac.uk (N. Mortensen), rachel.oeppen@uhs.nhs.uk (R.S. Oeppen), Peter.brennan@porthosp.nhs.uk (P.A. Brennan).

is also more robust, reducing the risk of cancellation if travel restrictions are changed due to new waves of infections or in response to the emergence of new variants.

Many colleagues will now have attended hybrid meetings and will appreciate the difficulties involved in making them successful, productive, and inclusive for all (Fig. 1). This review will discuss the benefits and pitfalls of a hybrid format for meetings and will discuss how an appreciation of human factors (HF) can improve their productivity and inclusivity.

Benefits and pitfalls of hybrid meetings

Benefits

There is little doubt that virtual meetings are cheaper than face-to-face meetings, as attending virtually means no travel

costs or additional accommodation requirements. These cost savings are likely to continue with the use of hybrid meeting formats due to fewer attendees incurring travel expenses and the use of smaller venues. Avoiding travel is likely to significantly reduce the carbon footprint of the meeting, thereby improving sustainability efforts. Lastly, attending virtually may also reduce the time needed to participate by avoiding the need to travel long distances and the need to cancel more clinical commitments. This ‘economy of time’ has been highly valued following the move to virtual meetings.

A key strength of virtual meetings during the pandemic is the ability to include experts and guests from further afield without incurring significant costs in time, money, or travel. This has led to the multinational collaborative work that was instrumental in developing our understanding of, and management approaches to, COVID-19, as well as meetings between national leaders regarding international policy.



Fig. 1. A hybrid meeting being prepared at the Royal College of Surgeons of England for the December 2021 Council.

The benefits of including experts in the field who otherwise may have been unable to attend cannot be understated. Science and medicine have made rapid developments during the pandemic and this collaborative work must continue to maintain the momentum.

Facilitating virtual attendance increases the robustness of the meeting, making it more resilient to sudden changes in travel restrictions and self-isolation requirements. Building a level of robustness into meeting plans is now vital to avoid the cancellation of events, which require considerable investment in time and funds to organise.

Virtual participation at hybrid meetings also increases the flexibility of attendance, enabling those who otherwise may have been unable to attend to join part of the meeting or the whole meeting. This is particularly useful given the rapidly changing workload surgeons and other healthcare professionals are experiencing while clinical services recover from the initial waves of the pandemic. In the current climate, clinicians often need to cover the responsibilities of colleagues at short notice due to sickness themselves or having to self-isolate.

However, many clinicians and healthcare workers will have missed the social and creative aspects of face-to-face meetings. Well-conducted face-to-face meetings can be social, productive, and inclusive.⁵ The use of hybrid meetings harnesses the best of both forms of attendance and enables in-person presence for those keen to return to a socially interactive means of doing business and developing relationships. Seeing and meeting friends and colleagues in person after many months of lockdown and reduced social contact will be the favoured option for many.⁴

In summary, hybrid meetings can combine the advantages of meeting in person with those of attending from a distance. If well organised, they can be efficient, productive, and inclusive.

Pitfalls

Hosting or chairing a meeting that is divided into two groups of attendees (those attending in person and those attending virtually) may present many new challenges compared with established methods of hosting either face-to-face or virtual meetings.

It can be difficult for virtual attendees to follow the discussion if multiple participants speak simultaneously or if there is background noise or chatter.⁶ It may also be difficult for virtual attendees to identify the speaker when the room is covered by a single distant camera and when microphones have not been placed ideally around the meeting room to pick up the contributions of each in-person attendee. Virtual attendees can often remain unnoticed when raising a 'screen-hand' to speak or when requesting the floor to discuss a topic unless a designated person constantly monitors the online video conferencing platform. These factors can lead virtual attendees to feel isolated, ignored, sidelined, or even unheard, and can result in dissatisfaction, reduced participation with disengagement, and reduced productivity.

Hosting or chairing a hybrid meeting requires good-quality technical equipment. Poor quality cameras or microphones at each end of the communication loop limit the understanding and participation of virtual attendees. Likewise, video conferencing uses a high bandwidth, and poor connectivity reduces the ability of the meeting to run effectively.^{7,8}

Non-verbal communication is often lost in virtual meetings and this must be factored into the hybrid meeting model. Reduced non-verbal communication clues or body language can impact the effectiveness of communication and understanding between attendees, and predispose to error.^{9,10} Those attending virtually may also struggle to 'read the room', resulting in further miscommunication, especially if they do not have access to camera facilities.

The time duration of virtual meetings might be different to that of face-to-face meetings, but it is important to factor in short breaks to reduce screen time and maintain concentration if they are prolonged.⁷ In-person attendees may expect a faster pace for the meeting and might find virtual meetings frustrating. Virtual attendees may also experience external distractions, such as interruptions by family or colleagues, pets, doorbells, emails, and mobile phones, as they are not in the 'sterile' environment of the meeting room. Any distraction or loss of concentration can result in reduced productivity and communication errors.^{11,12}

There are some potential pitfalls when running hybrid meetings, but the format also has many potential benefits over traditional face-to-face meetings (Table 1). Consideration of the human factors (HF) involved in the hybrid meeting environment may help enable the productivity and inclusivity of a meeting by improving the effectiveness of interpersonal communication (Fig. 2).

Human factors

Organisation

The key to an effective and productive meeting is organisation and prior planning. All attendees should receive a copy of the agenda and any resources related to it well before the meeting date. Having access to the agenda enables attendees to raise points for discussion in advance or plan points for discussion to be raised during the meeting. It also helps to give structure to the discussion and to maintain concentration, and therefore reduces the risk of error and loss of situational awareness.¹³ Attendees should be made aware of the meeting format and that virtual participation is possible if required or preferred.

Cameras and microphones in the meeting room should be set up well in advance of the start of the meeting to allow time for troubleshooting. As previously mentioned, to facilitate the involvement of virtual attendees, consideration must be given to the quality of the microphone and camera, as well as their positions in the room.¹⁴ At the beginning, the meeting or committee Chair should clearly set out the rules of discussion and participation, including the need for virtual

Table 1
The potential benefits and pitfalls of hybrid meetings.

Benefits	Pitfalls
Cheaper	More challenging for Chair and moderator
More sustainable	Easy to exclude virtual attendees
Less travel	Loss of non-verbal communication
Easier collaboration	Require good equipment and connection
More robust to changes of circumstance	May take longer
More flexible	Increased risk of distractions

attendees to turn off their microphones when not speaking to reduce background noise. It is also vital that background noise in the meeting room is reduced and that only one person speaks at any one time to enable virtual attendees to follow the discussion.

The rules of participation should include instructions for attendees on how to raise a point or contribute to the discussion. Attendees should then be invited by the Chair to speak. This identifies the speaker, reduces the risk of multiple attendees speaking at the same time, and enables equal participation by virtual participants.¹

The Chair must impose a gentle but firm adherence to the ‘rules of engagement’ for hybrid meetings to perhaps a greater extent than is commonly experienced when either format is used alone.

The meeting agenda should include regular breaks to help maintain concentration. More frequent breaks are often required for virtual attendees to reduce screen time, and it has been recommended that a 10-minute break every 90 minutes is a suitable minimum, with a longer break every three hours.¹ Fatigue, hunger, and dehydration reduce concentration and increase the risk of error, highlighting the need for frequent breaks to maintain effectiveness and productivity.^{15–17}

The introduction of all participants is vital for creating an environment in which everyone feels welcome and included. It is also imperative to lower the hierarchy within this environment to enable all attendees to participate in the discussions.¹⁸ This is particularly important when there is an authority or seniority gradient between attendees. The consequence of a hierarchy existing in such meetings may include ‘group-think’ in which members concur rather than disagree with the point raised to avoid causing disharmony or negative consequences.¹ This reduces the power of multidisciplinary

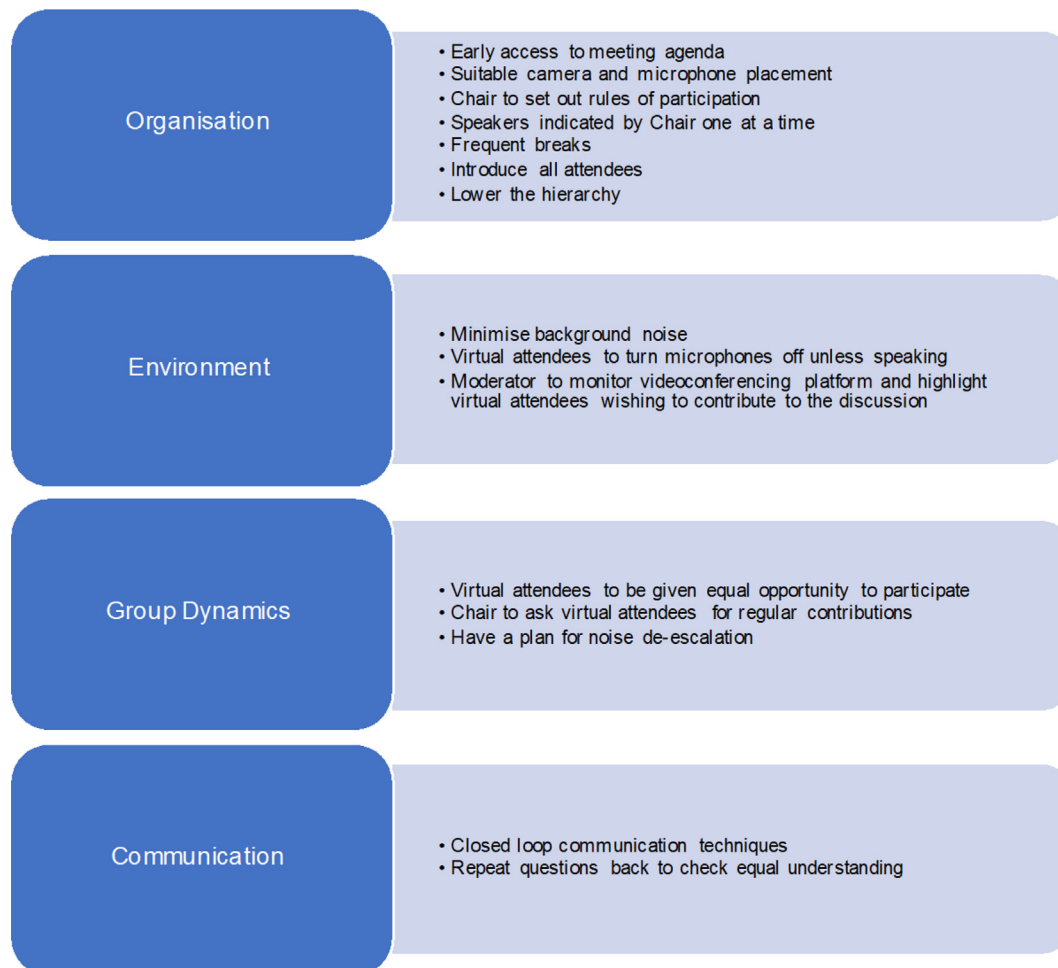


Fig. 2. Factors to consider when running hybrid meetings to facilitate productivity and inclusivity.

plinary and collaborative working, and inhibits progress and effectiveness.

Environment

An in-person attendee should be nominated to moderate the virtual platform by watching for attendees raising their hands, or raising points for discussion in the chat box or message function. Without someone actively monitoring this position, it can be easy for in-person attendees to continue talking and to be unaware of virtual participants who are trying to contribute. This role should ideally not be an additional responsibility of the Chair, who is already tasked with moderating the entire meeting, indicating the next speaker, aligning the discussion with the agenda, and actioning the points raised.

Equal opportunities to contribute to the discussion are a prerequisite for in-person and virtual attendees. This may require the Chair regularly to seek contributions from virtual participants to develop an inclusive environment.

Group dynamics

As with all types of meeting, outgoing and confident participants may dominate the conversation, and this must be regulated by the Chair to maintain an environment in which all participants have an opportunity to contribute. It is considerably more difficult to speak up or to interject when participating virtually, and this needs to be considered by the Chair if in-person attendees are dominating the conversation. As well as regularly seeking input from virtual attendees, it remains standard good practice to ask all meeting participants for additional comments before moving on to the next item on the agenda.

Noise levels can rise during discussion and debate, sometimes subtly and without immediate awareness within the room. Whilst this may be tolerated to a degree during face-to-face meetings, increased noise levels and multiple people speaking simultaneously make it difficult for virtual participants to follow the discussion and can result in them being excluded. Attendees must be reminded of the rules of participation by the Chair if this occurs. More animated meetings may require a system for de-escalation, such as the Chair interrupting proceedings to nominate one participant to speak at a time, allowing all members the opportunity to contribute equally.

Communication

Virtual attendance at meetings makes non-verbal communication more difficult, and may impact communication and understanding between participants. Closed-loop communication techniques should be used to reduce the risk of error and misunderstanding.⁹ If a question is asked by a virtual participant, either by speaking or using the chat function, the question can be repeated by the Chair or the moderator for the benefit and understanding of in-person attendees.

Likewise, it is good practice for the Chair or moderator to repeat a question that has been asked in the meeting room for the benefit of virtual attendees.

Hybrid meetings increase the cognitive burden on the Chair and moderator, who may need to clarify points of discussion to ensure that all participants have heard and understood what has been said. Thankfully, with good quality equipment and bandwidth, this is not often required.

Conclusion

Hybrid meetings that are well organised and moderated are powerful tools that combine the advantages of face-to-face meetings with virtual participation. Given their flexibility and reduced cost, and the ability to include participants from further afield, they are likely to play a significant role in healthcare and other industries in the future. Understanding the impact of human factors in this unique environment is vital for enabling productivity and inclusivity.

Conflict of interest

We have no conflicts of interest.

Ethics statement/confirmation of patients' permission

Not required.

References

- Oeppen RS, Shaw G, Brennan PA. Human factors recognition at virtual meetings and video conferencing: how to get the best performance from yourself and others. *Br J Oral Maxillofac Surg* 2020;**58**:643–646.
- Porpiglia F, Checucci E, Autorino R, et al. Traditional and virtual congress meetings during the COVID-19 pandemic and the post-COVID-19 era: is it time to change the paradigm? *Eur Urol* 2020;**78**:301–303.
- Fonseka T, Ellis R, Salem H, et al. The effects of COVID-19 on training within urology: lessons learned in virtual learning, human factors, non-technical skills and reflective practice. *J Clin Urol* 2021;**14**:29–35.
- Hameed BZ, Tanidir Y, Naik N, et al. Will “hybrid” meetings replace face-to-face meetings post COVID-19 era? Perceptions and views from the urological community. *Urology* 2021;**156**:52–57.
- Oeppen RS, Davidson M, Scrimgeour DS, et al. Human factors awareness and recognition during multidisciplinary team meetings. *J Oral Pathol Med* 2019;**48**:656–661.
- Enser M, Moriceau J, Abily J, et al. Background noise lowers the performance of anaesthesiology residents' clinical reasoning when measured by script concordance: a randomised crossover volunteer study. *Eur J Anaesthesiol* 2017;**34**:464–470.
- Alexander T, Pfendler C, Thun J, et al. The influence of the modality of telecooperation on performance and workload. *Work* 2012;**41**(Suppl 1):3476–3483.
- Fernández C, Saldana J, Fernández-Navajas J, et al. Video conferences through the internet: how to survive in a hostile environment. *Sci World J* 2014;**2014** 860170.
- Ellis R, Hay-David AG, Brennan PA. Operating during the COVID-19 pandemic: how to reduce medical error. *Br J Oral Maxillofac Surg* 2020;**58**:577–580.

10. Acai A, Sonnadara RR, O'Neill TA. Getting with the times: a narrative review of the literature on group decision making in virtual environments and implications for promotions committees. *Perspect Med Educ* 2018;**7**:147–155.
11. Drews FA. The frequency and impact of task interruptions in the ICU. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 2007;**51**:683–686.
12. Rivera-Rodriguez AJ, Karsh BT. Interruptions and distractions in healthcare: review and reappraisal. *Qual Saf Health Care* 2010;**19**:304–312.
13. Brennan PA, De Martino M, Ponnusamy M, et al. Review: Avoid, trap, and mitigate - an overview of threat and error management. *Br J Oral Maxillofac Surg* 2020;**58**:146–150.
14. Mühlbach L, Böcker M, Prussog A. Telepresence in videoconferences: a study on stereoscopy and individual eye contact. *Hum Factors* 1995;**37**:290–305.
15. Parry D, Oeppen RS, Gass H, et al. Impact of hydration and nutrition on personal performance in the clinical workplace. *Br J Oral Maxillofac Surg* 2017;**55**:995–998.
16. Parry DA, Oeppen RS, Amin MS, et al. Sleep: its importance and the effects of deprivation on surgeons and other healthcare professionals. *Br J Oral Maxillofac Surg* 2018;**56**:663–666.
17. Brennan PA, Oeppen R, Knighton J, et al. Looking after ourselves at work: the importance of being hydrated and fed. *BMJ* 2019;**364** 1528.
18. Brennan PA, Davidson M. Improving patient safety: we need to reduce hierarchy and empower junior doctors to speak up. *BMJ* 2019;**366** 14461.