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Implementation of the Vascular Surgery Board virtual certifying examination

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ABSTRACT

Objective: The onset of the COVID-19 (coronavirus disease 2019) pandemic mandated postponement of the in-person Vascular Surgery Board 2020 certifying examination (CE). Vascular surgery virtual CEs (VVCEs) were developed for the scheduled 2020 CEs (rescheduled to January 2021) and 2021 CEs (rescheduled to July 2021) to avoid postponing the certification testing. In the present study, we have reported the development, implementation, and outcomes of the first two VVCEs.

Methods: The VVCE was similar to the in-person format (three 30-minutes sessions, two examiners, four questions) but required a proctor and a host. In contrast to the general surgery VCEs, the VVCE also incorporated images. The candidates and examiners were instructed on the format, and technology checks were performed before the VVCE. The candidates were given the opportunity to invalidate their examination for technology-related reasons immediately after the examination. Postexamination surveys were administered to all the participants.

Results: The VVCEs were completed by 356 of 357 candidates (99.7%). The pass rates for the January 2021 and July 2021 examinations were 97.6% (first time, 99.4%; retake, 70%) and 94.7% (first time, 94.6%; retake, 100%), respectively. The pass rates were not significantly different from the 2019 in-person CE ($\chi^2 = 2.30$; $P = .13$; and $\chi^2 = 0.01$; $P = .91$, for the January 2021 and July 2021 examinations, respectively). None of the candidates had invalidated their examination. The candidates (162 of 356; 46%), examiners (64 of 118; 54%), proctors (25 of 27; 93%), and hosts (8 of 9; 89%) completing the survey were very satisfied with the examination (Likert score 4 or 5: candidates, 92.6%; noncandidates, 96.9%) and found the technology domains (Zoom, audio, video, viewing images) to be very good (Likert score 4 or 5), with candidate and other responder scores of 73% to 84% and >94%, respectively. Significantly more of the candidates had favored a future VVCE compared with the examiners (87% vs 32%; $\chi^2 = 67.1$; $P < .001$). The free text responses from all responders had commented favorably on the organization and implementation of the examination. However, some candidates had expressed concerns about image sizes, and some examiners had expressed concern about the time constraints for the question format. The candidates appreciated the convenience of an at-home examination, especially the avoidance of travel costs.

Conclusions: The two Vascular Surgery Board VCEs were shown to be psychometrically sound and were overwhelmingly successful, demonstrating that image-based virtual examinations are feasible and could become the standard for the future. (J Vasc Surg 2022;76:1398-404.)

Keywords: Board examination; Certification; Certifying examination; Virtual

The global COVID-19 (coronavirus disease 2019) pandemic has had profound effects on almost every aspect of life during the past 2.5 years, including the process of surgical board certification. The public health measures implemented and the restrictions on travel mandated cancellation of the Vascular Surgery Board (VSB) May 2020 certifying examination (CE). However, the VSB remained committed to continuing the certification process despite the challenges of the pandemic. They explored alternative options for both the qualifying examination and the CE, including a complete virtual format for the latter despite the inherent challenges of security and the increased information technology (IT) requirements. A series of pilot virtual CEs (VCEs) were conducted by the American Board of Surgery (ABS) for the general surgery certification

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process in mid-2020. The success of these initial pilot CEs and the lessons learned allowed the ABS to transition to a completely virtual format for the general surgery CE in the fall of 2020.[1] The VSB built on these initial experiences and implemented a complete VCE in January 2021, rescheduling the CE that had originally been scheduled for May 2020. This mandated a secure format to allow the candidates to review the images, unlike the previous general surgery experience, given the image-based nature of vascular surgery. The virtual format was also used for the 2021 annual CE, although the examination had been rescheduled from the traditional May period to July. The purpose of the present study is to describe the experience with the first two vascular surgery VCEs (VVCEs).

ARTICLE HIGHLIGHTS

- **Type of Research:** A prospective analysis of the Vascular Surgery Board's initial two virtual certifying examination (VCE) results and survey data
- **Key Findings:** The overall pass rates for the first two VCEs were comparable to those with the in-person format. The candidates, examiners, hosts, and proctors were all very satisfied with the process. The candidates favored the virtual format. In contrast, the examiners favored the in-person format. The initial two VCEs were shown to be psychometrically sound and were overwhelmingly successful.
- **Take Home Message:** The results of the present study have shown that the first two Vascular Surgery Board virtual certifying examinations were shown to be psychometrically sound and were overwhelmingly successful.

METHODS

Examination format. The overall objective of the virtual format was to reproduce the in-person experience and administer a psychometrically sound examination. Accordingly, the in-person format was maintained to the greatest extent possible. The candidates were given three sequential 30-minute examinations consisting of four questions per session lasting ~7.5 minutes each. These questions covered predefined subject areas spanning the gamut of vascular surgical practice defined by the blueprint for the specialty. The candidates were examined by two examiners per session, and these examiners graded each of the four individual question independently using a set scoring system (1, fail; 2, equivocal; 3, pass). The candidate scores were adjusted for examiner severity (ie, hawk vs dove) and then summed for a cumulative score. The cumulative score was then compared with a passing score to determine whether the candidate had passed the overall examination.

Virtual format modifications. Several changes were implemented to ensure the fidelity and security of the virtual format.[1,2] A proctor was assigned to each candidate to perform an immediate pre-examination security check and to monitor the candidate's desktop, environment, and behavior to identify any additional security-related issues. This included a room scan, having the candidates empty their pockets, and observing them turning off their mobile device. Additionally, the candidates had to share their desktop with the proctor and open up their task manager to prevent the candidate opening any additional programs. The process was structured such that each main room housed three candidates, three proctors, three pairs of examiners, and one host, who coordinated the flow of the candidates and examiners between the various examination "rooms" and served as a contact for any IT issues. The candidates were placed in a "breakout room" with their proctor, and the examiner pairs rotated through each of the three breakout rooms. Thus, each candidate was examined by six total examiners. All the examination material, including the specific questions and supporting materials, images, and grading scoresheets, were provided to the examiners in an electronic format at the examination, and the examiners were given the opportunity to review the questions and associated images in advance. However, all the electronic materials shared with the examiners were provided such that they could not be downloaded or printed and thus were not accessible after the examination, preserving the integrity of the materials for future examinations. The examiners were encouraged to record the candidates' scores on a separate piece of paper to serve as a backup in the event that a problem occurred with the electronic scoring system. All the examiners were instructed to continue the examination process alone in the event that any IT issues occurred with their co-examiner (eg, lost internet access). All the examinations were video recorded as a backup to allow the examiners to review the candidates' responses in the event they were unable to score the candidates in real time. These videos were destroyed before the release of the candidate scores. All candidates and examiners were required to complete a predefined IT assessment before the date of the examination to ensure they had the necessary computer support and internet access to complete the examination. All examiners were encouraged to have a dual monitor system to facilitate administration of the examination and simultaneous scoring. The candidates were given the option to invalidate their examination immediately after completion of the examination because of any IT-related issues.

Survey. The candidates and examiners completed a survey after both virtual examinations, and the proctors

and hosts completed the survey only after the first examination (January 2021). The survey included both closed- and open-ended questions about the process, including the check-in, security, IT (eg, audio, video, imaging sharing, electronic connection), expectations, overall satisfaction, and preference for future examinations (Supplementary Methods, online only). The questions were somewhat specific to the various groups of individuals according to their role in the process (eg, for the examiners, their ability to assess the candidates), although a fair amount of overlap was present for the more common issues (eg, video). The individuals completing the survey were asked to complete the closed-ended question using the Likert scale (1, very poor; to 5, excellent). The individuals completing the survey were also given the opportunity to provide free responses to the various open-ended components of the survey.

Statistical analysis. The passing rates for the two VCEs were compared to that of the 2019 in-person CE using the χ^2 test for independence, and $P < .05$ was defined as statistically significant. The closed-ended survey questions were aggregated and analyzed using descriptive statistics. The candidates' responses were compared to the examiners' and all noncandidates' responses using the χ^2 test. The responses to the open-ended questions were qualitatively explored to identify common themes and any pain points. The institutional review board at the University of Florida deemed the study to be exempt from review owing to its nature.

RESULTS

Of the 357 candidates, 356 (99.7%) had completed the two VVCEs. The single candidate who had not completed the examination had arrived late. This candidate was given the opportunity to reschedule later in the day but failed the initial security check. The overall fail rate for the two VCEs was 3.9% and was not significantly different from that of the in-person 2019 CE ($\chi^2 = 2.30$, $P = .13$; and $\chi^2 = 0.01$, $P = .91$, for the January 2021 and July 2021 examinations, respectively; Table I; Supplementary Table (online only)). None of the candidates had opted to invalidate their results because of any IT-related issues.

The survey results for the various components of the VCE are presented in Table II. The values reflect the percentage of responders who had stated that an individual component was either good or excellent (Likert scores 4 and 5). Approximately one half of the candidates (46%) and examiners (54%) had completed the survey compared with ~90% of the hosts (89%) and proctors (93%). The candidates and proctors responded that the check-in process was good or excellent in >90% of the surveys. The various components of the technology assessment, including the audio and video assessments, were rated as good or excellent by ≥80% of the candidates and noncandidates who had responded, with the notable exception of the ease of viewing the images by the candidates (73%). The hosts reported that the individual components of room management, including the breakout rooms and candidate identification were all good or excellent by 75% of those completing the surveys. The examiners reported that the case presentation and scoring were good or excellent in >85% of the responses. In addition, 89% of the examiners responded that they thought the format was good or excellent in terms of their ability to assess the candidates' judgment. Greater than 90% of the candidates and noncandidates responded that that their overall satisfaction for the delivery of the VCE was good or excellent in >90% of the surveys (Fig 1). A significantly larger percentage of the candidates who had completed the survey favored a virtual format for future CEs compared with the noncandidates (87% vs 32%; $\chi^2 = 67.1$; $P < .001$; Fig 2).

The open-ended comments from both the candidates and the examiners were consistent in reporting that the overall VCE was well organized, had met their expectations, and was fair. However, the candidates stated that the images were too small, and they complained about the inability to view the examiners on a larger screen. However, the candidates appreciated the convenience and cost-savings associated with not having to travel. The examiners believed that the time allotted to complete the individual questions (ie, four questions within 30 minutes) was challenging, and they suggested the inclusion of a time clock. The examiners also reported that they missed the in-person format, as noted previously.

DISCUSSION

The overall experience with the initial two VVCEs has demonstrated that the process is feasible, reliable, and, more importantly, allows for a fair assessment of the candidates in a secure format. The processes implemented in terms of IT checks, candidate and examiner check-ins, and the conduct of the virtual room flow all appeared to be effective and not particularly onerous. The learning curve for implementing the VCE was relatively brief, although perhaps not surprising in the COVID-19 era, with the widespread proliferation of electronic meetings.[1,3] The number of IT malfunctions was fairly small. However, it should be emphasized that these had been anticipated and that safeguards had been implemented to remediate them accordingly. These included recording the examination sessions for future review, having the hosts serve as a resource for any IT issues, instructing the examiners to continue solo in the event that their co-examiner lost virtual room access for whatever reason, and offering the candidates the opportunity to invalidate their scores because of any IT-related issues. A strong commitment was made to reproduce the in-person format and preserve the integrity of the

Table I. Certifying examination results for first-time and repeat candidates

Candidates	Total pass, No.	Total fail, No.	Difference, No.	Fail, %
2019				
All	179	169	10	5.6
First time	154	149	5	3.2
Retake	25	20	5	20.0
2020				
All	168	164	4	2.4
First time	158	157	1	0.6
Retake	10	7	3	30.0
2021				
All	188	178	10	5.3
First time	185	175	10	5.4
Retake	3	3	0	0.0

Table II. Likert score 4 and 5 (good and excellent) responses by individuals completing the survey

		Noncandidates, %			
Question	Candidates (46%),[a] %	All (63%)[a,b]	Examiners (54%)[a]	Hosts (89%)[a]	Proctors (93%)[a]
Check-in		NA	NA	NA	
Experience with host	97				NA
Experience with proctor	98				NA
Overall experience					92
Technology			NA	NA	NA
Ease of joining Zoom	85	96			
Ease of Zoom during VCE	84	96			
Audio quality	81	94			
Video quality	80	96			
Ease of viewing images	73				
Adequate training	NA	96			
Room management	NA	NA	NA		NA
Creating breakout sessions				75	
Admission to breakout sessions				75	
Verifying candidate				75	
Case presentation and scoring	NA	NA		NA	
Access virtual platform			92		NA
Presenting images			94		96
Sharing images			91		NA
Managing multiple screens			86		NA
Entering scores			94		NA
Assessing candidate's judgment			89		NA

NA, Not applicable; *VCE*, virtual certifying examination.
[a]Percentage of individuals completing the survey.
[b]The noncandidate percentages included the sum of the examiners', hosts', and proctors' responses.

process with the goal of assessing the candidates' clinical judgment, reasoning skills, and problem-solving abilities, with the ultimate objective of ensuring that they had the appropriate knowledge for certification and would be safe to practice. The examiners responded that they believed that the VCE format allowed them to adequately assess the candidates. Also, the overall pass rates were consistent with those from the preceding year. Finally, the process seemed to be secure, and no episodes of cheating or inappropriate behavior were

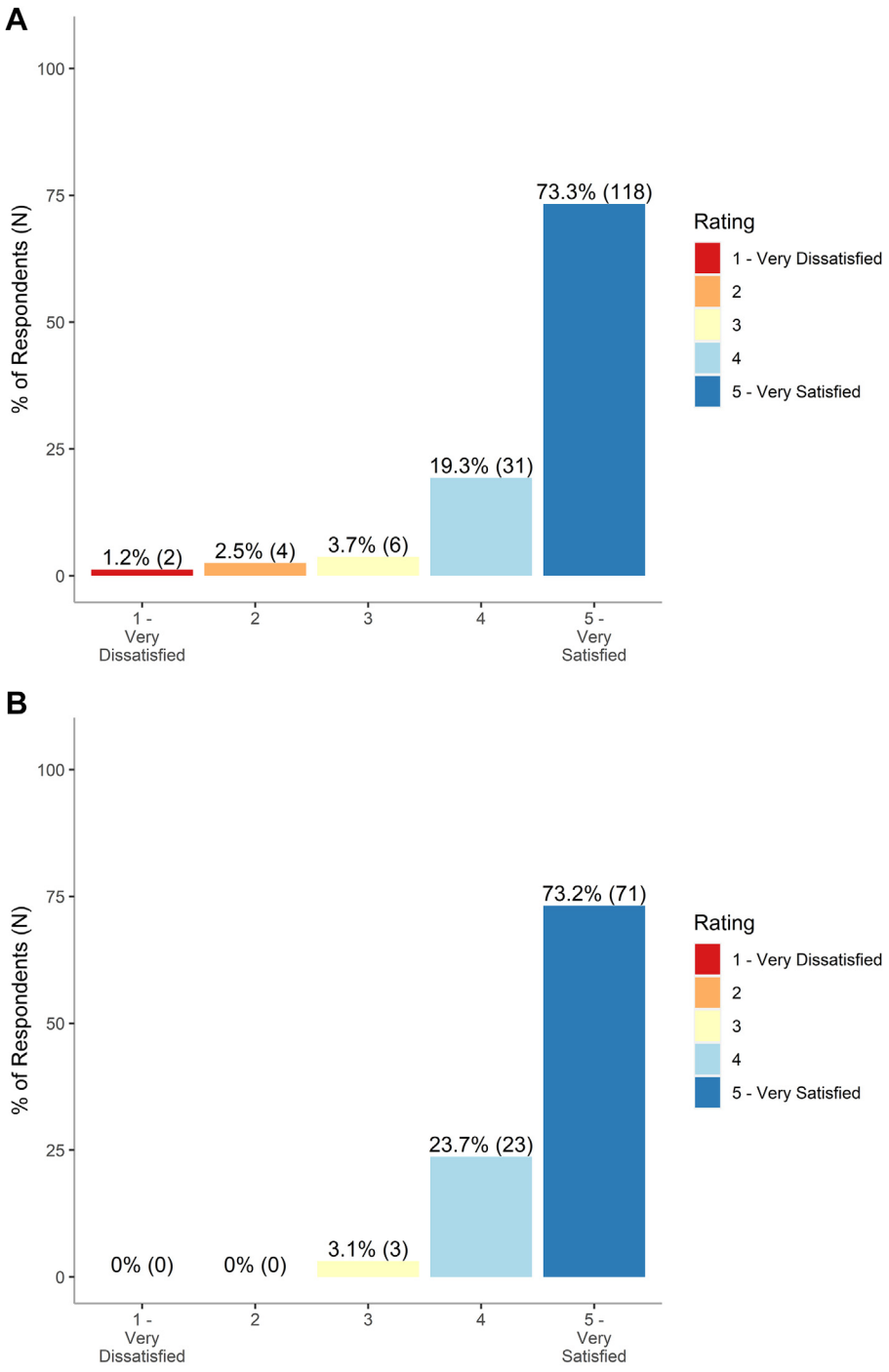

Fig 1. Survey response of candidates **(A)** and all noncandidates (**B** [ie, examiners, hosts, proctors]) to overall satisfaction for the virtual certifying examination (VCE) using a Likert scale (1 [very dissatisfied] to 5 [very satisfied]).

observed or reported. Admittedly, any episode of cheating would have been unacceptable and a direct violation of the professional standards of board certification.

The VVCEs were built on the initial experiences with the general surgery VCEs but necessitated the incorporation of images. Our successes have duplicated those with the general surgery VCE across all the various components surveyed and were consistent with the results reported for the two mock oral VCEs for vascular and general surgery trainees.[1,4,5] The incorporation of the images required both establishing a secure method for sharing the images and a mechanism by which the candidates could request additional images not provided in the initial stem. This required developing a strategy such

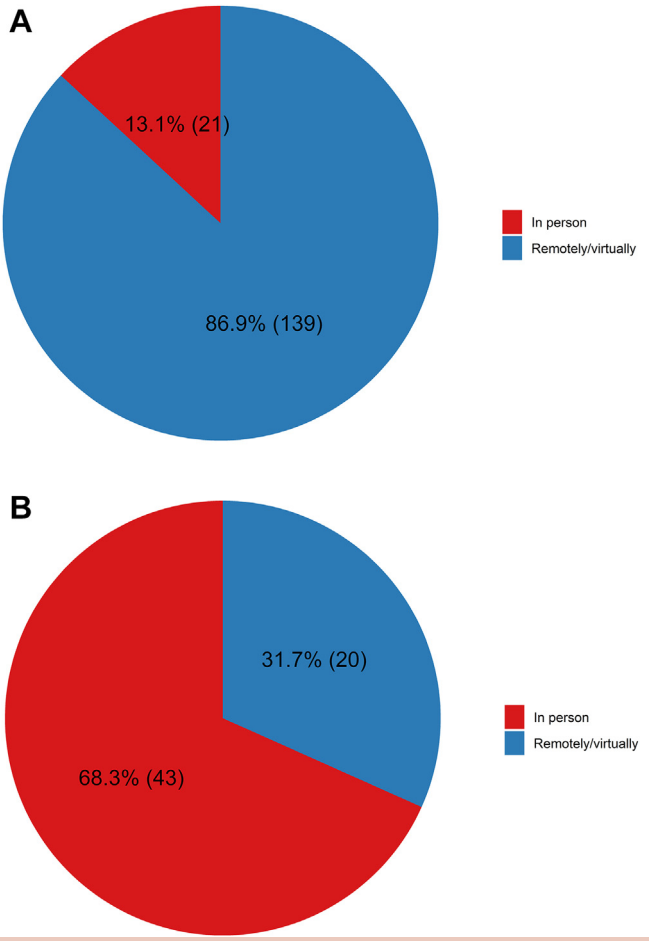

Fig 2. Survey response of candidates **(A)** and examiners **(B)** regarding their preference for the format of future certifying examinations (CEs) as defined by remote (virtual CE [VCE]) or in-person.

that they did not know whether any additional images were available for each question. Each of the images was assigned an unrelated name (eg, "zebra"), and the list of these was provided to the candidates, along with the stems. They were instructed to open the appropriate image using the term (eg, "open image zebra") when (or if) they had requested one of the available images. This process worked remarkably well and did not seem to require too much time, although some phonetic confusion had occurred during the initial examination (eg, "hot" vs "cot") that was remediated during the second VCE by using dissimilar, two-syllable terms.

The open- and close-ended survey questions provided important feedback on the conduct of the examination. The candidates stated after the first VCE that the images were too small and difficult to review. Despite this impression, it was possible to simply magnify the provided images using the Ctrl/+ commands on the keyboard. This information was provided to the candidates and examiners for the second VCE. However, it is important to emphasize that the vascular CE is an assessment of clinical judgment rather than image interpretation and, thus, the goal was to provide appropriate images to facilitate the appropriate decision making for patient care. The candidates also complained that the view of their examiners on their video screen was small and that it was difficult maintain eye contact and read their facial expressions. However, we could not remediate this issue owing to the necessary security concerns and IT requirements. The examiners expressed some concerns that it was difficult to finish the four questions during the 30-minute examinations (ie, 7.5 minutes per question). Several options were discussed after the first VCE in response to this issue (eg, extending the examination to 35 minutes). However, it was agreed to focus the stem and provide any necessary initial imaging to allow the examiners to move to the key management points of the question. This was designed to eliminate any routine, unnecessary questions and treatment plans such as "I would obtain a routine physical examination and complete blood count with a renal disease battery." The examiners did request that a desktop timer be included with the examination materials to optimize time management, but this has not been operationalized. The examiners echoed the candidates' concerns about the lack of direct contact and the inability to read any nonverbal clues owing to the virtual nature of the process.

It is not certain how these data should be used in terms of future in-person or virtual examinations. Everyone in the process (ie, candidates, examiners, hosts, proctors) was overwhelmingly satisfied with the process. However, a stark difference was found in the preferences for future examinations between the candidates and examiners. The benefits identified by the candidates were compelling and included significant costs savings from not having to travel and stay in a hotel and the overall reduced stress of being allowed to take the examination in a familiar environment in contrast to a hotel room. The examiners missed the social aspects of the examination, including the inability to reconnect with colleagues and establish relationships, similar to what we have all experienced during the past 2.5 years with the substitution of in-person society meetings with the virtual alternative. Although not analyzed in our study or the general surgery experience, a major cost reduction does not seem apparent from the perspective of the ABS.[1] The elimination of the costs associated with the examiners' travel and accommodations were offset by the need to hire additional personnel (ie, hosts and proctors) and the increased IT expenses. It is conceivable that these additional expenses will be minimized in the future because the initial IT expenses might not be recurring with each additional iteration of the VCEs. Furthermore, the practice-associated costs in terms of the lost revenues for both the examiners and the candidates

were clearly reduced because their time commitment was less (ie, 2 days vs 4 days for the examiners) without the requirement of traveling to an in-person testing site. The virtual format also affords the potential to improve the overall examination process, and it is conceivable that the inherent biases can be reduced further. All the examiners were required to take an implicit bias training course. The additional options include blurring the candidates' images, altering their voice, and/or having a separate group of examiners (instead of the ones administering the examination) score the candidates using the video recording or a transcription. These options are all consistent with the continued evolution of the CE and the goals to make it as fair, unbiased, and objective as possible, including standardization of the questions, psychometric analysis with the normalization of the examiners' scores according to their historic behavior, and refinement in the examiner education and selection process. Finally, the May 2022 vascular CE will be administered virtually; however, no decision has been made about the format of the 2023 CE.

Study limitations. The present study had the usual limitations of using survey data, including that not all the potential individuals had completed the survey, although the overall response rate was quite good. The survey questions had been evaluated by the VSB psychometricians but are potentially subject to bias. The hosts and proctors only completed the survey after the first VCE in January 2021, although we have no reason to suspect that their responses would have been different after the second examination because the process was similar and/or improved. Finally, it was impossible to quantify the open-ended questions, although we attempted to report the most common themes.

CONCLUSIONS

The initial two VSB VCEs were shown to be psychometrically sound and were overwhelmingly successful, demonstrating that an image-based virtual examination is feasible and could become the standard for the future.

AUTHOR CONTRIBUTIONS

Conception and design: TH, KB, JL, CB, BI, AJ, BP, GU
Analysis and interpretation: TH, KB, JL, CB, BI, AJ, BP, GU
Data collection: CB, BI, AJ
Writing the article: TH, KB, JL, CB, BI, AJ, BP, GU
Critical revision of the article: TH, KB, JL, CB, BI, AJ, BP, GU
Final approval of the article: TH, KB, JL, CB, BI, AJ, BP, GU
Statistical analysis: CB, AJ
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Overall responsibility: TH

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Additional material for this article may be found online at www.jvascsurg.org.

SUPPLEMENTARY METHODS (online only).

Virtual certifying examination surveys

Candidate survey

Candidate check-in and security check. When logging in, you were greeted by an American Board of Surgery (ABS) room host, who checked you in, and an examination proctor, who walked you through several security checks (eg, camera room scan).

Please rate your experience with the examination check-in process with your room host.
1 — Very poor 2 3 4 5 — Excellent

Please rate your experience with the security check process with your proctor.
1 — Very poor 2 3 4 5 — Excellent

Please provide any additional feedback on the check-in and security check processes, including any issues or difficulties you experienced. (Open-ended)

Technology. Please use this section to inform us about your experience with the technology used during the examination.

Please rate each of the following technical aspects of the remote examination delivery.

Ease of joining the remote examination via Zoom
1 — Very poor 2 3 4 5 — Excellent

Ease of using Zoom during the examination (eg, muting, screen share)
1 — Very poor 2 3 4 5 — Excellent

Audio quality of the remote session.
1 — Very poor 2 3 4 5 — Excellent

Video quality of the remote session.
1 — Very poor 2 3 4 5 — Excellent

Ease of accessing and/or viewing the images during the examination
1 — Very poor 2 3 4 5 — Excellent

Please provide any additional feedback on the technology-related aspects of the examination experience, including any issues or difficulties you experienced. (Open-ended)

Knowledge of cheating. Do you personally know of an example of a candidate cheating or attempting to cheat on a remotely administered, video-based ABS certifying examination (eg, recording an examination or obtaining unauthorized access to examination materials)? The ABS will NOT ask you to identify this individual.
Yes
No

General feedback. Please rate your overall satisfaction with the remote delivery of the certifying examination.
1 — Very dissatisfied 2 3 4 5 — Very satisfied

In what ways, if any, did your experience in the remote certifying examination differ from your expectations for the examination (eg, expectations based on previous examination experiences, tips from colleagues and/or faculty)? (Open-ended)

Please provide any additional feedback on any aspect of the remote delivery of the certifying examination that was not already captured in this survey. Please describe anything that went especially well or that could be improved. (Open-ended)

Given a choice, I would prefer to take any future oral examinations:
Remotely/virtually
In-person

Examiner, proctor, host survey

Candidate security check (proctors only). In your role as a room proctor, you were responsible for greeting the candidate and conducting several security checks (eg, camera room scan, candidate screen share, recording the session). Please use this section to inform us about this experience.

Please rate your experience with the security check process.
1 — Very poor 2 3 4 5 — Excellent

Please rate your experience with helping the candidate with the image share form.
1 — Very poor 2 3 4 5 — Excellent

Please provide any additional feedback on the check-in process, including any issues or difficulties you experienced. (Open-ended)

Room management (hosts only). As a host, you were responsible for managing the flow of the examination. Please use this section to inform us about this experience.

Please rate your experience with the following aspects of managing the room:

Creating breakout rooms to be used during the examination
1 — Very poor 2 3 4 5 — Excellent

Admitting proctors, candidates, examiners from the waiting room
1 — Very poor 2 3 4 5 — Excellent

Verifying candidate's identity (identification check)
1 — Very poor 2 3 4 5 — Excellent

Assigning candidates and proctors to breakout rooms
1 — Very poor 2 3 4 5 — Excellent

Assigning/reassigning examiners to candidate rooms and the examiner lounge throughout the examination.
1 — Very poor 2 3 4 5 — Excellent

Please provide any additional feedback on managing the flow of the examination, including any issues or difficulties you experienced. (Open-ended)

Examination schedule (examiners, proctors, hosts). Please use this section to provide feedback on the scheduling and timing of each day's examinations.

Please provide feedback on the amount of time scheduled for each of the following:

Breaks between candidates within an examination session
1 — Too short 2 — About right 3 — Too long

Breaks between the examination sessions
1 — Too short 2 — About right 3 — Too long

Lunch break
1 — Too short 2 — About right 3 — Too long

Overall length of each day
1 — Too short 2 — About right 3 — Too long

Technology. Please use this section to inform us about your experience with the technology used during the examination.

Please rate each of the following technical aspects of the remote examination delivery:

Ease of joining the remote session via Zoom
1 — Too short 2 — About right 3 — Too long

Ease of using Zoom during the examination (eg, muting, screen share)
1 — Too short 2 — About right 3 — Too long

Audio quality of the remote session.
1 — Too short 2 — About right 3 — Too long

Video quality of the remote session
1 — Too short 2 — About right 3 — Too long

The training I received (eg, orientation session, supporting instructions) adequately prepared me to use the technology to deliver the examination.
1 — Strongly disagree 2 3 4 5 — Strongly agree

Please provide any additional feedback on the technology-related aspects of the examination experience, including any issues or difficulties you experienced. (Open-ended)

Case presentation and candidate scoring (examiners only). Please use this section to inform us about your experience presenting the cases and scoring the candidates using the virtual certifying examination (CE) platform.

Please indicate the extent to which you agree with the following statements:

I was able to easily access the virtual CE platform during the examination
1 — Strongly disagree 2 3 4 5 — Strongly agree

The process of presenting cases using the virtual CE platform was simple
1 — Strongly disagree 2 3 4 5 — Strongly agree

The process of sharing images with candidates worked well
1 — Strongly disagree 2 3 4 5 — Strongly agree

The process of entering scores into the virtual CE platform was simple
1 — Strongly disagree 2 3 4 5 — Strongly agree

I was able to easily manage multiple windows (eg, Zoom, virtual CE platform) during the examination
1 — Strongly disagree 2 3 4 5 — Strongly agree

I was able to gauge the candidates' judgment through conversation, even with the transition to video
1 — Strongly disagree 2 3 4 5 — Strongly agree

Did you take written notes as the candidates answered?
Yes
No

Please provide any additional feedback on your experiences presenting cases and scoring the candidates, including any issues or difficulties you experienced. (Open-ended)

Examiner-specific events (examiners only). Please use this section to provide feedback on aspects of the examination specific to examiners.

Was the amount of time you had to prepare each morning in your examiner lounge
1 — Too short 2 — About right 3 — Too long

Do you have any other feedback on examiner-specific aspects of the examination, including tips for future examiners to make the examining process easier? (Open-ended)

General feedback (examiners, proctors, hosts). Please rate your overall satisfaction with the remote delivery of the certifying examination.
1 — Very dissatisfied 2 3 4 5 — Very satisfied

In what ways, if any, did your experience in the remote certifying examination differ from your expectations for the examination (eg, expectations based on previous examination experiences, tips from colleagues and/or faculty)? (Open-ended)

Please describe any pain points you experienced or observed others experiencing during the examination. These could be weak points in the process, points of confusion for the participants, and so forth. (Open-ended)

Please provide any additional feedback on any aspect of the remote delivery of the certifying examination that was not already captured in this survey. Please describe anything that went especially well or that could be improved. (Open-ended)

Given a choice, I would prefer to participate in any future oral examinations:

Remotely or virtually In-person

Supplementary Table (online only). Results of 2021 American Board of Surgery (ABS) survey of historic performance of vascular certifying examinations

Year	Total, No.	Pass, No.	Fail, No.	Fail, %
1986	104	75	29	27.9
1987	100	79	21	21.0
1988	119	96	23	19.3
1989	160	124	36	22.5
1990	161	126	35	21.7
1991	130	102	28	21.5
1992	126	103	23	18.3
1993	107	89	18	16.8
1994	109	79	30	27.5
1995	124	110	14	11.3
1996	105	83	22	21.0
1997	105	96	9	8.6
1998	99	79	20	20.2
1999	113	94	19	16.8
2000	109	106	3	2.8
2001	85	70	15	17.6
2002	120	99	21	17.5
2003	126	105	21	16.7
2004	121	106	15	12.4
2005	117	98	19	16.2
2006	121	101	20	16.5
2007	133	112	21	15.8
2008	114	107	7	6.1
2009	104	86	18	17.3
2010	145	127	18	12.4
2011	129	108	21	16.3
2012	159	135	24	15.1
2013	132	106	26	19.7
2014	152	135	17	11.2
2015	149	136	13	8.7
2016	171	151	20	11.7
2017	161	139	22	13.7
2018	185	159	26	14.1
2019	179	169	10	5.6
2020	168	164	4	2.4
2021	188	178	10	5.3