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Clinical Research

Vascular e-Learning During the COVID-19 Pandemic: The EL-COVID Survey

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Background: The corona virus disease (COVID-19) pandemic has radically changed the possibilities for vascular surgeons and trainees to exchange knowledge and experience. The aim of the present survey is to inventorize the e-learning needs of vascular surgeons and trainees as well as the strengths and weaknesses of vascular e-Learning.

Methods: An online survey consisting of 18 questions was created in English, with a separate bilingual English-Mandarin version. The survey was dispersed to vascular surgeons and trainees worldwide through social media and via direct messaging from June 15, 2020 to October 15, 2020.

Results: Eight hundred and fifty-six records from 84 different countries could be included. Most participants attended several online activities (>4: $n = 461$, 54%; 2–4: $n = 300$, 35%; 1: $n = 95$, 11%) and evaluated online activities as positive or very positive (84.7%). In deciding upon participation, the topic of the activity was most important ($n = 440$, 51.4%), followed by the reputation of the presenter or the panel ($n = 178$, 20.8%), but not necessarily receiving accreditation or certification ($n = 52$, 6.1%). The survey identified several shortcomings in vascular e-Learning during the pandemic: limited possibility to attend due to lack of time and increased workload ($n = 432$, 50.5%), no protected/allocated time ($n = 488$, 57%) and no accreditation or certification, while technical shortcomings were only a minor problem ($n = 25$, 2.9%).

Conclusions: During the COVID-19 pandemic vascular e-Learning has been used frequently and was appreciated by vascular professionals from around the globe. The survey identified strengths and weaknesses in current e-Learning that can be used to further improve online learning in vascular surgery.

Conflict of interest: Nikolaos Patelis and Sean Matheiken have served as Director of ESVS Distance Learning and are co-founders of the Med-PIE group. Harm Ebben has served as Video Editor of ESVS Distance Learning. Hubert Stepak has served as ESVS Distance Learning Fellow. Theodosios Bisdas is the Chief Executive Officer of Vascupedia. Zaiping Jing and Jiaxuan Feng are members of Endovascology, PR China.

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INTRODUCTION

Over the last twenty years, the internet has transformed from a novelty to a fixture that is constantly at the tips of our fingers. The academic utility of the internet has exponentially risen, generating the question of whether medical e-Learning is an efficient and effective training tool. Despite some sporadic research studies with promising results,¹⁻⁵ little systematic research has been performed to affirm or negate the validity of e-Learning as training modality in vascular surgery.⁵

The consequences of the global Corona Virus Disease (COVID-19) pandemic have been tragic and are far from concluded. Both clinical care provision and medical training have been forced to make drastic changes to cope with this never-foreseen situation.^{6,7} The crisis has spurred rapid acceptance and utilization of vascular e-Learning; trainees, surgeons, institutions and societies have embraced online learning. The aim of the present survey is to inventorize the e-learning needs of vascular surgeons and trainees need as well as the strengths and weaknesses of vascular e-Learning.

MATERIALS AND METHODS

From June 15, 2020 to October 15, 2020 an online survey was held under vascular surgeons and trainees in vascular surgery. The General Data Protection Regulation (GDPR) of the European Union was taken into consideration in preparing all materials of this research. The survey was approved by the ethics committee of the institution of the primary investigator.

For the study, a vascular e-Learning activity or distance learning activity was defined as any educational or training activity that is performed exclusively online (either synchronous or asynchronous) and the main topic falls under the scope of vascular or endovascular disciplines. The pandemic period was defined as the period between March 15, 2020 and May 15th, 2020 for Europe. For other regions, this period varied according to the imposed measures by each government and epidemiological data from each region. An online survey consisting of 18 questions was created (Supplementary material I); three questions were on demographics, 14 on the e-learning experience and opinion, and one field for the participants' email address. The official language of the survey was English. A bilingual English-Mandarin version of the same questionnaire was created according to the instructions of the Chinese Medical Association to be used in mainland People's Republic of China

(mainland PRC) (Supplementary material II). The original questionnaire was hosted on Google Forms (Mountain View, CA), while the bilingual version was hosted on SurveyLab (Warsaw, Poland) to allow participants based in mainland PRC a free access.

The EL-COVID survey was advertised through social media (so.me.); primarily in LinkedIn (Mountain View, CA) and secondarily in Twitter (San Francisco, CA) and Facebook (Menlo Park, CA). National and regional contributors contacted their respective colleagues through direct messaging on any so.me. platforms or by email. The above information was described in more detail in the official EL-COVID webpage.⁸ The survey responses were submitted to descriptive analysis of percentage. Data were validated by the first author (NP) and double entries were removed.

RESULTS

In total, 1015 participants have filled-in the two questionnaires. After data validation, 92 records were deleted as duplicate entries or malicious content. From the 923 remaining records, additional 67 records were deleted as the respective participants did not attend any online activities during the pandemic and this data will be analyzed separately. The remaining 856 records were taken into consideration and analyzed.

Participants came from 84 different countries, most were from mainland PRC ($n = 109$, 12.7%), Germany ($n = 62$, 7.2%), the United States of America ($n = 57$, 6.7%), Indonesia ($n = 52$, 6.1%) and Brazil ($n = 40$, 4.7%). The geographical distribution of participants can be seen in detail in [Table I](#). The majority of participants were male ($n = 673$, 78.6%). Two participants were non-binary/LGBTQ+. More than half ($n = 482$, 56.3%) were vascular surgeons with more than five years of post-training experience. One in four participants ($n = 213$, 24.9%) was a vascular surgeon with zero to five years of post-training experience, while the rest of the participants ($n = 161$, 18.8%) were trainees.

Most of the participants ($n = 461$, 53.9%) attended more than four online activities, while a third of the participants ($n = 300$, 35%) attended 2-4 activities. Ninety-five participants (11.1%) attended only one online activity. Two thirds of participants attended national online activities ($n = 580$, 67.8%) despite that half of the activities attended did not offer any Continuing Medical Education (CME) points or certificates ($n = 294$, 50.7%). Most participants attended international

Table I. Geographical distribution of participants.

Country	<i>n</i>
Albania	3
Algeria	3
Argentina	5
Australia	5
Austria	1
Bahrain	1
Bangladesh	4
Belarus	1
Belgium	3
Bolivia	1
Bosnia & Herzegovina	1
Brazil	40
Bulgaria	8
Cameroon	1
Canada	33
Chile	2
Colombia	3
Costa Rica	4
Croatia	12
Czech Rep.	2
Denmark	1
Dominican Republic	1
Ecuador	7
Egypt	8
Finland	2
France	12
Germany	62
Greece	32
Guatemala	2
Hong Kong SAR	1
Hungary	15
Iceland	1
India	13
Indonesia	52
Iran	6
Iraq	4
Ireland	3
Israel	2
Italy	38
Jordan	1
Saudi Arabia	9
Lebanon	24
Lithuania	3
Maldives	1
Mexico	16
Morocco	2
Myanmar	1
Namibia	1
Netherlands	15
New Zealand	2
Pakistan	4
Palestine & Gaza Strip	1
Paraguay	1
Peru	6
Philippines	3

(continued on next page)

Table I (*continued*)

Country	<i>n</i>
Poland	13
Portugal	7
PR China (Mainland)	109
Qatar	1
Moldova	3
Romania	17
Russian Federation	26
Serbia	1
Singapore	12
Slovenia	2
South Africa	13
Spain	26
Sweden	5
Switzerland	6
Syria	2
Taiwan	1
Thailand	4
Tunisia	1
Turkey	9
United Arab Emirates	3
United Kingdom of Great Britain & Ireland	31
Ukraine	10
Uruguay	5
United States of America	57
Uzbekistan	1
Venezuela	3
Vietnam	1
Yemen	1
Zambia	1
<i>Total</i>	<i>856</i>

online activities ($n = 600$, 70.1%). Half the international activities attended lead to an official accreditation ($n = 316$, 52.7%) – either CME points or certificates.

The topic of the online activity was most important in deciding upon participation ($n = 440$, 51.4%), followed by the reputation of the presenter or the panel ($n = 178$, 20.8%) and the reputation of the institution organizing the activity ($n = 165$, 19.3%) (Fig. 1). The possibility to receive official accreditation was much less important in deciding upon participation ($n = 52$, 6.1%). Other reasons or a combination of the above were reported by 21 participants (2.5%).

The information regarding online activities reached the participants through direct contact from national/international societies ($n = 325$, 38%), so.me. ($n = 251$, 29.3%), online educational platforms ($n = 132$, 15.4%) or word of mouth ($n = 63$, 7.4%) (Fig. 2). A small number of participants ($n = 57$, 6.7%) actively searched for the activities they later attended. Twenty-eight

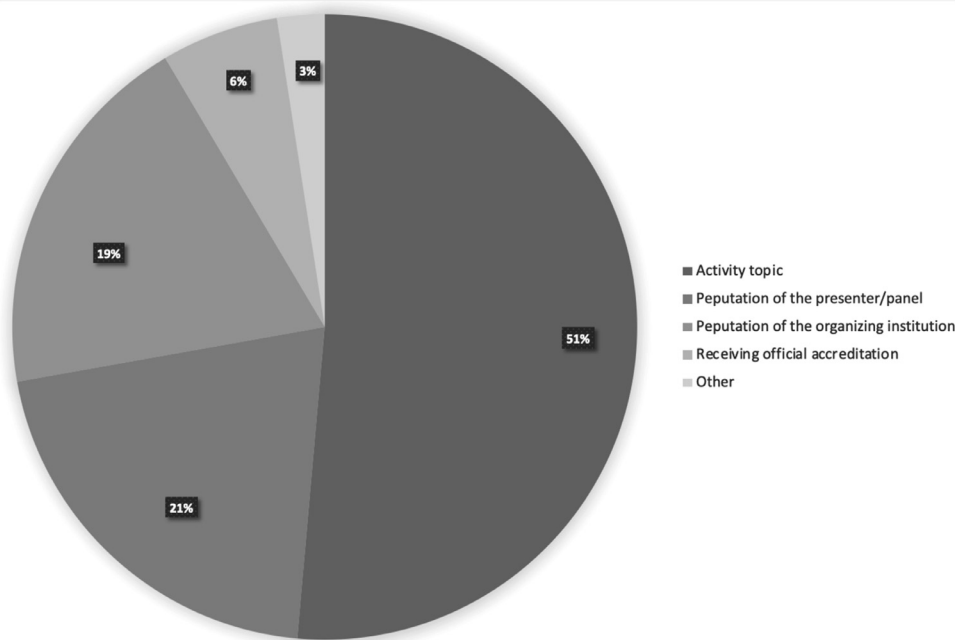


Fig. 1. Criterion of choosing activities.

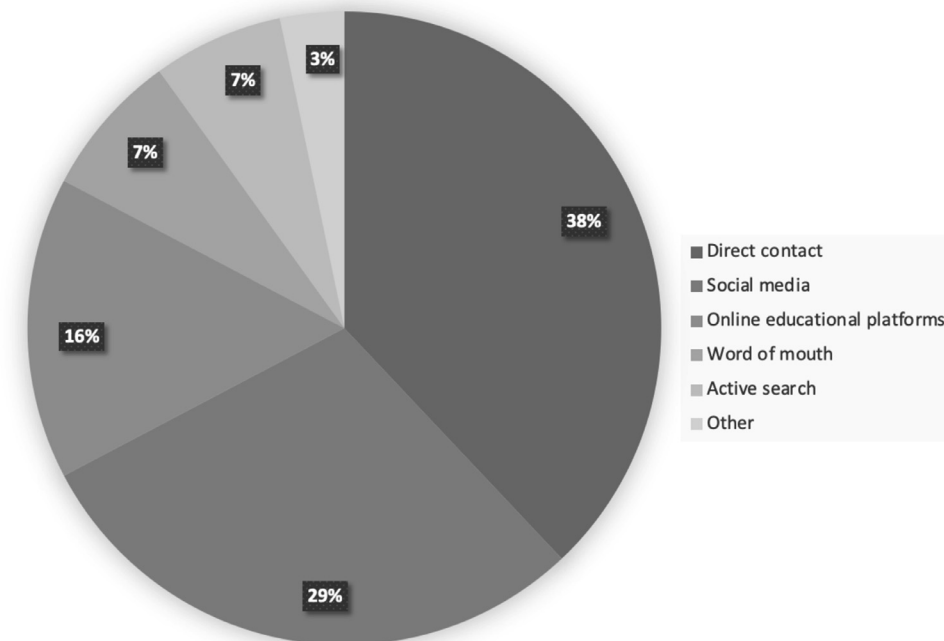


Fig. 2. Means of information dissemination.

participants (3.3%) reported other ways of finding the activities they were interested in.

In most cases ($n = 488, 57%$), employers did not support the online educational activities of the survey participants through protected/allocated time (Fig. 3).

Half of the participants did not manage to attend an activity of their interest, due to lack of

time and increased workload ($n = 432, 50.5%$). Other reasons preventing them from joining online activities were time-zone difference ($n = 157, 18.3%$), simultaneous online activities ($n = 97, 11.3%$), inability to isolate at home or workplace ($n = 79, 9.2%$), slow internet connection or other technical issues ($n = 25, 2.9%$), no interaction ($n = 24, 2.8%$) and no accreditation ($n = 20, 2.3%$).

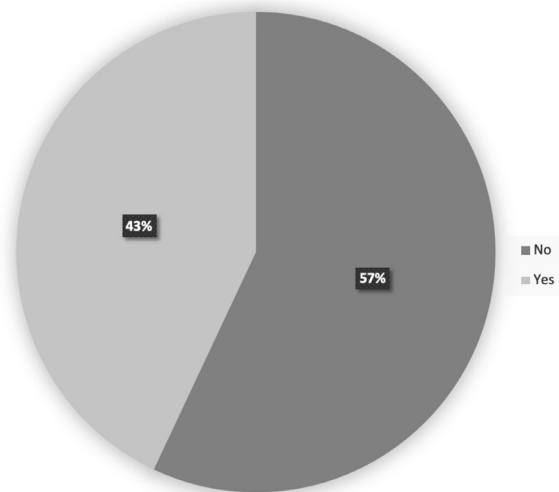


Fig. 3. Employer support.

Several other reasons were also reported by twenty participants (2.3%) (Fig. 4).

Most of the participants (84.7%) had a positive or a very positive opinion regarding online activities during the pandemic (Fig. 5). Half of them considered that there is room for improvement, while the other half considered that e-learning is mature enough to replace traditional methods in some cases. Hundred participants (11.7%) were neutral regarding e-learning. The minority of participants had a negative or very negative opinion regarding e-learning (1.6% and 2%, respectively).

The access to the online activities after they were concluded was easy or very easy according to 450 (52.6%) and 135 (15.8%) participants, respectively. The access was hard or very hard according to 132 (15.4%) and 63 (7.4%) participants, respectively. One out of ten participants ($n = 76$, 9.8%) found it impossible to access the content of the online activity they had previously undertaken, mainly based on whether there was an accreditation or not.

Citing an online training or educational activity was hard in 34.5% cases ($n = 295$), but easy in 220 (25.7%). More than a third of the participants ($n = 341$, 39.8%) would not cite an online activity as a source.

One out of three participants ($n = 241$, 28.2%) would not list online activities they have undertaken in their curricula vitae (CV). Approximately one out of five participants ($n = 162$, 18.9%) would list these activities in their CV. Most participants ($n = 453$, 52.9%) would list some of the undertaken online activities.

Approximately 316 points of potential improvement of vascular e-Learning were

mentioned by the participants and they will be mentioned in more detail in the discussion section. These comments are grouped and listed in Supplementary Table I.

DISCUSSION

The use of online educational tools is an idea almost as old as the internet itself. We must keep in mind that in 1989 the world-wide-web (WWW) was originally conceived and developed to meet the demand for information-sharing between scientists in universities and institutes located in different parts of the world.

Like any new training and educational method or tool, e-Learning has been met with some skepticism from the medical society. E-Learning potentially could replace theoretical parts of the core medical or specialty training. Even some practical skills can be taught online, while others need the use of simulators.⁹⁻¹⁶ Studies investigating e-learning in vascular and endovascular surgery training and education showed it's worthwhile, but had a small study size, were geographically limited and could marginally support their conclusions.^{1-3,5}

As the COVID-19 pandemic swept one country after the other, the necessity for an alternative method of training, scientific updates and networking in vascular surgery became more evident, eventually surpassing what were the pre-pandemic expectations.^{4,17} This exponential growth of e-Learning in the medical field and specifically in vascular surgery was recognized early by several authors, but their publications were limited.^{1,2,6,17} The EL-COVID team designed a short survey that aimed in identifying the learning needs of vascular surgeons and trainees, as well as the strengths and weaknesses of vascular e-Learning. Our research team did not aim in answering all answers regarding vascular e-learning, as this would have made the survey rather long and tiresome.

With 856 vascular surgeons and trainees from 84 countries participating this survey is a significant representation of vascular professionals worldwide. The demographics of the EL-COVID results were in line with the expected demographics of the international vascular community: male predominance and most post-training professionals. Most of the participants were active with e-Learning during the pandemic. This is a promising finding demonstrating the eagerness of the vascular professionals to continue with their training and education under these difficult times, especially if we consider that most vascular professionals did not have prior exposure to e-Learning.^{1,3}

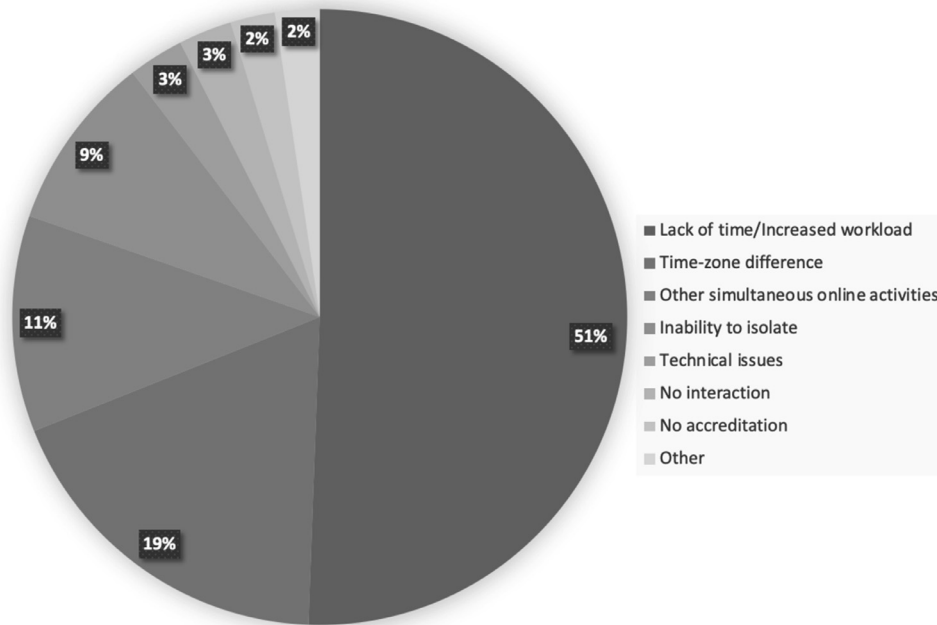


Fig. 4. Reasons for not attending.

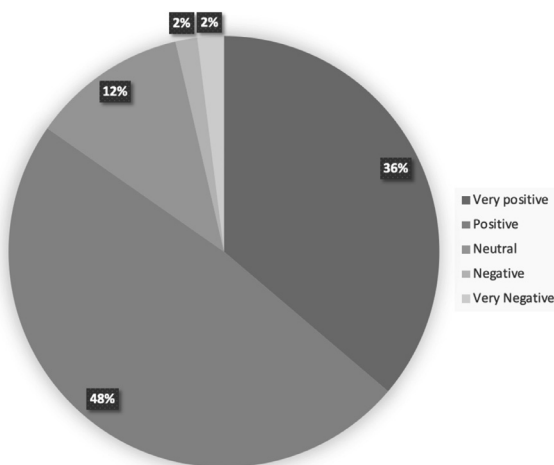


Fig. 5. Overall impression.

Almost half of the attended activities did not offer official accreditation, but this did not stop professionals from attending. One possible reason for online activities not offering official accreditation could be that under these unprecedented circumstances the organizers could not submit their activities to the respective authorities in time to have CME points granted. As it is known, submitting e-Learning activities to authorities towards CME points can be lengthier and more complicated than submitting other academic activities. Actions from the side of medical training

authorities (e.g., American Medical Association, European Union of Medical Specialists) are necessary to allow more e-Learning activities to receive official accreditation.

The topic of the e-Learning activity was the most important reason for participants to attend it, followed by the reputation of the presenter and the reputation of the institution that organized the activity. These three reasons were mentioned by more than 90% of the participants, leaving the CME points in the fourth place with a mere 6.1% of participants. The latter percentage, along with what is already mentioned above regarding the CME points, leads to a safe conclusion that official accreditation is not a priority for vascular professionals when attending e-Learning activities. This finding has a positive explanation and a negative projection. The positive explanation is that modern vascular professionals do not hunt accreditation as per se, but only when this is combined with an interesting training or educational point organized by a well-known institution or group. In this case, we might see professionals been awarded less CME points or certificates over a period of time, but it would not reflect negatively on their continuing professional development (CPD) as the quality of the activities would be improved. As vascular professionals do not expect to earn accreditation with every e-Learning activity, the content of such activities may be out of the control of proper authorities, such

as the medical associations or specialty societies, leaving only the organizing parties to decide what and how to present online. Therefore, in the future more professionals would take part in online activities that no controlling body has authorized and that may not be well-designed bias-free CPD activities. Importantly, the need for CME accredited e-Learning might change if on site learning will be impossible for longer time and e-Learning becomes a permanent and common CPD tool and vascular professionals need these points towards their registration, revalidation or licensing.

Most of the participants were contacted directly by their respective societies regarding an online activity showing that they play a significant role in the CPD activities of their members. So.me. are another important way to reach vascular surgeons.^{18,19}

Allocating time to e-Learning activities is still a challenge as a high percentage of vascular professionals did not receive any kind of support from their employers. Another finding is that half of our participants reported that they did not attend an e-Learning activity they would like to due to increased workload and lack of time. Third more frequent reason not to attend an interesting online activity is the time zone difference, a negative factor that was not so evident until the pandemic and the exclusively online CPD, but also an issue that could be solved by employing a combination of synchronous and asynchronous online CPD activities. In this context, it remains a great limitation that except for a few websites online activities are not provided on-demand. Simultaneous online activities also made it difficult for some participants to attend all the interesting activities they would like to, but this could also be solved by using asynchronous e-Learning. One out of ten participants could not properly isolate to attend an activity either at home or at work. In the latter case, the need of protected/allocated training time is evident once more. In large parts of the globe, some vascular professionals might have limited or no connectivity and these colleagues cannot take part to online surveys or e-Learning activities, so a larger number of colleagues might be affected.

Most of the participants (84.7%) had a positive opinion regarding online activities during the pandemic, although almost half of them (48.5%) thought that there is room for improvement. Only a mere 3.6% had a negative opinion. The above results come in line with several previous smaller studies, which demonstrated a persistent positive attitude towards e-Learning.^{1,3}

One of the questions that has risen in the past is the accessibility of the online activities once these are concluded. The accessibility of already held activities can be easy within a small time after the date of presentation, but it can become rather impossible once the original links to the activity become invalid. In our opinion, a persistent link or handler, for example, a Digital Object Identifier, should follow any online training activity in order to allow professionals to access it in the future.

Despite the increase of alternative online materials (e.g., videos, slide presentations, podcasts, Augmented Reality, or 3D materials) in medical training and education, the issue of future reference to these has been not adequately addressed. This might be due to the opinion of the medical professionals on the scientific value of such materials. Indeed, in our study, approximately 40% of participants would never cite an online activity as a valid source of data and one in three participants would not list e-Learning activities in their Curricula Vitae (CVs). e-Learning might not yet be registered in our minds as a scientifically sound source of data, unlike published manuscripts.

There was a number of comments for future improvement of vascular e-Learning. The first is the request for more interaction during e-Learning. The lack of interaction has been registered as a weakness of vascular e-Learning in a smaller study in the past and it persists in the feedback given by current participants.³ Second, a request for on-demand (asynchronous) e-Learning. Furthermore, 25 requested improved content and more knowledge transfer and 18 asked for better organization of the activities. Audio and video improvements, more visual presentations and translation/captions were requested by a total of 21 participants.

Strengths of our study are the high number of participants, the framed period for answering and the geographical spread of participants. Limitations of our study are the voluntary basis of the survey and inevitable selection bias of participants. Furthermore, the survey provides a snapshot of an exceptional period and devilmint of eLearning is constantly evolving.

Several online activities have been developed for vascular professionals during the pandemic. Other activities, that previously existed (e.g., Vascupedia, Endovascology), have emerged into the foreground, while some institutions (e.g., ESVS) have reinvented previously paused e-Learning activities into new methods of online teaching and training. The future form of vascular e-Learning will be shaped once the pandemic is over and the international vascular society returns to its normal

proceedings and it will certainly be based on the experience we have collected over the past years and on the impact the pandemic will have on e-Learning. Our results demonstrate the positive reception of vascular e-Learning from vascular professionals from around the globe, their selection criteria when it comes to choosing online activities, a number of difficulties they encountered, as well as how to improve e-Learning in the future. Since this is the largest study on vascular e-Learning to date, the information that is gathered is significant and it sets the base for future research and improvement.

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