**Appendix 5.**

Recommendations for training arising from the PERSEUS Delphi Consensus process

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| Statement | Median score | DI | |
| **Section 1 - Generic learning/training objectives**  **At the completion of their training the practitioner should be able to demonstrate:** | | |
| Knowledge of what ultrasound is and how it is generated | 9 | 0.132 | |
| An understanding of the relationship between frequency used, image quality and tissue penetration | 9 | 0 | |
| Knowledge of the biological effects and safety of ultrasound | 8 | 0.137 | |
| An understanding of the basic principles of real time and Doppler ultrasound including colour flow and power Doppler | 8 | 0.137 | |
| Selection of the most appropriate transducer for different examinations | 9 | 0 | |
| Adjustment of ultrasound machine settings to optimise Image quality | 9 | 0 | |
| Adjustment of transducer pressure, alignment, rotation and tilting to optimise Image quality | 9 | 0 | |
| Identification of arteries, veins, nerves, tendons, muscle and fascia, bones and air-filled spaces | 9 | 0 | |
| Recognition of common artefacts and provide an explanation of how they occur | 9 | 0 | |
| An understanding of in-plane and out-of-plane needle visualisation techniques | 9 | 0 | |
| Knowledge of the benefits and limitations of in-plane and out-of-plane techniques | 9 | 0 | |
| The capability to minimise unintended transducer movement during needle visualisation | 9 | 0 | |
| The capability to maintain visualisation of the needle shaft and tip during in-plane techniques | 9 | 0 | |
| The capability to visualise the needle tip during out-of-plane techniques | 9 | 0 | |
| That they can record ultrasound images | 9 | 0.292 | |
| An understanding of the principles of patient information, consent and preparation for ultrasound guided procedure | 9 | 0.046 | |
| Understanding the importance of practising within their own level of competence | 9 | 0 | |
| Procedures to minimise the risks of incorrect-site interventions | 9 | 0 | |
| Procedures to minimise cross-infection from ultrasound equipment | 9 | 0 | |
| The capability to perform ultrasound guided procedures under sterile condition | 9 | 0 | |
| An understanding of the value and techniques of continual personal audit for quality assurance and improvement | 9 | 0.046 | |
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| **Section 2 - Learning & assessment methods for generic competencies** | | |
| Learning and assessment methods should be tailored to learning objectives | 9 | 0 | |
| Certificating organisations should decide learning and assessment methods for each learning objective | 8 | 0.187 | |
| Training course organisers should be able to request approval for proposed learning and assessment methods from the ESA or relevant national societies. | 8 | 0.299 | |
| Training and successful assessment in a teaching laboratory simulation environment is essential before the practitioner undertakes US guided procedures on patients | 9 | 0.187 | |
| Assessment of competence to perform practical procedures is best undertaken using a global rating score added to a checklist of the individual components of the task | 9 | 0.132 | |
| Before attempting their first directly supervised ultrasound guided intervention the practitioner should have observed 5 ultrasound guided procedures and performed 5 ultrasound scans on patients scheduled for ultrasound guided procedures | 7.5 | 0.292 | |
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| **Section 3 - Specific learning/training objectives for US guided vascular access.**  **At the completion of their training the practitioner, in addition to achieving the generic objectives, should be able to demonstrate:** | | |
| Knowledge of the sectional and ultrasonic anatomy of the neck, axillary/subclavian veins, arm (basilic vein), groin/femoral triangle, forearm (radial artery) | 9 | 0 | |
| That they can recognise vascular pathology using ultrasound e.g. vessel patency, occlusion, deep venous thrombosis, arterial thrombosis, pseudo aneurysm, arteriovenous fistula | 7.5 | 0.200 | |
| Capability to use techniques to augment the size of different veins | 9 | 0 | |
| Proper selection of the catheter/vein ratio | 9 | 0 | |
| Identification of the intravascular location of guide wire and catheter tip | 9 | 0 | |
| Techniques for catheter tip navigation | 9 | 0.132 | |
| Pleural and lung ultrasound techniques for ruling out complications of central venous access | 8.5 | 0.187 | |
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| **Section 4 - Training & assessment methods for US guided vascular access** | | |
| Before attempting their first directly supervised attempt for each ultrasound guided vascular access procedure the practitioner should have observed 5 ultrasound guided procedures of that type and performed 5 ultrasound scans on patients scheduled for that ultrasound guided procedure | 9 | 0.132 | |
| The practitioner undergoing training in US guided vascular access should maintain a logbook that documents every procedure they perform | 8 | 0.200 | |
| For each ultrasound guided vascular access procedure the practitioner should be directly observed for at least 5 ultrasound guided procedures of that type before they perform the procedure unsupervised. | 9 | 0.187 | |
| For each ultrasound guided vascular access procedure the practitioner should be signed off as competent for that procedure by an expert trainer using a global rating scale before they perform the procedure unsupervised. | 8.5 | 0.187 | |
| To be eligible for completion of competency-based training in paediatric US guided vascular access the practitioner should have performed 30 US guided vascular access procedures of any type in a 12 month period | 7.5 | 0.467 | |
| To be eligible for completion of competency-based training in US guided vascular access cumulative summated outcomes for key performance indicators should be within the tolerance limits of expert practice standards. | 9 | 0.046 | |
| Competence in US guided vascular access for eligible practitioners will be signed off if they achieve satisfactory global rating scores following direct observation of a procedure by an expert trainer | 8 | 0.187 | |
| Maintenance of competence in US guided vascular access will require cumulative summated outcomes for key performance indicators to be within the tolerance limits of expert practice standards | 8 | 0.292 | |
| Maintenance of competence in US guided vascular access will require evidence of regular continuing professional development activities relevant to US guided vascular access | 8 | 0.137 | |
| Maintenance of competence in US guided vascular access should be based on performance indicators only and not number of procedures | 9 | 0.132 | |
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| **Section 5 - Performance indicators for US guided vascular access procedures.**  **The following are useful performance indicators for US guided vascular access:** | | |
| First-time puncture rate | 8.5 | 0.132 | |
| Successful completion of procedure within 30 minute | 8 | 0.164 | |
| Total procedural time | 7.5 | 0.271 | |
| Incidence of major complications | 9 | 0 | |
| Incidence of all complication | 9 | 0.046 | |
| Patient satisfaction | 8 | 0.29 | |
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| **Section 6 - Criteria for defining an expert trainer in US guided vascular access.**  **An expert trainer in US guided vascular access must be able to demonstrate** | | |
| One year of independent practice in US guided vascular access following completion of competency-based training, or | 8 | 0.361 | |
| Continuous independent practice in US guided vascular access for at least 3 years and which began before the introduction of competency-based training ("Grandfather" clause) | 9 | 0.137 | |
| Cumulative summated outcomes for key performance indicators to be within the tolerance limits of expert practice standards | 8.5 | 0.187 | |
| Evidence of regular continuing professional development activities relevant to US guided vascular access and education/training | 8 | 0.093 | |
| For paediatric practice, should meet relevant national criteria for maintaining practice privileges as specialist paediatric anaesthesiologist in children from the relevant age group (neonate, infant, toddler, older child) | 8 | 0.132 | |
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| **Section 7 - Specific learning/training objectives for US guided regional anaesthesia.**  **At the completion of their training the practitioner, in addition to achieving the generic objectives, should be able to demonstrate:** | | |
| Knowledge of the sectional and ultrasonic anatomy of the brachial plexus and its branches, sciatic nerve & its branches, femoral nerve and its branches, vertebral column and epidural space, paravertebral space, anatomy relevant to truncal blocks | 9 | 0 | |
| That they can recognise relevant variant anatomy using ultrasound e.g. anatomical relations of nerves, branching of nerves, abnormal nerve morphology, perineuronal blood vessels | 9 | 0.089 | |
| Supplementary techniques to confirm needle tip location | 9 | 0 | |
| Knowledge of perineural catheter techniques | 9 | 0.089 | |
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| **Section 8 - Training & assessment methods for US guided regional anaesthesia** | | |
| Before attempting their first directly supervised attempt for each ultrasound guided regional anaesthesia procedure the practitioner should have observed 5 ultrasound guided procedures of that type and performed 5 ultrasound scans on patients scheduled for that ultrasound guided procedure. | 9 | 0.132 | |
| The practitioner undergoing training in US guided regional anaesthesia should maintain a logbook that documents every procedure they perform | 9 | 0.132 | |
| For each ultrasound guided regional anaesthesia procedure the practitioner should be directly observed for at least 5 ultrasound guided procedures of that type before they perform the procedure unsupervised. | 9 | 0.132 | |
| For each ultrasound guided regional anaesthesia procedure the practitioner should be signed off as competent for that procedure by an expert trainer using a global rating scale before they perform the procedure unsupervised. | 9 | 0.132 | |
| To be eligible for completion of competency-based training in US guided regional anaesthesia the practitioner should have performed 50 US guided regional anaesthesia procedures of any type in a 12 month period | 8 | 0.48 | |
| To be eligible for completion of competency-based training in US guided regional anaesthesia cumulative summated outcomes for key performance indicators should be within the tolerance limits of expert practice standards. | 8 | 0.132 | |
| Competence in US guided regional anaesthesia for eligible practitioners will be signed off by satisfactory global rating scores following direct observation of a procedure by an expert trainer. | 8 | 0.132 | |
| Maintenance of competence in US guided regional anaesthesia will require cumulative summated outcomes for key performance indicators to be within the tolerance limits of expert practice standards | 8 | 0.132 | |
| Maintenance of competence in US guided regional anaesthesia will require evidence of regular continuing professional development activities relevant to US guided regional anaesthesia | 8 | 0.164 | |
| Maintenance of competence in US guided regional anaesthesia should be based on performance indicators only and not number of procedures | 8 | 0.122 | |
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| **Section 9 - Performance indicators for US guided regional anaesthesia procedures.**  **The following are useful performance indicators for US guided regional anaesthesia:** | | |
| Successful block rate (no supplementation) | 8 | 0.132 | |
| Rate of conversion to unplanned general anaesthesia | 8.5 | 0.132 | |
| Completion of procedure within 30 minutes | 8 | 0.187 | |
| Total procedural time | 8 | 0.292 | |
| Incidence of major complications | 9 | 0 | |
| Incidence of all complications | 9 | 0 | |
| Patient satisfaction | 8 | 0.187 | |
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| **Section 10 - Criteria for defining an expert trainer in US guided regional anaesthesia.**  **An expert trainer in US guided regional anaesthesia must be able to demonstrate:** | | |
| One year of independent practice in US guided regional anaesthesia following completion of competency-based training, or | 8 | 0.129 | |
| Continuous independent practice in US guided regional anaesthesia for at least 5 years and which began before the introduction of competency-based training | 7.5 | 0.499 | |
| Cumulative summated outcomes for key performance indicators to be within the tolerance limits of expert practice standards | 9 | 0.132 | |
| Evidence of regular continuing professional development activities relevant to US guided regional anaesthesia and education/training | 8 | 0.290 | |
| Completion of 50 US guided regional anaesthesia procedures per year | 9 | 0.132 | |

Legend: MAS 7-9: appropriate DI <1 indicates consensus