A Binational Need Assessment to Define the Level of Endovascular Expertise Required by Vascular Surgical Trainees

Rohan H.P. McLachlan, MD, BMS, MIPH,* Annette Burgess, PhD, MBT, MEd, MMedEd, BBusStud, MBioethics,† Timothy Wagner, MBBS, FRACS,‡ and Anthony J. Freeman, MBChB, FRACS, PhD†

*Faculty of Medicine and St George Hospital Clinical School, University of New South Wales, Sydney, NSW, Australia; †Faculty of Medicine and Health, The University of Sydney School of Medicine, Sydney, NSW, Australia; and ‡Department of Surgery, University of Melbourne, Melbourne, VIC, Australia

BACKGROUND: There has been a shift toward competency-based surgical education programs to improve trainee performance and achieve better patient outcomes. Endovascular procedures comprise a significant volume of vascular surgery, but the current methods for assessing the endovascular competence of vascular trainees in Australia and New Zealand are suboptimal. The objective of this study was to perform a need assessment to define the scope of endovascular expertise required by vascular surgical trainees to later aid in the development of novel surgical training assessment tools.

METHODS: A modified Delphi method was used to achieve expert consensus. Fifty-three key stakeholders in vascular surgical education and training (SET) in Australia and New Zealand were invited to take part in the 2-stage survey. Experts were asked which procedures they considered to be requisite for vascular surgery trainees and at which SET level competence should be achieved. The results were reiterated to the expert panel in the second stage, and consensus considered achieved if over 75% of experts were in agreement.

RESULTS: In the first stage 25 experts reached consensus that competence in 18 of the 26 procedures should be requisite for SET trainees. Twenty-two experts responded to the second stage and consensus was achieved for 12 out of 14 of the procedural items with mean percentage of experts in agreement being 90%.

CONCLUSIONS: A need assessment using a modified Delphi method has achieved consensus among experts in vascular surgery regarding the endovascular procedures considered to be requisite for vascular surgery trainees in Australia and New Zealand. (J Surg Ed 76:982–989. Crown Copyright © 2019 Published by Elsevier Inc. on behalf of Association of Program Directors in Surgery. All rights reserved.)

KEY WORDS: vascular surgery, surgical training, endovascular procedures, need assessment, competency-based education

COMPETENCIES: Medical Knowledge, Practice-Based Learning and Improvement, Patient Care, Systems-Based Practice

INTRODUCTION

The ability to successfully perform the required components of a surgical procedure is an essential component of being a proficient surgeon. This technical expertise is recognized as a core competency by the Royal Australasian College of Surgeons[1] because it has been shown to be paramount to patient safety and health including during vascular procedures.[2] Due to increasing limitations on surgical trainees' access to operative experience, we have seen a shift away from case-number dependent training toward competency-based surgical education programs.[3-5] Formative assessments in real time have been shown to improve the performance of vascular trainees and have become a key component of this new approach.[6] They are particularly useful for governing bodies such the Board of Vascular Surgery who are required to provide objective evidence that trainees are

Correspondence: Inquiries to Anthony J. Freeman, MBChB, FRACS, PhD, Faculty of Medicine and Health, The University of Sydney School of Medicine, Sydney, NSW, Australia; e-mail: anthony.freeman@sydney.edu.au

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performing at an appropriate level.[4] In addition, trainees expect transparent and unbiased assessment on a regular basis and objective formative assessments are useful tool for providing this.

Endovascular procedures have become more common and more complex, requiring a greater number of tools and techniques.[7-9] The current assessment of endovascular competence among vascular trainees in Australia and New Zealand is comprised of 3 tools; procedural logs, in-training assessment forms, and the direct observation of procedural skills (DOPS) assessment form. However, these are fraught with shortcomings. The procedural logs do not describe the degree of procedural understanding, trainee performance level or the quality of the procedure performance.[4] The in-training assessment form is based on the subjective opinion of senior colleagues and thereby not reliable across training hospitals. The DOPS form is not a vascular procedure-specific tool. Only 2 of its criteria judge procedural performance "*demonstrated knowledge of procedure'* and '*procedural or technical skills*" on a 3-point Likert scale. This results in a vague rating of performance rather than constructive feedback.

There is growing support within Australian and international institutions for more reliable and valid assessment of surgical trainees' competence in the operating theatre.[4,5,10] Competency-based education targets standardize an accepted level of proficiency to guarantee that all learners and trainees are competent at the completion of training. Clearly there is a need to develop tools that more effectively assess endovascular competence during vascular surgery training and establish an objective level of performance to be met as trainee's progress. The development of such tools requires an understanding of the level of endovascular expertise required from trainees as they progress through training.[11,12]

The objective of this study was to execute a need assessment across Australia and New Zealand to define the scope of endovascular practise expected of vascular trainees. Using a Delphi process we aimed to identify the endovascular procedures that experts considered requisite for trainees to be able to perform as well as the surgical education and training (SET) level at which they are expected to achieve competence in the various procedures.

MATERIALS AND METHODS

Study Design and Administration

A 2-stage Delphi method was employed to achieve expert consensus on the scope of endovascular procedures considered requisite for vascular surgery SET trainees. The Delphi method is a widely used and accepted process for achieving convergence of opinion by soliciting knowledge from experts within certain topic areas.[13,14] It is often used in need assessments by employing multiple iterations designed to develop a consensus of opinion regarding possible outcome alternatives.[15,16] The feedback process allows and encourages the selected Delphi participants to reassess their initial judgments by reviewing and assessing the comments and feedback provided by the other participants. Experts on the panel remain anonymous so that individual participants do not have a disproportionate influence over other participants or the end outcome.[13,17]

Each stage comprised of an electronic survey, collation of data ,and analysis of the results. Surveys were administered using the web-based program Survey Monkey (Palo Alto, California). Experts were invited to participate via an emailed link and remained anonymous throughout the process. Each stage closed after 2 weeks with 2 reminder emails sent to maximize response rates.

Participant Selection

Participants were selected with the aim of engaging key stakeholders in vascular surgical training throughout Australia and New Zealand. Surgeons invited to participate in the process included supervisors of training at hospitals with accredited vascular surgical SET trainees, members of the Board of Vascular Surgical Training, members of the Australia and New Zealand Society of Vascular Surgeons Executive and Vascular Surgeons appointed to the Royal Australasian College of Surgeons Court of Examiners. A total of 54 experts were identified, all of whom are practising vascular surgeons employed in both academic and nonacademic institutions.

Stage 1

A predetermined list of 26 endovascular procedures relevant to vascular training was derived from the current procedural logbook required to be completed by all vascular SET trainees. For each procedure participants were asked the question: *"Vascular surgery trainees should be able to perform the following procedure without direct supervision and be able to troubleshoot common issues by the completion of which SET level?"* and could select a response from SET 1 to SET 5 or alternatively "trainees do not need to be competent in independently performing this procedure by the completion of training." Participants were also asked an open-ended question to identify any additional procedures not captured by the predetermined list.

Procedures were included in the next stage if over 75% of experts agreed that trainees should achieve

competence during a given SET year or during previous years. Over 75% is a commonly accepted cut-off for consensus in Delphi studies[18] and has been widely adopted in medical research on a global scale.[19-24] Based upon comments from experts, some procedures were merged into a single item and where appropriate, other suggestions from experts were incorporated into the second stage. A list of procedures that SET trainees should be able to perform was thereby established.

Stage 2

For each procedure on the list the percentage of experts who thought competence should be achieved by a particular SET level was calculated and this information provided to the experts. Experts were then asked whether they agreed or disagreed that competence in these procedures should be achieved by the respective SET level. If over 75% of experts agreed that trainees should achieve competence by the prescribed SET level the procedure was considered as representing the level of competence expected for that SET level.

Statistical Analysis

Cronbach's α was chosen to assess internal validity and confirm consensus. A Cronbach's α of >0.8 is an accepted value for internal reliability in most studies and >0.9 is regarded as necessary for clinical application.[25,26]

RESULTS

Twenty-five out of 53 (47%) experts responded to the first stage. The Cronbach's α value for the first stage was 0.92. The results of both stages are illustrated in Figure 1. Eighteen of the 26 procedures achieved consensus as being requisite for SET trainees and 8 were excluded from the second stage. For those procedures reaching consensus, the mean percentage of experts in agreement was 86%. Of the 8 excluded procedures (Table 1), the mean percentage of experts who believed competence was not requisite was 64%. Eight procedures were merged into a single item after the first stage resulting in a preliminary list of 14 procedural items for the second stage. Based upon the stage 1 data, 2 procedures were considered potentially requisite for SET 3 trainees, 4 for SET 4 trainees, and 8 for SET 5 trainees.

Twenty-two experts responded to the second stage. Consensus was achieved for 12 out of 14 of the procedural items. For these items the mean percentage of experts in agreement was 90% (range 77-95) suggesting that when consensus was achieved, it was achieved convincingly. The 2 procedures that did not achieve consensus were (1) endovascular management of iliac aneurysmal disease (including internal iliac embolization and performing an iliac branch device) by SET 5 and (2) performing a renal or mesenteric stent for ostial stenosis by SET 5. Experts who disagreed that these 2 procedures are requisite for trainees stated that achieving competence should be expected after training, such as during fellowship.

A final list of 12 endovascular procedures that are considered requisite for trainees, and the SET level at which competence is expected to be demonstrated is shown in Table 2.

DISCUSSION

Using a modified Delphi method, experts in vascular surgery across Australia and New Zealand have reached consensus on the endovascular procedures that SET trainees are expected to be able to perform, and at which stage in their training competence should be achieved. As the paradigm in surgical education shifts toward competency-based programs, it is essential to identify which procedures should be used for technical milestone assessments.[27] The assessment tools currently in use are blunt and subjective. They are particularly ineffective when applied to endovascular procedures because they were initially designed for open surgery and as a result do not interrogate endovascular-specific techniques or troubleshooting. Given that endovascular procedures now comprise the majority of the cases performed by vascular surgeons,[8,28] there is a need to define the scope of expectation in endovascular training so that targeted, objective tools can be developed to assess a trainee's technical expertise in these types of procedures.

Despite the initial response rate being low, having a relatively large panel engaged in this study across a geographically diverse catchment (Fig. 2) substantiates the consensus achieved, as does the high retention rate for the second stage. The Cronbach's α value of 0.92 suggests a high level of consistency in responses by participants and reflects an internally valid study appropriate for clinical application. When consensus was achieved, the agreement among experts was often close to unanimous and nonconsensus was just as convincing. This reflects that even among a varied group of experts with differing practises, there is an almost universal opinion regarding expectations of vascular trainees. These high rates of agreement confer clinical significance to the final list of prioritized procedures. The final list is comprised of a diverse group of procedures that incorporate venous and arterial interventions, acute and chronic diseases, diagnostic procedures and management of complications, as well as exhibiting great anatomical

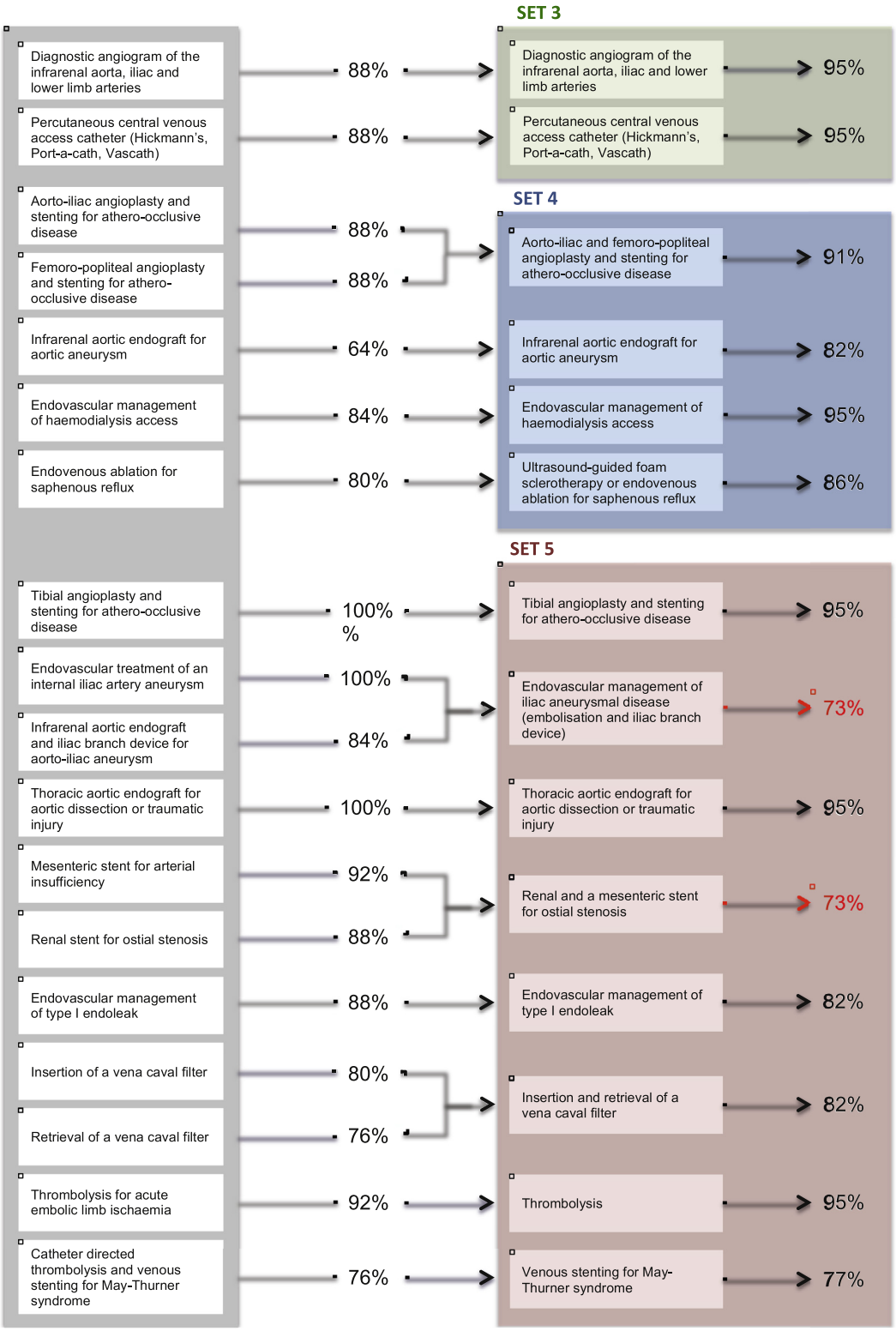

FIGURE 1. Overview of the Delphi process. Stage 1 procedures achieving consensus in the left column are assigned with the percentage of experts who thought competence should be achieved by the respective SET level. The right column contains procedures included in stage 2 and the percentage of experts who agreed that competence should be achieved by either SET 3 (green), SET 4 (blue), or SET 5 (red). Two procedures did not achieve consensus in stage 2 and were therefore excluded from the final list.

TABLE 1. List of Procedures Not Reaching Consensus at Each Stage and the Percentage of Experts Who Did not Think Competence was Requisite (by Respective SET Level)

Excluded Stage 1	**% of Experts Choosing to Exclude**
Retrograde infrainguinal arterial endovascular interventions	28
Atherectomy for athero-occlusive disease	56
Fenestrated aortic endograft for a juxtarenal abdominal aortic aneurysm	64
Branched aortic endograft for a thoracoabdominal aortic aneurysm	88
Parallel chimney grafting for aortic aneurysm	68
Endovascular management of type II endoleak	48
Extracranial carotid stent for symptomatic internal carotid stenosis	60
Mesenteric angiography and intervention for gastrointestinal bleeding	96
Excluded Stage 2	
Endovascular management of iliac aneurysmal disease (including internal iliac embolisation and performing an iliac branch device)	27
Renal and a mesenteric stent for ostial stenosis	27

diversity. The list of prioritized procedures captures most of the core endovascular techniques and skills required by any proficient vascular surgeon.

The number of procedures ascribed to specific SET levels reflects the expected progression of trainees as they learn how to perform endovascular procedures. No procedures were thought to be requisite for SET 1 and SET 2 trainees. This is a time period in which trainees are newly exposed to endovascular techniques and usually operate under close supervision. By SET 3, experts agreed that trainees should be competent in diagnostic angiogram of the infrarenal aorta, iliac and lower limb arteries, as well as percutaneous central venous access catheters. Compared to more complicated endovascular procedures, these procedures require less time, with fewer number of steps. They demand an understanding of fewer instruments and endovascular techniques, and are often deemed to be safer with less serious complications. As trainees progress they are expected to become competent in a greater number of endovascular procedures each year. The complexity and difficulty of these procedures also increases (Fig. 1 and Table 2).

TABLE 2. Final List of Endovascular Procedures Considered Requisite by Rxperts

Set 3
Diagnostic angiogram of the infrarenal aorta, iliac and lower limb arteries
Percutaneous central venous access catheter (Hickmann's, Port-a-cath, Vascath)
Set 4
Aorto-iliac and femoro-popliteal angioplasty and stenting for athero-occlusive disease
Endovascular management of haemodialysis access
Infrarenal aortic endograft for aortic aneurysm
Ultrasound-guided foam sclerotherapy or endovenous ablation for saphenous reflux
Set 5
Tibial angioplasty and stenting for athero-occlusive disease
Thrombolysis
Thoracic aortic endograft for aortic dissection or traumatic injury
Endovascular management of type I endoleak
Perform venous stenting for May-Thurner syndrome
Insertion and retrieval of a vena caval filter

The procedures that did not reach consensus in the first stage are more complex or less frequently performed. In the second stage, experts did not agree that trainees should achieve competence in performing endovascular management of iliac aneurysmal disease by SET 5. This likely reflects the complexity of the procedure with an increasing number of steps, more devices and increased operative times needed in comparison to a standard endovascular repair of infrarenal aortic aneurysm, for example.[29,30] The other procedural item that did not achieve consensus in the second stage was performing a renal or mesenteric stent for ostial stenosis. Possible reasons for these procedures not being prioritized could be the low case numbers leading to insufficient exposure of trainees in order to gain competence or that the stakes of these procedures are high with visceral injury difficult to reverse and often resulting in very poor outcomes. Experts believed that achieving competence in these more complex procedures is expected after SET training, during fellowship.

Consensus on the scope of endovascular procedures that vascular trainees are expected to be competent in provides a foundation for developing more robust technical milestone assessment tools. A shift away from the generic DOPS form that is designed to assess open surgery toward an endovascular-specific global rating scale would be the next step. A universal tool individualized for each of these index procedures would be most

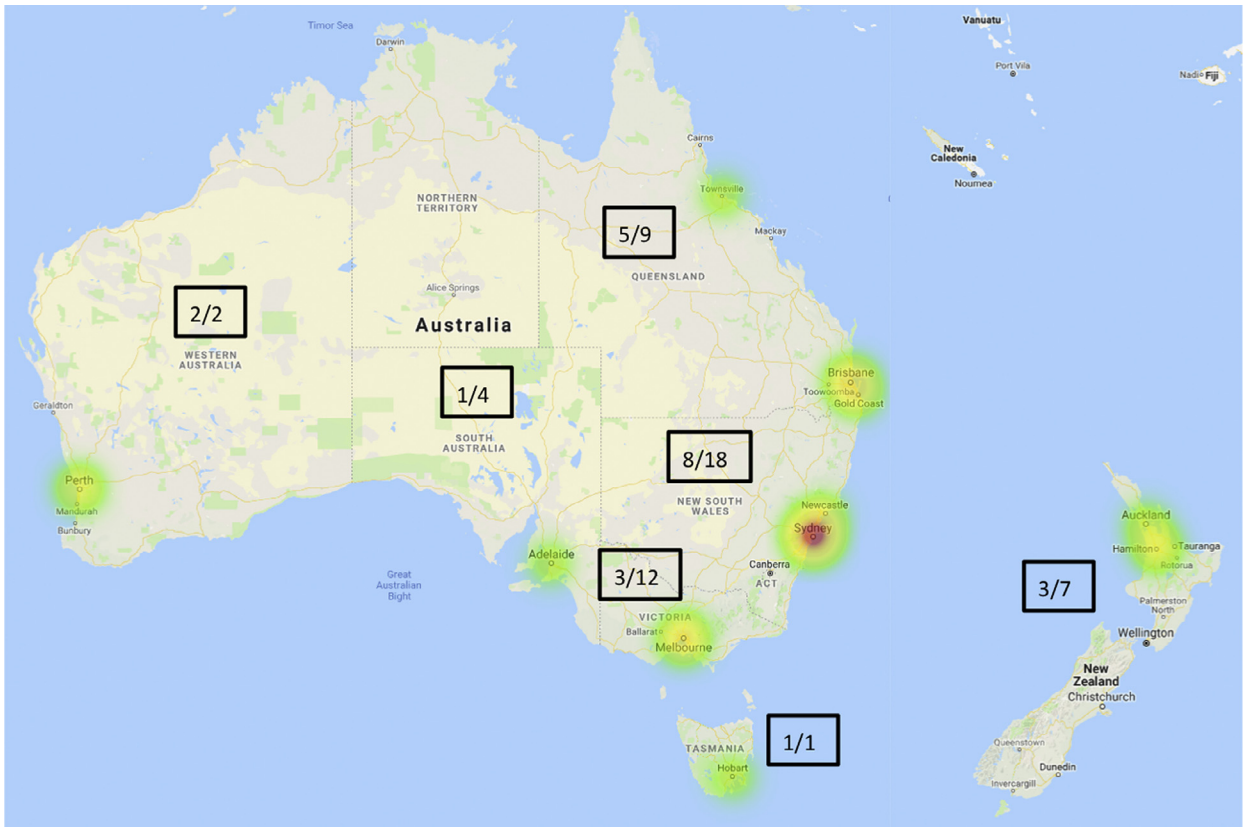

FIGURE 2. Geographical map demonstrating the response rates of invited experts. The heat map illustrates the density of responders. The numbers of experts who were invited and who responded are provided for each state and New Zealand. From *Map data ©2018 GBRMPA, Google*.

appropriate with trainees expected to demonstrate competence by the respective SET level. Such a tool has already been developed to assess competence specifically in endovascular infrarenal aortic aneurysm repair, although this has not been validated in a clinical setting.[31] Valid and reliable performance standards would have to be established for these novel tools.

LIMITATIONS

We acknowledge that this study has some limitations, notably that it is a binational need assessment and does not reflect the opinions or practises of the international vascular surgery community. This may limit the transferability of any assessment tools subsequently developed beyond Australia and New Zealand. We had a relatively low initial response rate and lost 3 experts in the second stage. Twenty-two respondents is an acceptable figure with most panels comprising 15 to 20 experts[32] and although the reliability of the Delphi method increases with more participants no minimum has been established.[15,33,34] Our study does not take into consideration the frequency with which certain endovascular procedures are performed. Although experts may expect trainees to be able to perform a particular procedure, depending on their previous placements individuals may not have had adequate exposure to learn and prove their competence. Stenting for May-Thurner syndrome may be an example of this.

CONCLUSIONS

There is a need to develop better competency-based assessment tools for endovascular procedures. In this binational need assessment, experts have reached consensus on the endovascular procedures that vascular trainees are expected to be competent in performing. These procedures could be targeted for the development of novel assessment tools to be used in the future.

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