


# The Utility and Educational Impact of a Virtual Webinar to Deliver an International Undergraduate Cardiovascular Conference

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**Introduction:** Conferences are an important avenue for dissemination of knowledge, research and provide networking opportunities for career development. The COVID-19 pandemic has prompted adoption of virtual platforms for delivery of these conferences. The aim of the study was to determine the utility and educational impact of a student-led virtual webinar to deliver an undergraduate cardiovascular conference compared to a traditional in-person conference.

**Methods:** We conducted a two-day virtual conference using the Zoom platform in June 2021. The conference consisted of cardiology subspecialty lectures, and workshops were conducted by a junior doctor, senior cardiology trainees and consultants. The conference also outlaid a virtual poster hall and oral presentation session while networking opportunities were encouraged using breakout rooms and poster hall chat function. A 38-item self-administered online questionnaire was designed and disseminated at the end of the conference to all attending delegates. All data analysis and data visualisation strategies were conducted on R statistical programming.

**Results:** Eight-hundred and forty students from 55 countries attended the event. Four hundred and ninety participants (58.5% response rate, 55.9% female) completed the questionnaire. Factors such as weekend conference (84.9%), student-led or organised (84.1%), environmental/sustainable (82.3%), appropriate level for me (81.5%) and comfort to present (80.8%) were deemed to be at least equal to traditional in-person conference. The conference also increased participants' interest, their core cardiology knowledge and improved their critical analysis and basic echocardiography skills [median 4 (IQR 3–5) for all parameters]. Overall, participants also found it easy to use the virtual platform [median 5 (IQR 5–5)] and easier to ask questions compared to in-person conferences [median 5 (IQR 4–5) vs median 4 (IQR 3–5),  $p < 0.001$ ].

**Conclusion:** Our virtual conference provided opportunities to students that the COVID-19 pandemic would have otherwise affected; however, its utility and educational impact will need to be assessed within its individual context of delivery.

**Keywords:** virtual conference, undergraduate, international, educational impact, cardiology, webinar

## Introduction

Scientific conferences are an important avenue for dissemination of research and breakthroughs within a discipline, serving as important learning moments for all attendees.<sup>1</sup> In addition to learning, the convention of experienced clinicians, academics, trainees and students offers opportunities for networking, hence enabling exchange of ideas and insight, and promotes collaboration and mentorship relationships. Hence, organisation of useful and inclusive meetings is a key responsibility of the scientific community to promote continuous medical education, which have direct implications towards patient care.<sup>2</sup>

In the setting of medical education, the COVID-19 pandemic had led to an adoption of online formats for various purposes, including delivery of the undergraduate curriculum and assessment.<sup>3,4</sup> Online delivery of medical conferences has been in place for some time; however, travel restrictions have seen this virtual transition accelerated.<sup>5,6</sup> There are

multiple benefits of virtual conferencing over traditional in-person meetings. Participants can save time and cost associated with travel and lodging, which also reduces the environmental burden generated through these.<sup>2</sup>

Within various clinical specialties including cardiology, this transition has witnessed remarkable participation metrics,<sup>7,8</sup> owing to its inclusivity for those who would have otherwise been unable to travel due to disability or health problems, cost and those from under-developed scientific communities.<sup>9</sup> However, these efforts can present several challenges. For example, there could be limited ability to interact with other participants and speakers in real-time while attendees' undivided attention can often be difficult to sustain, mainly due to their surroundings.<sup>10</sup> Not only does this potentially hinder professional networking and conventional social interactions, hands-on training and workshops (eg, echocardiography, catheterisation simulation) are also compromised in virtual settings.<sup>11</sup>

In the undergraduate setting, conferences offer a unique set of opportunities towards its attendees.<sup>12</sup> It allows students in their formative years to meet with like-minded students, engage senior clinicians, experience the practical side of their specialty and be afforded opportunities to present their research works, shaping their future career trajectory.<sup>13,14</sup> Given the move of curricula in the UK towards more generalist principles, this leaves many students interested in clinical specialties without much experience in their subject.<sup>15</sup> This is true in clinical cardiology, which is a rapidly evolving field within its various subspecialties and a highly popular and competitive training programme in many countries.<sup>16</sup> Medical students have previously reported low confidence and knowledge in managing cardiac patients particularly in the emergency setting.<sup>17,18</sup> Hence, it is key for undergraduate conferences to not only push the frontiers with latest developments within the field, but also allow students to improve on their clinical acumen and allow their transition from a legitimate peripheral participator towards the centre of the profession.<sup>19</sup>

Given the importance of undergraduate conferences and that virtual meetings are exceedingly commonplace, acceptable and likely necessary, our study aims to provide the first quantitative evidence for the utility and educational impact of our two-day student society led virtual undergraduate cardiology conference compared to traditional in-person conferences. This is a unique setting not extensively explored. We intend to determine participants' perceptions of the strengths and weaknesses of the virtual format compared with traditional in-person conferences. We then investigate the extent to which our virtual conference improved their cardiology interest, knowledge and skills while considering their overall conference experience.

## Methods

### Delivery of the Online Conference

This was the first All-Wales Undergraduate Cardiology conference, held on a virtual online platform (Zoom Video Communications Inc., San Jose, CA, USA). This two-day conference (26–27 July 2021) was organised by an undergraduate university society, the Cardiff University Cardiovascular Society (CUCS) in conjunction with the British Undergraduate Cardiovascular Association.<sup>20</sup> The conference programme was also student-led, which meant that the conference itinerary, content and speaker recruitment was solely designed by senior medical students who were committee members of the Cardiff University Cardiovascular Society ([Supplementary Figure 1](#)).

The online conference was free for all participants, within the UK and internationally. It was advertised for three months using the Cardiff University social media platform pages and mailing list of our student society. Although primarily targeting medical students, doctors of any grade were also free to attend the conference. Zoom access was provided by Cardiff University School of Medicine and there was no limit on participation/attendees.

### Questionnaire Design and Dissemination

The novel 38-item self-administered online questionnaire was designed by the society committee members using Google Forms (Google, USA). The questionnaire was developed through discussion of published literature relevant to ways to evaluate the utility of online conferences compared to traditional in-person conferences.<sup>13,14,21</sup> It included 5 or 10-point Likert scales (to assess improvement in knowledge, skills or interest in the field), checkboxes, dropdown options (to compare in-person vs virtual conferences) and free-text questions to improve the granularity of the data. A pilot survey of the questionnaire was distributed to members of CUCS who were not involved with its design and improved on following feedback, to ensure

objectivity and enhance clarity. The final questionnaire was distributed at the end of the conference to all conference attendees. A copy of the final questionnaire can be found in the online supplement ([Supplementary Figure 2](#)).

To prevent double data entry, participants were informed to only respond to the questionnaire once. Duplicate responses were then identified and removed based on all columns using the open-source statistical environment “R” (Version 4.0.2). Names, student numbers and email addresses were not collected in the questionnaire and not used to identify participants to preserve anonymity of the responses.

## Conducting the Virtual Conference

The conference consisted of a series of talks and workshops, primarily delivered by consultant cardiologists, senior trainee cardiologists and a junior doctor. The talks covered various cardiovascular subspecialties (that are not widely covered by our undergraduate curricula) such as cardiothoracic surgery, paediatrics cardiology, sports cardiology, medical devices and interventional cardiology. Workshops were interactive sessions with more audience participation through the chat, polls and audio function (participants unmuting themselves) and aimed to build upon common skills in cardiovascular medicine such as ECG interpretation, basic echocardiography, cardiovascular anatomy and critical appraisal skills.

Along with plenaries and workshops, the conference welcomed delegate abstract submissions. These were judged by two Professors of Cardiology and a cardiology trainee, who were senior ambassadors of our student society. A total of 29 abstracts were selected for posters, as well as 6 live oral presentations. Posters were displayed on an online poster hall on the MedAll™ virtual platform (chat function utilised for interaction) and oral presentations were presented live virtually to all delegates during the webinar (with live Question and Answer segment).

For networking opportunities, delegates were encouraged to use the chat function or the breakout rooms to speak to other delegates, organising committees and speakers should both parties be agreeable to this. These opportunities were mainly facilitated by the organising committee of Zoom who had the administrative licence to move participants and speakers into separate rooms. In the virtual poster hall, comment functions were enabled to allow participants to discuss the research works presented. Furthermore, all emails of organising committees and speakers on the day were given to the participants through their conference pack. This allowed students to connect during or after the conference.

## Statistical Analysis

Summary statistics were presented for baseline characteristics as appropriate. For all continuous data, normality of distribution was tested using the Shapiro–Wilks test, where a threshold of  $p > 0.05$  was utilised to indicate normal distribution. A non-parametric Wilcoxon rank sum test with continuity correction was used to compare medians between two groups. For all comparative statistical analysis, a p-value threshold of  $<0.05$  was considered statistically significant. All data was analysed using the “R” (Version 4.0.2) statistical programming using the “tidyverse” and “rms” for data analysis and “ggplot2” for data visualisation. Word cloud analysis was conducted on the “wordcloud2” package.

## Results

### Population Characteristics

Population characteristics are summarised in [Table 1](#). Nine hundred and seventy individuals registered for the conference, of which 840 unique participants attended the virtual conference across the two days. Five hundred and twenty-two feedback forms were received, of which 490 unique responses (58.5% response rate of attending participants) were analysed after duplicates ( $n = 32$ ) were removed. The median age was 23 [Interquartile range (IQR 21–25)] and 55.9% were female. Most attendees did not have an additional degree (74.3%) and more participants had attended a virtual conference compared to an in-person conference prior to this (400 vs 346). Our participants were very interested in pursuing cardiology in the future (median 8, IQR 7–10) and mostly heard about the conference via Facebook (69.4%). The participant’s country of medical school is shown in [Supplementary Table 1](#).

**Table 1** Baseline Characteristics

Baseline Characteristics	Participants (n=490)
Age	Median: 23 (IQR: 21–25)
Gender	Male = 213 (43.5%) Female = 274 (55.9%) Prefer not to say = 3 (0.6%)
Additional degrees	No – 364 (74.3%) Yes – 126 (25.8%) <ul style="list-style-type: none"> <li>• BDS – 1 (0.2%)</li> <li>• BMedSci – 13 (2.7%)</li> <li>• BSc – 33 (6.7%)</li> <li>• MD – 66 (13.5%)</li> <li>• MSc – 10 (2.0%)</li> <li>• PhD/DPhil – 3 (0.6%)</li> </ul>
Prior to this, have you attended a conference in-person?	Yes – 346 (70.6%) No – 144 (29.4%)
Prior to this, have you attended a conference virtually	Yes – 400 (81.6%) No – 90 (18.4%)
How did you hear about the conference (just list big ones and rest as others)	Facebook – 340 (69.4%) Word-of-mouth – 58 (11.8%) Instagram – 35 (7.1%) Society mailing list – 20 (4.1%) WhatsApp – 5 (1.0%) Other – 32 (6.6%)
Interest to pursue cardiology in the future (0 – not at all, 10 - extremely interested)	Median: 8 (IQR: 7–10)

**Note:** Table 1 shows the participant baseline characteristics.

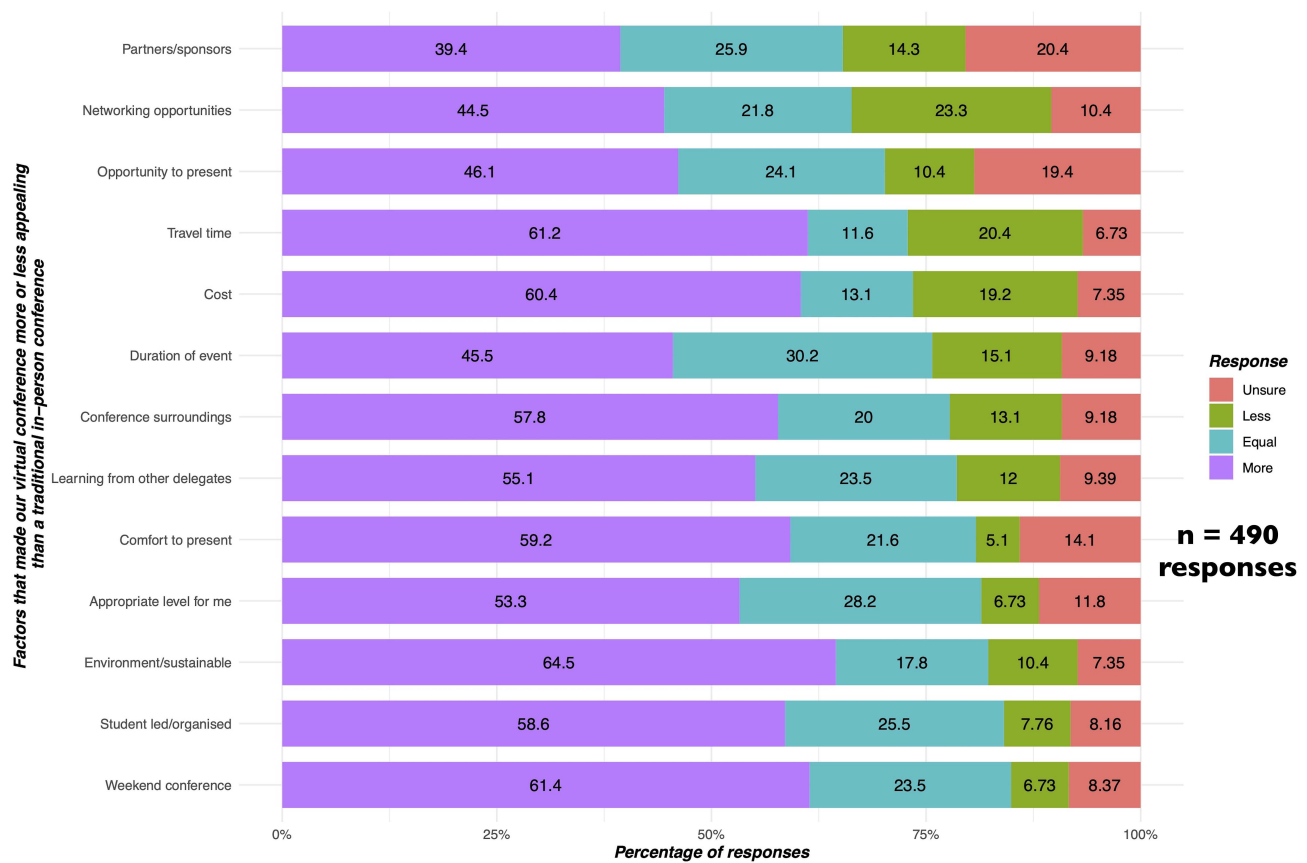
**Abbreviations:** BDS, Bachelor of Dental Surgery; BMedSci, Bachelor of Medical Sciences; BSc, Bachelor of Science; IQR, Interquartile Range; MD, Doctor of Medicine; MSc, Master of Science; PhD/DPhil, Doctor of Philosophy.

## Utility of the Virtual Undergraduate Cardiology Conference Compared to In-Person Conferences

Figure 1 shows the utility of our virtual conference compared to in-person conferences. Factors (combined response of “More” plus “Equal”) such as weekend conference (84.9%), student-led or organised (84.1%), environmental/sustainable (82.3%), appropriate level for me (81.5%) and comfort to present (80.8%) were deemed to be at least equal to traditional in-person conference. However, factors for our virtual conference such as environmental/sustainable (64.5%), weekend conference (61.4%), travel time (61.2%), cost (60.4%) and comfort to present (59.2%) were deemed more appealing than in-person conferences. Albeit in lower percentages, our virtual conference was less appealing compared to traditional in-person conferences for networking opportunities (23.3%), travel time (20.4%), cost (19.2%), duration of event (15.1%) and partners/sponsors (14.3%). Participants were mainly unsure about factors such as partners/sponsors (20.4%), opportunity to present (19.4%), comfort to present (14.1%), appropriate level for me (11.8%) and networking opportunities (10.4%).

## Educational Impact of the Virtual Conference

Table 2 shows the educational impact of our virtual undergraduate conference. Our conference had increased our participants’ interest [median 4 (IQR 3–5)] and likelihood of applying for cardiology in the future [median 4 (IQR 3–5)]. Furthermore, participants’ felt that our virtual conference also increased their core cardiology knowledge [median 4 (IQR 3–5)] and knowledge about a career in cardiology [median 4 (IQR 3–5)]. In terms of skills, participants felt that our conference improved their critical analysis [median 4 (IQR 3–5)] and basic echocardiography [median 4 (IQR 3–5)].



**Figure 1** Assessing factors between virtual and in-person conferences. Figure 1 shows the factors that made our virtual conference more or less appealing than a traditional in-person conference. Factors have been arranged in ascending order based on the total percentage for responses of "More" and "Equal" combined.

### Overall Conference Experience

The overall conference experience is shown in Table 3. Participants very much enjoyed the conference [median 5 (IQR 4–5)] and were extremely likely to recommend the conference to another peer [median 5 (IQR 4–5)]. They also found it very easy to use our Virtual Zoom platform [median 5 (IQR 5–5)]. Participants also found it easier to ask questions in our virtual conference compared to in-person conferences [median 5 (IQR 4–5) vs median 4 (IQR 3–5),  $p < 0.001$ ].

**Table 2** Educational Impact of Our Conference

To What Extent Has the Conference Improved Your Knowledge, Skill or Interest in the Following:	Median (IQR) (0 – not at all, 5 - Significantly Improved/ Increased)
Interest in cardiology	4 (3–5)
Likelihood of applying for cardiology	4 (3–5)
Knowledge about a career in cardiology	4 (3–5)
Core cardiology knowledge	4 (3–5)
Critical analysis skills	4 (3–5)
Basic echocardiography skills	4 (3–5)

**Note:** Table 2 shows the educational impact of our conference measured based on metrics of interest, knowledge and skill.  
**Abbreviation:** IQR, Interquartile Range.

**Table 3** Overall Conference Experience

Overall Conference Experience	Median (IQR) (0 – Not at All, 5 - Very Much So)
Did you enjoy the conference?	5 (4–5)
How likely are you to recommend the conference to another peer?	5 (4–5)
How easy was it to use zoom?	5 (5–5)
I find it easy to ask questions in a virtual conference vs I find it easy to ask questions in an in-person conference	5 (4–5) vs 4 (3–5) respectively, $p < 0.001$
To what extent do you agree/disagree with the following statement: Webinar conferences offer flexibility and convenience (eg not having to spend time and money travelling) (0 - not at all, 5 - very much so)	5 (4–5)
What type of conferences do you prefer?	Virtual: 227 (46.3%) In-person: 108 (22.0%) Hybrid (Virtual+In-person): 155 (31.7%)
Do you think virtual conferences have provided students with opportunities that COVID-19 would have otherwise affected?	Yes: 418 (85.3%) Maybe: 64 (13.1%) No: 8 (1.6%)

**Note:** Table 3 shows the overall conference experience.

**Abbreviations:** IQR, Interquartile range; Vs, Versus.

Following our conference, the majority felt that they prefer virtual (46.3%) or hybrid (31.7%) conferences. They felt that our virtual conferences offered flexibility and convenience [median 5 (IQR 4–5)] and 85.3% agreed that virtual conferences provided them with opportunities COVID-19 would have otherwise affected.

Word cloud analysis of participants' free text responses regarding any other comments, issues or suggestions regarding the conference (shown in [Supplementary Figure 3](#)) mainly shows their gratitude towards its organisation.

## Discussion

This is the first study to quantitatively evaluate the utility and educational impact of a virtual webinar for an undergraduate cardiology conference. Primarily, we qualitatively describe various factors more appealing in an online conference compared to an in-person conference such as reduced travel time, cost, environmental benefits and comfort to present. Despite these, networking opportunities, travel time, cost and duration of the event were stated as being less appealing for other participants. Overall, however, students did find webinars flexible, convenient, easy to use and easier to ask questions compared to in-person conferences. Furthermore, the virtual webinar also increased participants' interest and knowledge about the career while improving their core cardiology knowledge and skills.

We anticipated networking opportunities, learning from delegates and conference surroundings to be the main drawbacks.<sup>24</sup> Surprisingly, although networking opportunities accounted for the highest percentage of “less appealing” votes (23.3%), there was a relatively larger proportion (majority) of attendees finding it more (44.5%) or equally (21.8%) appealing. Furthermore, only 12% of participants felt that the online conference was less appealing to learn from other delegates compared to an in-person conference. This could be due to the early identification and adaptation of our platform to ensure effective interaction between speakers and attendees such as the “breakout room” feature and “poster hall” communications. A recent study on a dedicated one-hour virtual networking session between senior neurologists, faculty moderator and junior/early career mentees was felt to be at least comparable to in-person networking sessions by 99% and better by 60% of attendees.<sup>25</sup> However, whether attendees continued interaction with their mentors after the conference was unclear and the attrition rate for mentee attendance was high (nearly 40% did not attend). Hence, although technology seems to be able to accommodate vital career networking events, longer term evaluations are needed on the benefits of virtual platforms for this purpose moving forward.<sup>26</sup>



Based on current literature, we also expected environmental factors/sustainability, travel time and cost to be major drawing factors towards an online conference. Sustainability proved to be the most appealing factor with a study showing that the combined carbon footprint from the 2019 American Society of Tropical Medicine and Hygiene and the 2006 American Thoracic Society equated to the yearly per capita emissions of 13,000 people in Bangladesh.<sup>27</sup> Furthermore, the cost of attendance which can include airfare, accommodation, food along with registration and ticket fees can equate to one or more months of a graduate and postdoctoral researcher's net salary worldwide.<sup>2</sup> 60.4% of participants felt that virtual conferences were more appealing in cost.

Surprisingly however, approximately 20% of participants found travel time and cost to be less appealing with a virtual conference compared to an in-person conference. This could have been due to the less appealing difference in time zone for international attendees or possibly the need to travel and obtain adequate resources to participate virtually such as a computer or Internet facilities.<sup>28,29</sup> We also speculate a potential reason for this result could have also been due to misinterpretation of phrase-structure, mistaking "less appealing" for "less travel time" or "less cost".

## Educational Value of Virtual Conferences

This study also evaluated the educational value of the virtual conference among medical students. On average, participants felt that our virtual conference increased their interest in cardiology and likelihood to apply for this speciality [median: 4 (IQR 3–5), for both]. As cardiology draws parallels with surgical specialties with its competitiveness and interventional nature, it is interesting that another study also found that interest in surgery during the COVID-19 pandemic increased with a virtual conference but did not with a similar study based on face-to-face conferences.<sup>13,30</sup> This is likely since disruption of medical school placements with reduced elective work, redeployment and only essential staff being present due to social distancing purposes meant that students were not able to appreciate both the appeal and downside of cardiology as a career.<sup>31</sup> Furthermore, our inclusion of more niche subspecialties within cardiology such as sports cardiology and paediatric cardiology (usually gained from extracurricular activities or student selected components rather than undergraduate curricula) would also explain why our conference was able to increase students' knowledge regarding a career in cardiology [median: 4 (IQR 3–5)].<sup>32</sup>

Although our conference was encouragingly able to improve participant self-assessed core cardiology knowledge and both critical appraisal and basic echocardiography skills [median: 4 (IQR 3–5), for all metrics], it is important to appreciate Miller's pyramid when drawing further conclusions. Knowledge, although at the base of the pyramid, is not the pyramid itself.<sup>33</sup> For example, with basic echocardiography, understanding its principles from a virtual conference does not translate to technical skills of its performance.<sup>34,35</sup> Although one could argue that critical appraisal and ECG interpretation could be developed online as are relatively less hands-on skills. This again is another drawback of non-real time virtual conferences that potentially could be supplemented with hybrid formats. However, a recent online surgical skills course found equivalent demonstrator-rated competency of delegate (junior trainees and medical student) suturing, tendon repair and vascular anastomosis and participant-rated teaching quality for face-to-face and online breakout-room teaching.<sup>36</sup> These results suggest that application of commonly used teaching models such as Kolb and Fry's theory for experiential learning can be developed in a virtual setting.<sup>37</sup>

An important design element of our conference, however, was that it was student-led. Near-peer teaching theories would suggest that our core committee of senior medical students, who planned the agenda, are likely to be able to identify the current gaps in knowledge and understanding within our undergraduate cardiology curricula, through social and cognitive congruence.<sup>3,38</sup> Despite our diverse delegate community, participants felt that the student-led nature was more appealing (58.6%, or at least equal to in 84.1%) in our virtual conference compared to in-person conferences and this could have led to 53.3% of participants feeling that this was an appropriate level for them (or at least equal in 81.5% for our virtual format compared to in-person conferences). Although our core committee was not directly involved with most of the teaching (only SG conducted the critical appraisal workshop), we provided our speakers with suggestions for topics and acted as student-peer reviewers for their content. Collaboration with speakers to help them understand the participants' zone of proximal development through deliberations regarding contents would allow more meaningful and relevant teaching moments.<sup>39</sup>

## Strength and Limitations

Our study had a relatively decent sample size ( $n = 490$ ) representing 6 different continents with a modest response rate (58.5%). Despite this, there are distinct elements of selection or participation bias towards those engaged in our society social media accounts and those who were highly interested in cardiology. Furthermore, within our population, interestingly, more participants had attended virtual webinars compared to in person webinars prior to our conference. This could mean that they were more inclined towards virtual formats and skewed the responses as such. While we also acknowledge that our survey is novel and has not been previously validated, some of our results were dependent on participants comparing their experience of in-person conferences with our virtual one; however, 29.4% of our respondents had not previously attended an in-person conference. To account for this, we had included the response option of “unsure” for in-person naive conference participants. Finally, our data for increased educational impact was analysed at one time-point and not as a pre-post paired analysis. Hence, our results are descriptive rather than inferential.

## Future Directions and Conclusions

The outcome of this study shows the benefits of conducting an international conference virtually. In a post-Covid-19 era, institutions may seek to continue hosting conferences online due to the added benefits to both organisers and attendees.

Despite the benefits of a virtual conference, recent literature has suggested that zoom fatigue, described by Kushner (2021)<sup>40</sup> as “discomfort and disaffection [with an online platform]”, increasingly poses an issue. As such, use of hybrid models for virtual events should also be considered in the future. Incorporation of both face-to-face and virtual events will enable more active engagement whilst maintaining the same accessibility and opportunities as discussed.<sup>21</sup>

Our virtual conference enabled a far greater international audience due to mitigated travel expenditures and geographical restrictions. Furthermore, for many years travel, accommodation and conference expenditures have posed a severe disadvantage to those of lower socioeconomic backgrounds,<sup>41</sup> which has the potential to in turn impact career progression. This is a major obstacle that is removed via a virtual platform, to ensure equality and inclusivity.

In summary, our virtual conference provided opportunities to students that the COVID-19 pandemic would have otherwise affected. Conferences delivered virtually or as a hybrid model has significant advantages over traditional in-person conferences; however, its utility and educational impact will need to be assessed within its individual context of delivery.

## Data Sharing Statement

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

## Ethical Approval and Consent to Participate

This project was an evaluation of the effectiveness of a virtual international conference for our undergraduate cardiology society and aimed to improve future teaching sessions/conference programmes. According to advice obtained from the NHS Health Research Authority’s online decision tool, our study did not require formal ethics committee approval.<sup>21–23</sup>

All data was collected in a voluntary manner and complied with GDPR rules. Questionnaires were sent to delegates who had attended the conference and informed consent was obtained from all participants that their anonymous data may be used for future publications. All methods were carried out according to the Declaration of Helsinki.

## Consent for Publication

All authors consent for the publication of the results of this study.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.



## Funding

The authors did not receive any support or funding from any organisation for the submitted work.

## Disclosure

The abstract of this paper was presented at the British Cardiovascular Society Annual Scientific Meeting in Manchester in June 2022 as a poster presentation with interim findings. The poster's abstract was published in the Allied Health Professionals/ Nursing/Health Scientists section of the *Heart BMJ* as a supplement ([https://heart.bmj.com/content/108/Suppl\\_1/A59.1](https://heart.bmj.com/content/108/Suppl_1/A59.1)).<sup>42</sup>

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