Accreditation in Adult Critical Care Echocardiography (ACCE)

Information Pack

This pack is for the use of all candidates undergoing the accreditation process and becomes effective as of

25th April 2023

This document supersedes all previous versions

This document is a guide to completing BSE ACCE accreditation

Submission and assessment criteria are included

Contents

Welcome message from Chair of Accreditation

Dear Candidate,

Welcome to the British Society of Echocardiography (BSE). The process underlying accreditation is set up to assist the echocardiographer in training with the ultimate aim of achieving and maintaining a high standard of clinical echocardiography for the benefit of our patients.

The Adult Critical Care Accreditation (ACCE) process represents a joint venture between the BSE and the Intensive Care Society (ICS) and is primarily offered as a service to the members of both these specialist societies. It is designed to accommodate the requirements of those working within the Critical Care environment.

The accreditation process is regulated to ensure a high level of proficiency and professional standard. We aim to make it possible for as many members to achieve accreditation. A list of accredited members is maintained on the BSE website.

Please let us know if we can assist you in this process or if you have constructive feedback to offer the accreditation committee; please just get in touch.

Good luck with your accreditation process.

Best wishes,

Sadie Bennett

Chair, BSE Accreditation Committee

Introduction & aims

- Accreditation is run as a service for members of the BSE and is not a compulsory or regulatory certificate of competence or excellence.

- Accredited members are expected to be able to perform and report echocardiographic studies unsupervised.

- The Accreditation process comprises two parts: a written theory examination and a practical assessment. Further information for both is available within this pack.

- Accreditation is a minimum requirement and cannot be regarded as a guarantee of competence.

- Echocardiography skills can only be maintained by continued education and practical involvement in echocardiography. The importance of this is underlined by limiting accreditation to five years, after which reaccreditation must be sought. Further details surrounding reaccreditation can be found on the BSE website.

Summary of process requirements

- The candidate must be a member of the BSE.

- The candidate must have a designated mentor to assist them through the accreditation process.

- The accreditation process has two compulsory elements: A written theory examination and a practical assessment. Both elements need to be passed in order to become an accredited member.

- The written theory exam compromises two parts: A multiple-choice question (MCQ) theory section and a "best answer" image reporting section.

- The practical assessment compromises three parts: A logbook, a practical scanning assessment and a viva assessment of five patient case studies.

- The candidate must pass the written assessment before registering to attend the practical assessment.

- The logbook should be collected over a period of no more than 24 months from the written examination.

- Any queries regarding the accreditation process should be addressed to: BSE Accreditation Department, contact details and registrations are available on www.bsecho.org. **Tel:** 0208 065 5794 (operating hours **09:00 -17:00 Monday-Friday**, excluding UK public holidays), **email:** accreditation@bsecho.org.

Exam fees

- A fee of £275 is charged for the complete accreditation process. This fee is payable in advance upon registration for the written section of the examination and covers the practical assessment. There is a non-refundable booking fee of £25 to pay upon registering for a secured placement at the practical assessment.

- Candidates who are unsuccessful in the written section of the examination will be charged a reduced fee of £137.50 to re-sit this section. This reduced fee only applies to candidates who

re-sit the examination within two sittings of the unsuccessful attempt (i.e. within 12 months of an unsuccessful attempt).

- Candidates are entitled to one re-attempt at the practical assessment. A re-attempt at the practical assessment is subject to an additional fee of £137.50.

Extensions and appeals

Extensions to the 24-month deadline may be granted per the extensions policy. Extension requests forms must be submitted **before the submission deadline.** Extension request information and forms (along with all other BSE application forms) can be found at www.bsecho.org. Requests received after the case deadline may not be granted.

Candidates can appeal the decision on a practical assessment. There is no appeals process for the written section of the examination. Further information can be accessed via www.bsecho.org.

Mentor

- A mentor is an experienced echocardiographer who can successfully guide a candidate through the BSE accreditation process. If the mentor is BSE accredited, this is an advantage but not essential.
- The mentor should have a clear understanding of the accreditation process including the training syllabus (see Appendix 1) and all relevant assessment criteria (see remainder of this accreditation pack for more details).
- The mentor must assess the candidate's ability to undertake an echocardiogram to a proficient level. Once a proficient level of ability is achieved the mentor must complete the curriculum-based competency tool and the mentor statements. These can be accessed and completed via the online logbook portal. The curriculum-based competency tool can also be found in Appendix 2.
- Candidates who cannot find a mentor should contact us; we will try our best to help source a suitable mentor.
- Candidates who cannot find a mentor should contact us; we will try our best to help source a suitable mentor. Alternatively, candidates can reach out to local BSE representatives, please visit the Governance, committees section of www.bsecho.org.

Details of the written theory examination

- The full training syllabus for this accreditation process is available in Appendix 1. A recommended reading list is available in Appendix 3.
- The written exam is held twice a year, usually in the Spring and Autumn. The examinations are held at various Pearson VUE centres across the UK, Republic of Ireland, and some overseas locations. Dates and online registration are announced on the written assessment section of BSE website. Further information on registrations for the written examination can be found in Appendix 4.
- The written examination has two parts, an MCQ theory section and an image reporting section. In order to pass the written examination overall, it is necessary to pass both parts at the same exam sitting.
- The pass mark for the MCQ is 70%, the image reporting section is 60%. These may vary slightly at the discretion of the Accreditation Chair following moderation.
- There is no bar to re-sitting the written examination any number of times.

- Accreditation is awarded once a candidate has also successfully completed the practical assessment. Satisfactory performance at the written assessment alone does not allow 'partial accreditation.'

Multiple-choice section

- Consists of 25 questions that must be answered within 60 minutes.

- Questions are designed to test the knowledge of echocardiographic findings and the physics of ultrasound.

- Each question comprises a brief statement followed by five questions. Candidates are required to answer 'true' or 'false' to each question. Example questions are provided in Appendix 5.

- This part of the examination will be marked +1 for correct answers, 0 for incorrect, or unanswered questions (no negative marking).

- There are no 'trick' questions.

- There are no fixed number of correct answers, i.e. for each question, it is possible for every answer to be false or every answer to be true or any combination of true or false.

- The maximum possible mark is 125.

Image reporting section

- Consists of 50 questions centred around 10 patient case studies that must be answered within 90 minutes.

- The candidate will be presented with 10 patient case studies. Each case study will compromise of relevant patient details and a variety of echocardiographic images.

- For each case study, the candidate will be required to answer five questions. Each question will have four possible answers, the candidate must select the best single answer. An example case study and questions are provided in Appendix 6

- The maximum possible mark is 50.

Details of the practical assessment

- The practical assessment is held up to five times per year. Dates, locations and online registration instructions are announced on the practical assessment section of BSE website.

- The practical assessment has three parts, a 250 case logbook, a practical scanning assessment and a viva assessment of five patient case studies.

- All candidates will be required to attend a within 26 months of starting the accreditation process (i.e. within two months of their case collection deadline). A two months of grace period has is designed to give the candidate time to review, prepare and submit the logbook and a viva assessment of five patient case studies.

- Registration should **ONLY** be sought after collecting the logbook and patient case studies.

- It is the Candidates responsibility to ensure they enter correct information on registration forms. Incorrect information will lead to a rejected registration.

Logbook submission

- The logbook should demonstrate the candidate's ability in meeting the competencies as shown Appendix 2. The specific case mix of the logbook is shown below.

- It should consist of 250 reports personally **performed and reported** by the candidate during the specified period of 24 months. The logbook is reduced to 150 reports if the candidates holds BSE or EACVI TOE Accreditation. There is no reduction in the logbook numbers for candidates holding EAVCI TTE accreditation.

- The logbook format is copies of the actual clinical report. The reports are to be uploaded and submitted via the BSE logbook portal. Please see the portal user guide in Appendix 7 . **Non-portal logbooks will not be accepted.**

- For full details of what is expected in reports and how the logbook is marked, please see Appendix 8.

- Duplicate reports are not acceptable.

- If a candidate encounters problems finding enough specific cases, this should be discussed with the mentor who may consider arranging for you to attend a nearby centre.

- The logbook should reflect the candidate's best clinical practice, and as such targeted scans, unless showing a significant and rare pathology, should not be included.

- Competencies and mentor statements are to be completed via the BSE logbook portal.

- Fully subscribed BSE members can request access to the portal before sitting the written examination by emailing accreditation@bsecho.org.

The logbook should reflect the normal case-load of a department with the following constraints:
- At least 25 cases should be for assessment of the shock state.
- At least 25 cases should be for valve disease assessment.
- At least 10 cases should be for right heart assessment.
- At least 5 cases should be for pericardial disease/effusion assessment.
- At least 15 cases should be for volume status and volume responsiveness.
- At least 3 cases should be for abnormalities of the aorta.
- At least 2 cases should be for confirmed endocarditis, mass or thrombus.
- At least 10 cases should be for refractory hypoxaemia / difficult to wean.
- At least 3 cases should be for complications of acute myocardial infarction.
- A maximum of 50 cases should be for ICU re-assessment studies.
- A maximum of 50 cases should be for no significant abnormality.

Other information regarding the logbook:

- **All** patient identifiable data should be removed. This may require the manual removal of identifiable data. See Appendix 9.
- **At least the final 150** cases should be reported primarily by the candidate, although they may be checked by another operator.
- Logbook reports should reflect the latest BSE guidance. Where local policy deviates from this, a supporting letter and current standard operating procedure from the departments echo lead stating local policy should be included. This should be submitted under the "optional supporting information" section on the BSE logbook portal.
- The candidate's name must appear on the report as the performing and reporting echocardiographer / sonographer. Where local policy deviates from this, a supporting letter and current standard operating procedure from the departments echo lead stating local policy should be included. This should be submitted under the "optional supporting information"

section on the BSE logbook portal.

- Final sign off / validation of the logbook is undertaken by the departments echo lead. Please see the portal user guide in Appendix 7.

- **Logbooks must be submitted in advance**, usually up to eight weeks before a practical assessment date. Please check the online registration information before booking a space. Candidates may request an extension by contacting accreditation@bsecho.org.

Practical scanning assessment

- Consists of a candidate acquiring up to 10 different echocardiographic imaging views within 20 minutes. A real-life model or simulator may be used.

- This part of the assessment is designed to assess a candidate's practical scanning ability along with their ability to perform basic image optimisation.

- All imaging views used in this assessment are taken from the from the minimum BSE transthoracic echocardiography dataset.

- A pass mark / trigger score of 66% is used. Once obtained, the candidate will be deemed successful at this part of the assessment process.

- The candidate is not expected to be familiar with the equipment. The Assessor will alter equipment setting as directed by the candidate.

- For full details of the practical scanning marking criteria please see Appendix 10.

Patient case study viva assessment

- Consists of a viva assessment of five separate patient case studies. See below for the required cases.

- The candidate will be expected to discuss their patient cases **with the Assessor. All five cases may be reviewed.**

- For full details of the viva case marking criteria please see Appendix 11.

- The case studies should be assessed using the most up to date BSE guidance. Candidates will be expected to know the most up to date BSE guidance and local deviations in practice **will not** be accepted.

- The cases must represent a complete study that is of good quality. Cases should be accompanied with a printed report. This should be complete, comprehensive and reflect the patient case study being presented.

- The candidate must ensure that at least one full cardiac cycle is recorded. The cases must play automatically / continuously within a PowerPoint presentation (or equivalent). Cases that do not play appropriately may be classified as an unsuccessful attempt.

- Candidates must bring and present their patient case studies on their **own laptop. It is the candidate's responsibility to ensure these are anonymised and can be viewed in a manner to allow an assessment of the cases being presented.**

- Up to three studies may be performed outside the critical care setting. Two should be performed in the critical care setting.

The patient case studies should include:

1. A study showing no significant abnormality.

2. Fluid responsiveness and volume status assessment in a critically unwell patient.

3. Cardiogenic shock of any cause in a critically unwell patient.

Patient case studies *four and five* should include any of the below pathologies:

- At least moderate valvular dysfunction.

- Significant pericardial effusion.

- Intra-cardiac mass.

- Significant structural abnormality such as severe left ventricular hypertrophy or hypertrophic obstructive cardiomyopathy.

Patient case studies may be used in subsequent BSE written exams, educational and training sessions

Practical assessment- Outcomes and process for re-attempts

In total a candidate will have two attempts at passing the practical assessment part of the accreditation process. A second attempt at the practical assessment is subject to a fee of £137.50.

If a candidate is successful in all three parts of the practical assessment, the candidate will be awarded BSE ACCE accreditation and will join the accredited member list.

If a candidate is unsuccessful in any of the three parts of the practical assessment, the candidate will be deemed to have been unsuccessful at this first attempt. The candidate will be provided with constructive feedback to facilitate a re-attempt. Please see below for more information.

In the event of an unsuccessful first attempt, the candidate may be requested to resubmit logbook reports / patient case studies. These must be new reports / patient case studies. A candidate is not permitted to resubmit previously assessed work under any circumstance.

If a candidate is unsuccessful at the second attempt of the practical assessment. The accreditation process must be started over with the candidate undertaking the written examination again.

In the event of an unsuccessful attempt, the candidate is required to:

- Attend another practical assessment and re-attempt **ONLY** the parts of the practical assessment that the candidate was unsuccessful at in the first attempt. The pass marks from the remaining practical assessment elements will be upheld.

- The timescale allowed for re-attempts will depend on which elements were unsuccessful and the candidates current and future work commitments. This will be discussed with the candidate during the first attempt. Typical timeframes may include: 3-9months.

Our feedback consistently demonstrates that non-face to face feedback does not adequately equip a candidate to pass at the next sitting. Therefore, all re-attempts at the practical assessment, require the candidate's attendance in-person to facilitate adequate and helpful face-to-face feedback*.

*Subject to government guidance we may authorise virtual submissions.

Appendix 1: Training syllabus

The following sections form the minimum suggested training syllabus for this accreditation process. Candidates should use as a guide to prepare for the written and practical assessments of this accreditation process.

1. The role of TTE in the critically ill patient

- Awareness of the potential for TTE to guide first-line management of the critically ill
- Awareness of important pathology that can be missed by TTE
- Awareness of specific indications for TOE examination
- Appropriate action and *in*action in relation to clinical findings
- Awareness of indications for immediate expert assistance
- Knowledge of common indications in acute/critical care
- Knowledge of the relationship between TTE, TOE and other methods of assessing cardiac status (e.g. MRI)
- Knowledge of the potential hazardous biological effects of ultrasound eg. heating/resonance

1.1 Service design and provision

- Awareness of mechanisms for safe devolution of critical care echocardiography
- Awareness of how to design a service to suit local need
- Awareness of the importance of linking cardiology and critical care services
- Appreciation of service costs: outlay and ongoing
- Awareness of issues surrounding staff training
- Knowledge of the importance of quality control within devolved echo services
- Awareness of equipment maintenance including infection control

1.2 Professional relationships

- Awareness of providing patient explanation relevant to the clinical setting
- Awareness of maintaining professional interdepartmental relationships with colleagues

1.3 Reporting and Documentation

- Knowledge of standard report structure
- Awareness of accurate documentation of cardiorespiratory support at the time of the study
- Awareness of the distinction and importance of both a technical and clinical report
- Awareness of the Data Protection Act with respect to echocardiography reporting
- Awareness of the need for appropriate storage systems for echocardiograms
- Awareness of digital acquisition and storage systems, scan converters and digital memories

2. Imaging Physics & Instrumentation
2.1 Concepts and Terminology

- Knowledge of compression wave definitions: frequency, wavelength, propagation velocity and their units of measurement
- Knowledge of the differences between audible and ultrasound frequencies

2.2 Propagation of ultrasound through tissues
- Knowledge of the speed of sound in different body tissues
- Knowledge of the frequency range used for diagnostic imaging
- Knowledge of the distinction between specular reflection and backscatter
- Knowledge of the principles of attenuation and scattering

2.3 Ultrasound Transducers
- Knowledge of the piezo-electric effect
- Knowledge of the structure of the 2D ultrasound beam including far (Fraunhofer) and near (Fresnel) zones and the importance of side lobes
- Knowledge of beam steering methods: mechanical vs electronic
- Knowledge of focusing methods including dynamic receive focusing
- Knowledge of appropriate focus position and use of dual focus

2.4 Imaging physics
- Knowledge of appropriate imaging frequencies in adults
- Knowledge of the effect of harmonics on imaging quality
- Knowledge of B mode and M Mode imaging methods
- Knowledge of the relationship between pulse repetition frequency, frame rate, lines per frame, field of view, and imaging depth.
- Awareness of 'parallel processing' and influence on frame rate and image quality
- Knowledge of the grey scale and dynamic range
- Knowledge of optimisation of resolution: axial, lateral and temporal
- Knowledge of reverberation artefacts
- Knowledge of factors limiting detection of small targets

2.5 Echo Instrumentation
- Knowledge of machine controls: overall gain, time gain compensation, reject, and logarithmic compression
- Knowledge of signal processing, dynamic range, pre-processing and post processing
- Knowledge of correct imaging optimisation including transducer frequency, scan angle, spatial and temporal smoothing

2.6 Optimising Images
- Awareness of the importance of optimal patient positioning
- Appreciation of the importance of the use of echo gel and the relevant infection risk
- Knowledge of all standard views
- Awareness of the potential and pitfalls for the use of non-standard views

3. Doppler physics & fluid dynamics
3.1 Basic Fluid Dynamics
- Knowledge of fluid flow: significance of peak and mean velocities
- Knowledge of determination of volumetric flow using the continuity equation
- Knowledge of laminar and turbulent flow: Reynolds' equation (qualitative)
- Knowledge of the transition from laminar to turbulent flow: inlet jet Bernoulli equation

3.2 Principles of Doppler

- Knowledge of the generation of the Doppler effect by red blood cells and ultrasound waves
- Knowledge of the Doppler equation and factors influencing the magnitude of Doppler shift
- Knowledge of the concept of spectral analysis: fast Fourier transform (qualitative)
- Knowledge of the spectral Doppler display: mean, modal and peak velocities
- Awareness of the limitation of CW Doppler caused by lack of depth discrimination
- Knowledge of the audible range of Doppler shift frequencies
- Knowledge of the effect of beam angle errors on Doppler velocities
- Knowledge of the concept of aliasing including cause and clinical manifestation
- Knowledge of the Nyquist limit
- Knowledge of the influence of transducer frequency/sample depth/beam angle on aliasing
- Awareness of high pulse repetition frequency PW Doppler and range ambiguity
- Awareness of the advantages and disadvantages of CW, PW and HPRF modes
- Knowledge of the concept of colour flow imaging as multi-sampled PW
- Knowledge of the effect of aliasing when using colour Doppler
- Appreciation of the effect of packet size/colour mode/sector size on frame rate and aliasing
- Awareness of the principles of pulse wave tissue Doppler

4. Doppler instrumentation
4.1 Spectral Doppler Instrumentation

- Awareness of the appropriate use of the 'stand-alone' Doppler probe
- Knowledge of the spectral display: positive/negative velocities, scale and baseline controls
- Awareness of the effect of high and low pass filter and intensity threshold ('reject') settings
- Knowledge of setting pulsed Doppler sample volume: influence of gate length and distance
- Awareness of representation of signal strength by image intensity
- Awareness of how aliasing manifests on the spectral display

4.2 Colour Flow Instrumentation

- Knowledge of the colour display: 'BART' convention
- Knowledge of the use of colour maps to show velocity scales
- Knowledge of the relationship between velocity and power (signal amplitude) displays
- Awareness of the principles of Tissue Doppler Imaging

5. Deformation Analysis
5.1 Principles of myocardial deformation

- Awareness of the concepts of myocardial displacement, velocity, strain and strain rate

6. Cardiac Anatomy and Physiology
6.1 Anatomy of the thorax

- Knowledge of thoracic anatomy including vascular structures

6.2 Gross anatomy of the heart

- Knowledge of basic relevant cardiac embryology
- Knowledge of the nomenclature of the cardiac chambers and valves
- Knowledge of the relationships between the cardiac chambers, valves and blood vessels
- Knowledge of the pericardial reflections

6.3 Cardiac anatomy and physiology as demonstrated by echocardiography

- Knowledge of echocardiographic anatomy: chambers/valves/great vessels/pericardium

- Knowledge of normal variants in standard echocardiographic planes
- Knowledge of the phases of atrial function: reservoir/conduit/contractile phases
- Knowledge of the effect of AF on the appearance of cardiac function
- Knowledge of cardiac remodelling in response to chronically elevated preload /afterload
- Knowledge of the effects of vasoactive drugs and positive pressure ventilation on cardiac physiology

6.4. Coronary anatomy and relationship to LV function
- Knowledge of the anatomy of the major coronary arteries
- Knowledge of the derived regional blood supply to the cardiac walls
- Knowledge of the nomenclature for describing myocardial segments: 16 and 17 segment models
- Knowledge the definitions of segmental systolic myocardial function:
    - normal
    - hypokinesia
    - Akinesia
    - dyskinesia

6.5 The Cardiac Cycle
- Knowledge of the temporal relationships of the ECG/chamber pressures/valve movements
- Knowledge of typical values for intracardiac pressures
- Knowledge of the relationship of valve movements to heart sounds
- Knowledge of valve opening and closure signals on Doppler recordings
- Knowledge of the timing of aortic valve closure as a marker of end-ejection in M-mode
- Knowledge of the effect of spontaneous unsupported ventilation on the cardiac cycle

7. Cardiac functional parameters
7.1 General measurements and calculations
- Knowledge of on-screen measurement of length/slope/area/volume/time interval
- Knowledge of measurement significance in 2-D/M-mode/spectral Doppler displays
- Awareness of the effect of off-axis images on area and volume measurements
- Knowledge of geometric assumptions in estimation of chamber volumes with M mode/2D
- Awareness of the limitation of single plane measurements of atrial size
- Knowledge of standard M-mode measurements including LV wall thickness

7.2 Methods for determining systolic function and cardiac work
- Awareness of the importance of overall visual assessment of LV function
- Appreciation of technique limitations/selection for assessing LV function
- Application of the following measures of LV function/ejection fraction where appropriate:
    - LV fractional shortening
    - LV volume measurements: biplane area/area-length/Simpson's methods
    - Doppler velocity time integral calculation of stroke distance/stroke volume/cardiac output
    - M-mode assessment of annular function: TAPSE/MAPSE
- Awareness of the influence of volume status/vasoactive medication on the above

7.3. Methods for determining diastolic function
- Appreciation of the importance of diastolic function
- Knowledge of the four progressive stages of diastolic dysfunction
- Knowledge of the characteristic transmitral and tissue Doppler patterns, and pulmonary

venous flow patterns associated with each stage
- Knowledge of accurate assessment of E/A velocity and ratio and deceleration time
- Awareness of pseudonormal transmitral filling
- Awareness of the effect of significant mitral regurgitation on transmitral flow patterns
- Appreciation of the potential effects of ventilation/vasoactive medication/sepsis on diastolic function
- Appreciation of the complexities of interpretation of diastology during critical illness

7.4 Methods for determining fluid status/responsiveness
- Knowledge of the normal patterns of IVC movement on inspiration in
  - unsupported spontaneous respiration
  - patient triggered positive pressure ventilation
  - mandatory positive pressure ventilation
- Knowledge of percentage IVC collapse with respiratory cycle indicating fluid responsiveness
- Knowledge of the use of inter-atrial septal motion as an indicator of filling status
- Knowledge of trans-mitral/aortic velocity variation as an indicator of fluid responsiveness
- Knowledge of the clinical definition of fluid responsiveness
- Awareness of the use of serial targeted studies to assess the effects of vasoactive medication/fluid challenges

8. Contrast Studies
- Awareness of the significance of spontaneous echo contrast
- Knowledge of indications for a bubble contrast study:
  - diagnosis of intracardiac shunts and PFO
  - diagnosis of left sided SVC
  - assessment of unexplained hypoxaemia
- Knowledge of the technique for performing a hand-agitated contrast study:
  - optimal injection site injection
  - timing
  - use of valsalva to accentuate right to left shunts
- Knowledge of the effects of positive pressure ventilation on intra-cardiac shunts

- Awareness of the interaction between ultrasound and encapsulated contrast agents
- Awareness of the main indications for LV and RV opacification

9. Mitral valve
9.1 Normal Mitral Valve
- Knowledge of the 2D, M-mode and Doppler characteristics of the normal mitral valve

9.2 Mitral stenosis
- Recognition of valvular appearance in rheumatic mitral stenosis
- Recognition of valvular and subvalvular calcification in degenerative valve disease
- Measurement of orifice area by planimetry
- Measurement of mean/end-diastolic gradient using CW Doppler
- Measurement of 'pressure half-time': technique and limitations

9.3 Mitral regurgitation
- Recognition of functional regurgitation related to LV chamber size or wall ischaemia
- Recognition of bowing of the leaflets, mitral valve prolapse, flail leaflet, Barlow leaflets
- Recognition of calcified annulus and retracted calcified leaflets
- Recognition of the features of a rheumatic valve

- Recognition of features of infective endocarditis
- Assessment of severity
  - Colour jet size in relation to LA
  - Assessment of regurgitant fraction
  - CW Doppler: shape and density of contour of Doppler signal
  - Vena contracta width
  - PISA and effective regurgitant orifice area
  - Pulmonary vein flow patterns
  - Indirect effects on LV and LA
  - Awareness of the influence of volume status/ inotropes/ventilation on severity
- Awareness of the echocardiographic indications for TOE assessment of the mitral valve

10. Aortic Valve
10.1 Normal Aortic Valve
- Knowledge of the 2D, M-mode and Doppler characteristics of the normal aortic valve

10.2 Aortic stenosis
- Recognition of valvular appearance in senile degenerative aortic stenosis
- Recognition of the features of a bicuspid aortic valve
- Recognition of the appearance in rheumatic aortic valve disease
- Recognition of subvalvular and supravalvular obstruction
- Planimetry of the valve area
- Assessment of peak and mean gradients using CWD
- Awareness of cross-checking peak gradient using right parasternal/suprasternal windows
- Measurement of valve area using the continuity equation

10.3 Aortic regurgitation
- Recognition of functional regurgitation related to ectasia of the aortic root
- Recognition of AR related to bicuspid valve
- Recognition of flail leaflet
- Recognition of the features of a rheumatic valve
- Recognition of features of infective endocarditis including aortic root abscesses
- Appreciation of the relevance of TOE where root abscess is suspected
- Assessment of severity
  - Colour jet size in relation to the LV and LVOT
  - CW Doppler: shape and density of contour of Doppler signal
  - PHT of the CWD signal
  - Vena contracta width
  - Diastolic flow reversal in the descending aorta
  - Indirect effects on LV size
  - Measurement of the EROA
  - Awareness of the influence of volume status/ inotropes/ventilation on severity

11. Tricuspid Valve Disease
11.1 Normal Tricuspid valve
- Knowledge of the 2D, M-Mode and Doppler characteristics of the normal tricuspid valve

11.2 Tricuspid stenosis
- Recognition of valve appearance and increased transvalvular peak gradient

11.3 Tricuspid regurgitation
- Recognition of functional regurgitation related to dilatation of the RV

- Recognition of artefact TR in association with trans-tricuspid wires
- Recognition of TR related to endocarditis
- Recognition of the features of a rheumatic/carcinoid valve
- Assessment of severity
  - Colour jet size in relation to RA size
  - CW Doppler: shape and density of contour of Doppler signal
  - Vena contracta width
  - Diastolic flow reversal in the hepatic veins
  - Awareness of the influence of volume status/ inotropes/ventilation on severity

12. Pulmonary Valve Disease
12.1 Normal Pulmonary valve
- Knowledge of the 2D, M-Mode and Doppler characteristics of the normal tricuspid valve

12.2 Pulmonary stenosis
- Recognition of valve appearance and increased transvalvular peak gradient

12.3 Pulmonary regurgitation
- Recognition of common functional jet vs pathological jets
- Assessment of severity
  - Colour jet size in relation to the PA size
  - CW Doppler: shape and density of contour of Doppler signal
  - Awareness of the influence of preload/inotropes/ventilation on severity

13. Infective endocarditis
- Knowledge of risk factors for infective endocarditis
- Knowledge of pathological patterns: right vs left sided vegetations
- Recognition of typical echocardiographic appearance of vegetations
- Recognition of anterior aortic root abscess
- Recognition and awareness of 'kissing' lesions
- Recognition of acute valvular dysfunction or wall perforation
- Recognition of vegetations on intracardiac foreign objects e.g. pacing wires
- Knowledge of the indications for TOE in suspected endocarditis

14. Prosthetic Valves
14.1 Normally functioning prosthetic valves
- Knowledge of the appearance of a well-seated normally functioning prosthetic valve
  - Tilting Disc
  - Bi-leaflet
  - Ball & cage
  - Bioprostheses: stented and stentless
- Appreciation of echo artefacts resulting from prosthetic valves
- Knowledge of where to source normal range values for transvalvular gradients
- Knowledge of normal pattern of washing jets according to different valve type

14.2 Prosthetic valve stenosis
- Knowledge of assessment using 2D, m-mode and CWD assessment
- Knowledge of the use of the continuity equation in prosthetic valve assessment

14.3 Prosthetic valve regurgitation
- Knowledge of the appearance of abnormal para-valvular leaks using colour Doppler

- Knowledge severity assessment using CWD

15. Cardiomyopathies
15.1 Dilated cardiomyopathy
- Recognition of the key echocardiographic features of DCM
- Knowledge of the causes of DCM
- Recognition of intra-cardiac thrombus

15.2 Hypertrophic cardiomyopathy
- Knowledge of diagnostic wall thickness ratio in HCM
- Recognition of systolic anterior motion of the mitral valve using 2D and M-mode imaging
- Assessment of mid-cavity flow acceleration for detection of obstruction
- Awareness of the effect of inotropes on mid-cavity gradients
- Awareness of the differential diagnosis and features of an athletic heart

15.3 Restrictive cardiomyopathy
- Awareness of potential diagnosis of restrictive cardiomyopathy
- With preserved or moderate to severe diastolic dysfunction

15.4 LV Non-compaction
- Recognition of the main features of LV non-compaction
- Knowledge of the clinical manifestations of non-compaction

15.5 Takotsubo cardiomyopathy
- Recognition of the classical appearance of a Takotsubo's cardiomyopathy
- Knowledge of the clinical causes of Takotsubo's cardiomyopathy

16. Myocardial ischaemia
16.1 Acute myocardial ischaemia
- Recognition of acute regional wall motion abnormalities
- Knowledge of the coronary anatomy relevant to those wall motion abnormalities
- Recognition of acute valve dysfunction due to acute ischaemia

16.2 Early post-infarction complications
- Recognition of post-infarction complications
    - LV dysfunction
    - Papillary muscle rupture and flail mitral valve leaflet
    - Acute VSD
    - Free wall perforation and tamponade
    - True and pseudo-aneurysm formation
    - Dresslers syndrome

17. Intracardiac Masses
- Recognition of intracardiac thrombus in typical locations and the relevant causes
- Recognition of a typical atrial myxoma

18. Pericardial Disease

18.1 Echocardiographic features of pericardial fluid
- Recognition of a pericardial effusion as distinct to a pleural effusion
- Measurement and categorisation of volume of pericardial fluid

18.2 Features of tamponade
- Recognition of the progressive signs of cardiac tamponade
  - Collapse of the RA
  - Diastolic and then systolic collapse of the RV free-wall
  - Exaggerated interdependence of tricuspid/mitral/aortic Doppler velocities
  - Splinting of the IVC
  - Awareness that cardiorespiratory support may distort the classical echocardiographic features of tamponade
  - Awareness that cardiovascular compromise may occur in the critically ill without classical features of tamponade

18.3 Features of pericardial constriction
- Recognition of an abnormal thickened and bright pericardium
- Awareness of how to distinguish pericardial constriction from restrictive cardiomyopathy

19. Assessment for pulmonary hypertension
- Knowledge of aetiologies:
  - Acute:
    - Tricuspid valve destruction/dysfunction due to all motion abnormalities
    - Pulmonary embolism
    - Physiological pulmonary
    - Vasoconstriction o Chronic
    - Primary
    - Secondary to chronic lung disease/pulmonary emboli
    - Left heart lesions
- Knowledge of RV size and functional assessment by
  - visual assessment
  - fractional area change
  - TAPSE
- Appreciation of the effect on septal motion of volume and pressure overload including
  - 'D' deformity
  - paradoxical septal motion

20. Diseases of the aorta
- Knowledge of normal aortic sizes
  - Ascending
  - Arch
  - Descending limb
- Awareness of the features of Marfans syndrome
- Recognition of a dissection flap and associated findings

21. **Grown-up congenital heart disease**
   - Recognition of atrial septal defects
   - Recognition of ventricular septal defects
   - Recognition of aortic coarctation
   - Knowledge of the shunt calculation

22. The post cardiac arrest patient

- Awareness of the technical considerations inherent in peri-arrest echocardiography
- Knowledge of the relationship between peri-arrest echo and the ALS alogorithm
- Knowledge of the process and role of focused peri-arrest echocardiography in excluding:
   - Cardiac tamponade
   - Gross left ventricular overload and failure
   - Gross hypovolaemia
   - Massive pulmonary embolus
   - Gross RV impairment
- Limitations of the technique

23. Assessment of the hypotension/shock/acute breathlessness
- Awareness of the order in which life-threatening pathology should be sought and remedied
- A full study should be undertaken following exclusion and remedy of abnormalities in the following hierarchy
   - Pericardial fluid
   - Aortic dissection
   - Severe hypovolaemia
   - Evidence of massive pulmonary embolism
   - LV dysfunction: causes and sequelae
   - RV dysfunction: causes and sequelae
   - Acute valvular pathology

24. LV assessment in sepsis
- Knowledge of the potential effects of sepsis on ventricular function
- Awareness that functional status during sepsis is poorly reflective of baseline function
- Knowledge of how echocardiography findings should influence:
   - volume resuscitation and maintenance
   - inotrope/vasopressor selection and dosing
   - decisions regarding further cardiovascular support
- Awareness of the need for re-assessment following changes in therapy
- Awareness of the need for re-assessment following resolution sepsis

25. Assessment in blunt and penetrating cardiac trauma
- A full study should be undertaken following exclusion and remedy of abnormalities in the following hierarchy
   - Pericardial fluid
   - Aortic dissection
   - LV dysfunction: causes and sequelae
   - RV dysfunction: causes and sequelae
   - Acute valvular pathology

- Recognition of the need for urgent TOE in the presence of:
    - o a wide mediastinum on CXR and normal TTE findings
    - o any other clinical findings that do not correlate with TTE findings

26. Assessment in failure to wean from mechanical ventilation
- Recognition of the need for a full standard echocardiographic assessment with particular focus on:
    - o search for unexpected vegetations
    - o consideration of the presence of intracardiac shunts
    - o consideration of unexpected pulmonary emboli
    - o assessment of observed fluid balance compared with cumulative volume status

27. Assessment post cardio-pulmonary by-pass/surgical and obstetric intervention
- Awareness of the transient effects of cardio-pulmonary by-pass on ventricular function
- Awareness of the need for frequent re-assessment in this setting
- Awareness of unusual causes of LV dysfunction following surgical intervention including:
    - o regional tamponade: the need for TOE to visualise posterior collections
    - o thromboembolism
    - o fat embolism
    - o amniotic fluid embolism
    - o peri-anaesthetic myocardial ischaemia
    - o fluid overload
    - o intrathoracic pressure effects on cardiac chambers
    - o intrathoracic pressure causing graft occlusion

28. Findings/clinical settings in the critically ill which should trigger expert help
- Echo windows insufficient to answer the clinical question
- Greater than moderate valvular dysfunction
- Any concern regarding prosthetic valve function
- Post myocardial infarction complications
- Suspected takotsubo cardiomyopathy
- Suspected hypertrophic cardiomyopathy
- Moderate to severe diastolic dysfunction: to exclude restrictive cardiomyopathy
- Suspected or impending cardiac tamponade
- Abnormal appearance of the pericardium: to exclude constrictive pericarditis
- Intracardiac mass
- Suspected congenital heart disease
- Unusual intracardiac devices such as TAVI, Mitraclips or LVAD

Appendix 2: Curriculum based competency tool

The following competency assessment tool should be used to ensure all knowledge and practical experience are covered during the candidates training period.

The competency tool is now required to be completed by the candidates mentor via the BSE **online logbook portal.**

Principles of using TTE in the critically ill	Date	Signed
Demonstrates theoretical knowledge of the role of TTE in the critically ill patient		
Makes appropriate timely use of abbreviated or specific echo protocols according to the clinical context for example: Cardiac arrest Shock Trauma Sepsis Acute breathlessness		
Demonstrates good clinical practice with respect to repeating or completing abbreviated studies in a timely fashion		
Can accurately and systematically report echo findings describing all parts of the heart and including and interpreting the context of the patient's illness and organ support		
Is familiar with and strives to achieve the BSE minimum dataset for each study		
Is aware of Caldicott principles of patient confidentiality and uses them in day to day practice		
Relays clinical findings to the critical care team in an appropriate and timely manner		
Demonstrates consistent and appropriate referral of echo findings requiring expert help		
Imaging physics and instrumentation		
Demonstrates theoretical knowledge of ultrasound physics to allow full and accurate use of imaging equipment		
Knows how to and routinely optimizes all images in accordance with this		
Principles of Doppler physics and fluid dynamics		
Demonstrates understanding of the appropriate use of PWD including colour flow and TDi, CWD		
Describes the Nyquist limit and how this affects clinical practice		
Doppler instrumentation		
Demonstrates accurate use of colour Doppler with attention to: Box size and position, gain setting, scale and baseline		
Demonstrates accurate and appropriate use of PWD and TDi with attention to clear spectral optimization		
Demonstrates accurate and appropriate use of CWD with attention to clear spectral optimization		
Anatomy and physiology		
Demonstrates knowledge and use of standard nomenclature for describing the 17 left ventricular segments		
Demonstrates accurate description of the motion of each individual region		

Measurements and calculation		
Measures 2D distances from point to point accurately		
Measures M-mode distances from leading edge to leading edge accurately		
Demonstrates accurate qualitative assessment of ventricular performance		
Accurately measures ejection fraction using fractional shortening or volume measurements		
Accurately measures stroke volume and cardiac output		
Demonstrates accurate assessment and interpretation of the components of diastolic function within the clinical context		
Demonstrates accurate measurement and interpretation of assessments of fluid status and responsiveness in the ventilated and non-ventilated patient		
Valve pathologies		
Demonstrates full and accurate assessment of the stenotic valve within the clinical context		
Demonstrates full and accurate assessment of the regurgitant valve within the clinical context		
Recognises features of infective endocarditis and can accurately assess the functional consequences		
Can recognise and assess normal and pathological function in the common types of prosthetic valves		
Cardiomyopathies		
Recognises and assesses cardiomyopathy including interpretation and reassessment according to the clinical context		
Myocardial infarction		
Distinguishes acute from chronic cardiac ischaemia		
Recognises and assesses the severity of acute ischaemia		
Recognises and assesses the consequences of sub-acute and chronic ischaemia		
Pericardial disease		
Can recognise and accurately assess the haemodynamic effects of abnormal pericardial fluid		
Recognises and refers possible cases of constrictive pericarditis		
Pulmonary hypertension		
Demonstrates recognition of acute versus chronic pulmonary hypertension		
Accurate assesses pulmonary hypertension using all qualitative and quantitative features		
Aortic disease		
Can recognise acute dissection of the aortic root and knows when to refer for TOE		
Congenital Heart Disease		
Can recognise the features of common presentations of grown up congenital heart disease		

Appendix 3: Reading list

The reading list is provided by the Accreditation Committee of the British Society of Echocardiography and represent only a handful text that are available for candidate to learn from.

Echo made Easy Sam Kaddoura Churchill Livingstone 2001 ISBN 0443061882

Echocardiography: Guidelines for reporting – a practical handbook Helen Rimington and John Chambers Taylor & Francis 1998 ISBN 1850700117

Cardiac Ultrasound Leonard M Shapiro & Antoinette Kenny Manson Publishing 1999 ISBN 1874545081

Feigenbaum's Echocardiography H.Feigenbaum Lippicott, Williams & Wilkins 2004 ISBN 0781731984

Textbook of Clinical Echocardiography Catherine Otto W. B. Saunders 2004 ISBN 0721607896

Echocardiography: The Normal Examination and Echocardiographic Measurements. Second Edition Bonita Anderson MGA Graphics, Australia 2007 ISBN-13 9780646468631 ISBN-10 0646468634

Hemodynnamic Monitoring Using Echocardiography in the Critically Ill. DeBacker, Cholley, Slama, Vieillard- Baron, Vignon. Springer 2011. ISBN-13 9783540879541 ISBN-10 3540879544

Newton J, Sabharwal N, Myerson S et al. Oxford Specialist Handbooks in Cardiology: Valvular Heart Disease. Oxford University Press, Oxford, 2011.

Concensus of circulatory shock and haemodynamic monitoring. Task force of the European Society of Intensive Care Medicine. Maurizio Cecconi, Daniel De Backer etal. Intensive Care Med DOI 10.1007/s00134-014-3525-z

The introduction of intensive care-led echocardiography into a tertiary care unit. SR Alam, A Docherty, I Mackle, MA Gillies. JICS 14(1) January 2013.

The accuracy of diagnostic and haemodynamic data obtained by transthoracic echocardiography in critically ill adults: a systematic review. CL Colebourn, V Barber, JB Salmon, JD Young. JICS 9(2) July 2008.

Measuring and monitoring quality in satellite echo services within critical care: an exploration of best practice. T Thomas, C Colebourn Echo Res Pract June 2015 2:57-64; published April 15, 2015, doi:10.1530/ERP-14-0098

Echocardiographically derived parameters of fluid responsiveness. J Gerstle, S Shahul, F Mahmood. International Anaesthesiology Clinics 2010:48(1);37-44.

Echocardiographic measurement of fluid responsiveness. C Charron, V Caille, F Jardin, A Vieilard-Baron. Curr Opin Crit Care 2006 12;249-254.

Shape and movement of the interatrial septum predicts change in pulmonary capillary wedge pressure. CF Royse, PF Soeding, DW Blake. Ann Thoracic Cradiovasc Surg. 2001:7(2);79-83.
Can transthoracic echocardiography be used to predict fluid responsiveness in the critically ill patient? A systematic review. J Mandeville, C Colebourn. Crit Care Res Pract. 2012;2012:513480.

Predicting fluid responsiveness in the critically ill adult. J Mandeville, C Colebourn. British Journal of

Intensive Care 05/2013;23(1):20.

Assessing left ventricular systolic function in shock: evaluation of echocardiographic parameters in intensive care. Bergenzaun et al. Critical care 2011, 15 R:200.

Evaluation of left ventricular systolic function revisited in septic shock. Critical Care, 2103 17(4) 164. Septic cardiomyopathy. Vieillard Baron, Annals of Intensive Care Medicine 2011 1:6.

Nagueh SF, Appleton CP, Gillebert TC, Marino PN, Oh JK, Smiseth OA, Waggoner AD, Flachskampf FA, Pellikka PA, Evangelisa A: Recommendations for the evaluation of left ventricular diastolic function by echocardiography. European journal of echocardiography : the journal of the Working Group on Echocardiography of the European Society of Cardiology 2009, 10(2):165-193.

Moschietto S, Doyen D, Grech L, Dellamonica J, Hyvernat H, Bernardin G: Transthoracic Echocardiography with Doppler Tissue Imaging predicts weaning failure from mechanical ventilation: evolution of the left ventricle relaxation rate during a spontaneous breathing trial is the key factor in weaning outcome. Critical care (London, England) 2012, 16(3):R81.

Aurigemma GP, Gaasch WH: Clinical practice. Diastolic heart failure. The New England journal of medicine

2004, 351(11):1097-1105.

Vignon P, Allot V, Lesage J, Martaille JF, Aldigier JC, Francois B, Gastinne H: Diagnosis of left ventricular diastolic dysfunction in the setting of acute changes in loading conditions. Critical care (London, England) 2007, 11(2):R43.

Jacques DC, Pinsky MR, Severyn D, Gorcsan J, 3rd: Influence of alterations in loading on mitral annular velocity by tissue Doppler echocardiography and its associated ability to predict filling pressures. Chest 2004, 126(6):1910-1918.

Echocardiographic assessment of the right ventricle and associated hemodynamics. Karas MG, Kizer JR. Progress in Cardiovascular Diseases (2012);55:144–160.

Imaging the failing right ventricle. Mitoff PR, Beauchesne L, Dick AJ, Chow BJ, Beanlands RS , Haddad H, Mielniczuk LM.. Curr Opin Cardiol (2012);27:148 – 153 .

Right ventricular responses to massive and submassive pulmonary embolism. C Castillo, VF Tapson. Cardiol Clin.2012 30:233-241.

Fibrinolysis for patients with Intermediate-Risk Pulmonary Embolism. G Meyer, E Vicaut, T Danays. NEJM.
2014;370:1402-11.

Modern protective ventilation strategies: impact upon the right heart. CGT Morris, SA Burn, SB Richards JICS 2014 15(1):28-33.

Otto, C, Prendergast B. Aortic-valve stenosis - from patients at risk to severe valve obstruction. N Engl J Med 2014;371:744-56.

Wunderlich, N, Beigel, R, Siegel, R. Management of Mitral Stenosis using 2D and 3D Echo-Doppler imaging. JACC: Cardiovascular imaging 2013; 6(11):1191-1205

Carabello B. The current therapy for mitral regurgitation. J Am Coll Cardiol 2008; 52:319–26.

Bhattacharyya S, Khattar R, Chahal N, Senior R. Dynamic mitral regurgitation: review of evidence base, assessment and implications for clinical management. Cardiol Rev. 2015 May-Jun; 23(3):142-7.

Concensus on circulatory shock and haemodynamic monitoring. Task force of the European Society of Intensive Care Medicine. M Cecconi, D De Backer, M Antonelli et al. Intensive Care Med 2014 DOI 10.1007/s00134-014-3525-z.

Transthoracic echocardiography in obstetric anaesthesia and obstetric critical illness. AT Dennis. Int J Obstet An 2011 Apr;20(2):160-8.

Transthoracic Echocardiography with Doppler Tissue Imaging predicts weaning failure from mechanical ventilation: evolution of the left ventricle relaxation rate during a spontaneous breathing trial is the key factor in weaning outcome. Moschietto S, Doyen D, Grech L, Dellamonica J, Hyvernat H, Bernardin G. Crit Care. 2012;16(3):R81. doi: 10.1186/cc11339.

Protocols and the most up to date BSE guidelines are available under the Education tab of www.bsecho.org.

Please note that only fully subscribed BSE members are granted full access to all education and exam content.

Appendix 4: Written examination registration guidance

[BSE written exams](#) are delivered in partnership with Pearson VUE. Candidates will be able to sit the exam at local centres throughout the UK, Republic of Ireland, and some overseas areas.

Pre-Registration (through BSE website)

- Candidates must register their interest to sit the written exam by completing an **online pre-registration form via the accreditation section of** www.bsecho.org. The pre-registration window is open for up to four weeks.
- Candidates registered names should appear the same as per their photo identification. Pearson Vue follows a strict admission policy.
- BSE will transfer data and requirements to Pearson VUE, who will contact all pre-registered candidates with further information on booking an paying for the exam.
- **Delivery methods:** there are two ways candidates can take the exam- **Test Centre (recommended)** or Online proctored exam (OnVUE), which allows candidates to sit the exam from home (subject to system requirement).

Special accommodations

- Pearson Vue can provide [special accommodations](#) to candidates who have official requirements, such as extra time, a reader, or the need for medication during the examination.
- Further information on accommodations is available on www.bsecho.org.
- All requests must be put in writing with supporting documents to support claims for special accommodations. Requests will be approved at the discretion of the BSE. Forward such requests to accreditation@bsecho.org.

Registration (through Pearson VUE)

- All registration and payments will be managed by Pearson VUE after the stage of pre- registration.
- Candidates with special requirements or conditions should notify the BSE during the pre-registration stage.
- Cancellations made in less than 7 days do not qualify for a refund. All cancellations must be processed through Pearson VUE.

On the day of the exam

- Instructions will be given on the day of the exam via a video tutorial at the test centre. Candidates will complete the exam on a computer at the test centre.
- A basic calculator is already built into the online exam. An erasable sheet will be given to candidates by the examining centre. If sitting the exam from home using online proctoring- a calculator and whiteboard are built into the exam.
- Candidates are not required to bring any stationery to the exam.
- **Candidates are required to bring a photo ID.** Please ensure that the registration details match your photo ID exactly as otherwise you will be refused entry. If denied entry, candidates should contact BSE immediately.
- **Any last-minute requests for special accommodations will not be facilitated by the test centre**.

Results

- Results are released 5-6 weeks after sitting the exam. Scores will be uploaded to BSE personal profiles. Both sections must be passed to achieve an overall pass grade.
- **Pass:** candidates will be issued with login details to the portal to begin uploading cases. The submission deadline will appear at the 'Practical submission deadline' in the member profile.
- **Fail:** candidates can register interest to sit the next sitting of the exam.

- The reduced fee only applies to candidates who physically sat the exam and were unsuccessful; the next attempt must be taken at the next sitting (within 12 months).
- Results cannot be appealed or 'remarked' as the tests are computer-based.

Please watch the demo available via Pearson VUE; http://www.pearsonvue.com/demo/

Additional Information

Candidates are advised to check the security procedures in the "What to expect section" of the Pearson VUE/BSE guide page; https://home.pearsonvue.com/test-taker/security.aspx

Pearson Vue operates a strict admissions policy. Candidates registered names should be exactly as they appear on their government photographic ID.

Appendix 5: Examples of written exam multiple choice questions

Answer 'True' (T) or 'False' (F) to each of the following.

There is no negative marking - one mark added for a correct answer, no mark deducted for an incorrect answer.

Q1	In an ultrasound imaging system:	
a)	Sector width, sector depth and frame rate can all be controlled independently	F
b)	Frame rate falls as sector width increases	T
c)	Using a lower frequency transducer improves the frame rate	F
d)	Frame rate increases as sector depth increases	F
e)	Using Colour Flow Doppler reduces the frame rate	T

Q2	On a spectral Doppler display:	
a)	The velocity at which aliasing occurs increases at higher ultrasound frequencies	F
b)	The velocity at which aliasing occurs increases at greater depths	F
c)	The velocity at which aliasing occurs increases at greater sector angles	F
d)	At 2MHz the aliasing velocity at 10cm is approximately 1.5m/s	T
e)	The aliasing velocity can be increased by increasing the pulse rate (high PRF)	T

Q3	In a patient with significant hypovolaemia:	
a)	LV appears hyperdynamic with increased contractility and reduced end-systolic cavity size	T
b)	LV fractional shortening and ejection fraction may be normal	T
c)	E/A and E/E' ratios may be normal	T
d)	Non-collapsible dilated IVC is a common finding	F
e)	Early diastolic free wall collapse is seen	F

Q4	Regarding assessing aortic stenosis:	
a)	Aortic valve maximum velocity of 5.2m/s is consistent with severe AS	F
b)	A mean gradient of 30mmHg and a valve ratio of 0.20 is consistent with severe AS	F
c)	In severe AS there is rapid acceleration and early peaking of the Doppler waveform	F
d)	A rate of change of >0.9m/s/year is associated with poor patient prognosis	F
e)	An aortic valve velocity ratio of 0.34 and a maximum velocity of 3.8m/s is consistent with moderate AS	T

Appendix 6: Examples of the written exam image reporting questions

A number of moving clips and stills will be included in each question. Although these can be viewed and replayed as many times as the candidate wishes, the candidate should be mindful of the time spend on each question.

The **SINGLE BEST ANSWER** should be selected.

There is no negative marking - one mark added for a correct answer, no mark deducted for an incorrect answer.

Case 1
Request: male, 42 year old, admitted with chest pain radiating into back, SOBOE.

Data: LVIDd: 7.4cm, SoV dimension: 7.0cm, STJ: 6.9cm, proximal ascending aorta: 7.4cm, TAPSE: 1.4cm. proximal RVOT dimension: 4.2cm. Descending aorta end diastolic velocity: 0.30m/s. TR Vmax: 3.2m/s, right atrial area: 26cmsq, pulmonary valve acceleration time: 100ms, AR Pressure half time: 149msec.
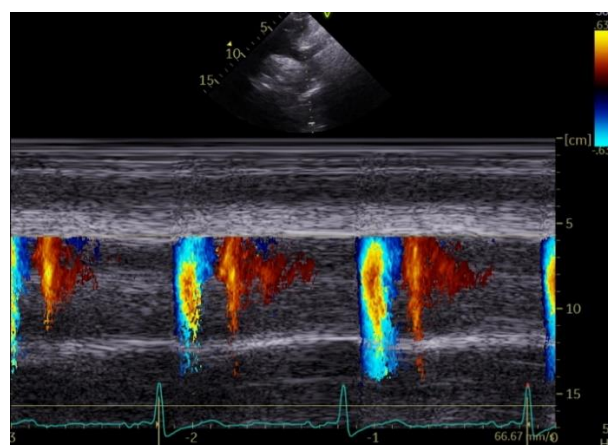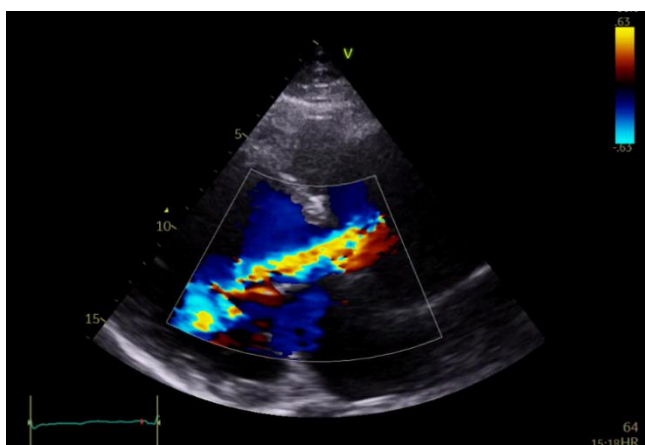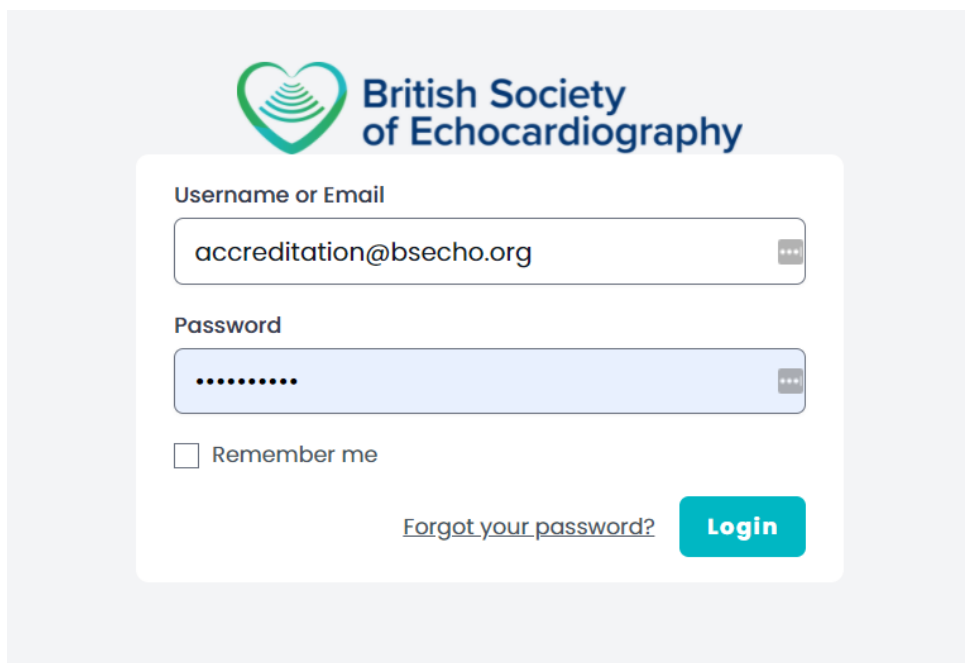
1.1	Regarding the severity of the aortic regurgitation	Answer
a	There is moderate central aortic regurgitation	
b	There is moderate eccentric aortic regurgitation	
c	There is severe central aortic regurgitation	T
d	There is severe eccentric aortic regurgitation	

1.2	Regarding the echo probability of pulmonary hypertension	
a	There is no echo probability of pulmonary hypertension	
b	There is low echo probability of pulmonary hypertension	
c	There is intermediate echo probability of pulmonary hypertension	
d	There is high echo probability of pulmonary hypertension	T

Appendix 7: BSE logbook portal user guidance
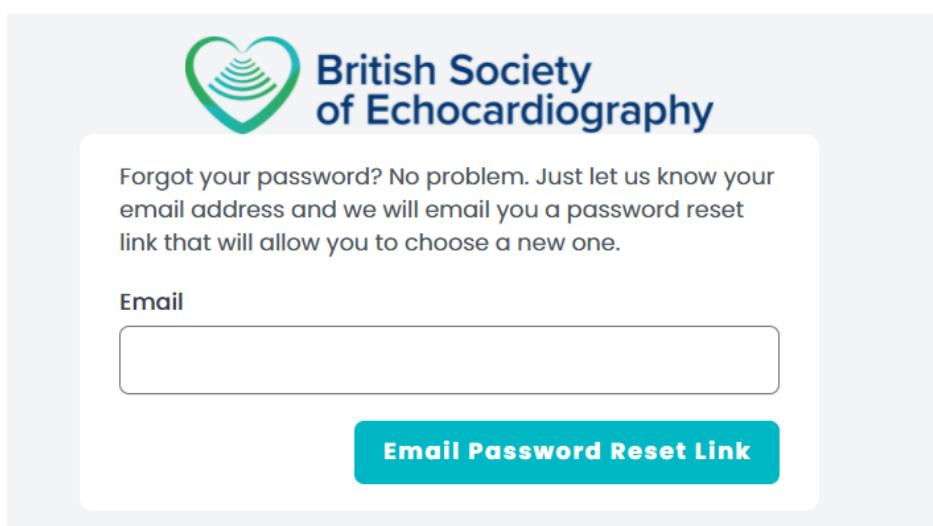
1.   User Login Details:

- Request login details by emailing the accreditation team- accreditation@bsecho.org.
    - Provide your **BSE ID number**, the type of *accreditation you are pursuing.
    - Also, inform us of your mentor's name and email address- we will assign them to your logbook.
- An automated message from the portal will be emailed to you with your login details.
- Link to the portal: https://logbook.bsecho.org/

a. If you have forgotten your password, please click the link titled Forgot your password?

2. Update your profile

- Click on your name, then **'Profile'** to update your name, email and password.

Enter new password and click 'save.'

3. User dashboard (e.g. Candidate, Mentor or Assessor)

- Click on the visible heading to access your dashboard
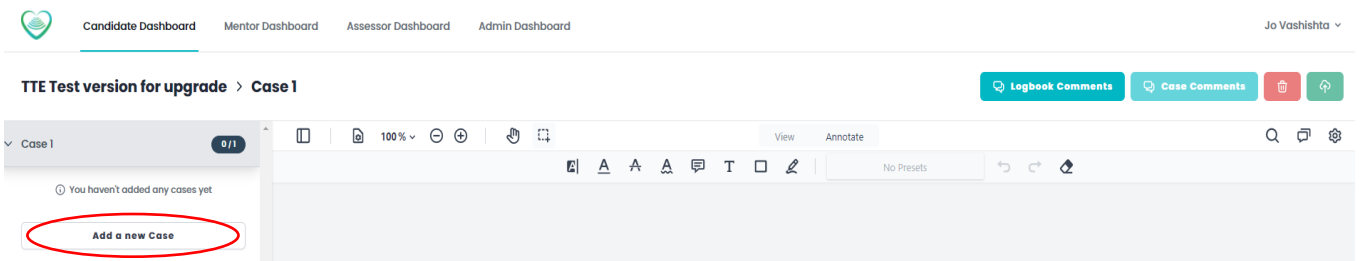
a. Enter Written Exam Date

- Click on × No date set to bring up the calendar and select the date you sat the written exam.
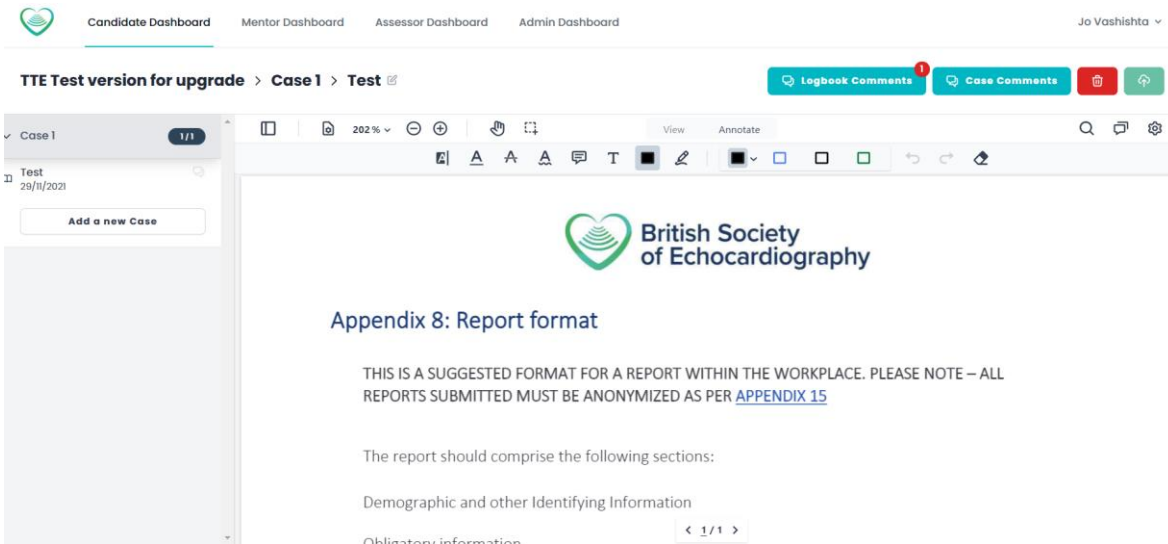

b. Click the box under the Logbook title to begin uploading PDF reports. The portal will take only PDF uploads.
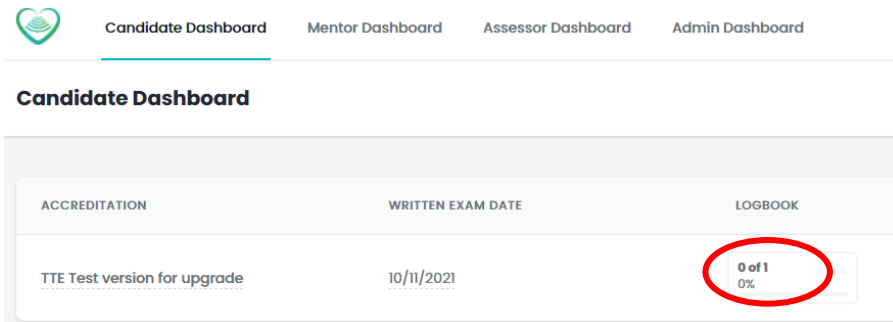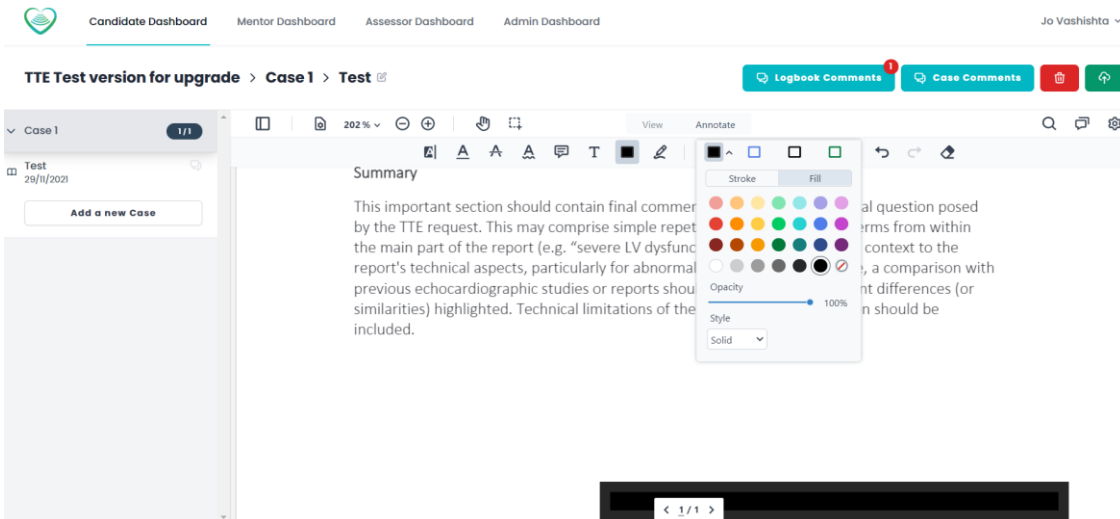

To add a new case, click on '**Add a new Case**', give it a Title, enter the date of the case and Choose File.
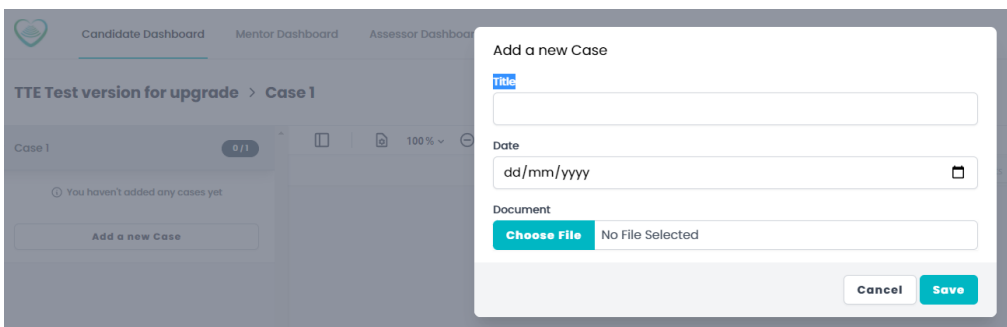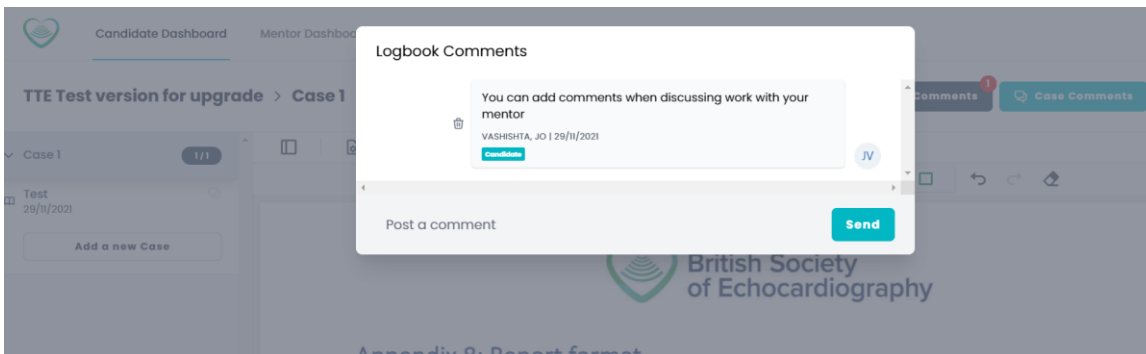
- Explore the features and tools by hovering over the icons to find what they can do.
- To **save** your work, click , to **delete** click

The 'Rectangle' tool allows masking over unwanted data. Click the Save button to keep the anonymise changes.
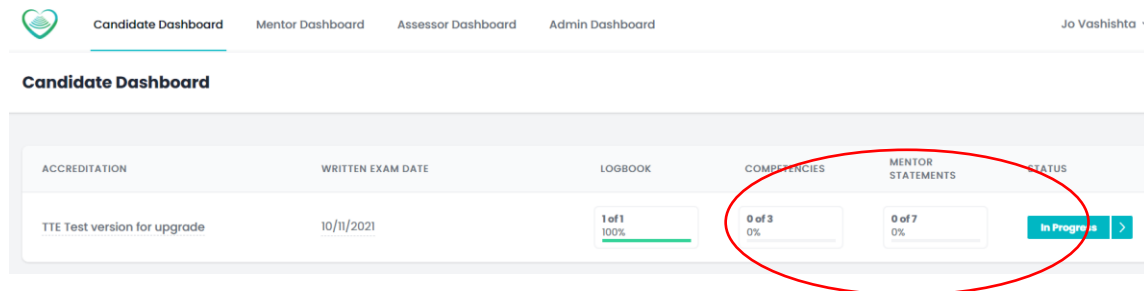

You can add logbook or case comments to share with your mentor only.

4. Competencies

Your mentor will access your portal via their login and sign off each of the competencies.

Candidate can view the progress in the dashboard.

a. Mentor view:

The mentor clicks the sections below the 'DATE SIGNED OFF' header to sign off competencies by clicking on 'Sign off.'

When mentor has completed competency sign off, they must do the same for the 'Mentor statement.'

5. Candidate logbook submission

Candidate can check the progress of their logbook in the dashboard and click the arrow after 'In Progress'.
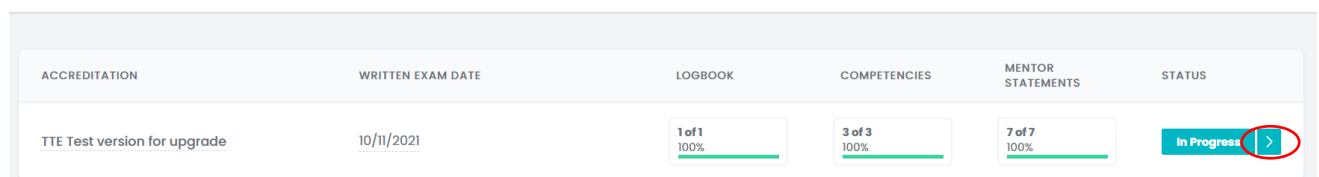
a. Verify and submit

Check you have completed the requirement before clicking 'Continue.'
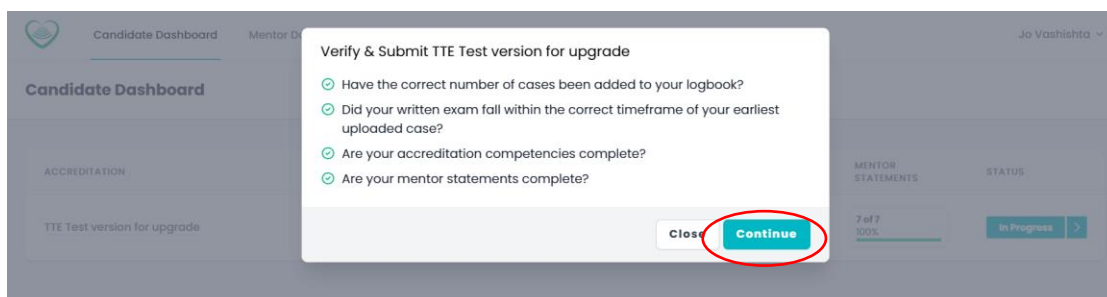
b. Enter Head of Department Email Address and click submit
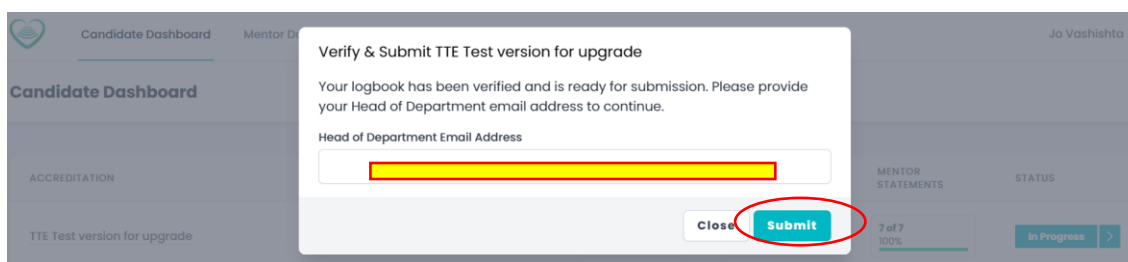
c. Contact accreditation@bsecho.org to inform you have entered your HOD's email address and clicked submit.

6. Validate logbook

Your Head of Department must click the link to accept the statement.
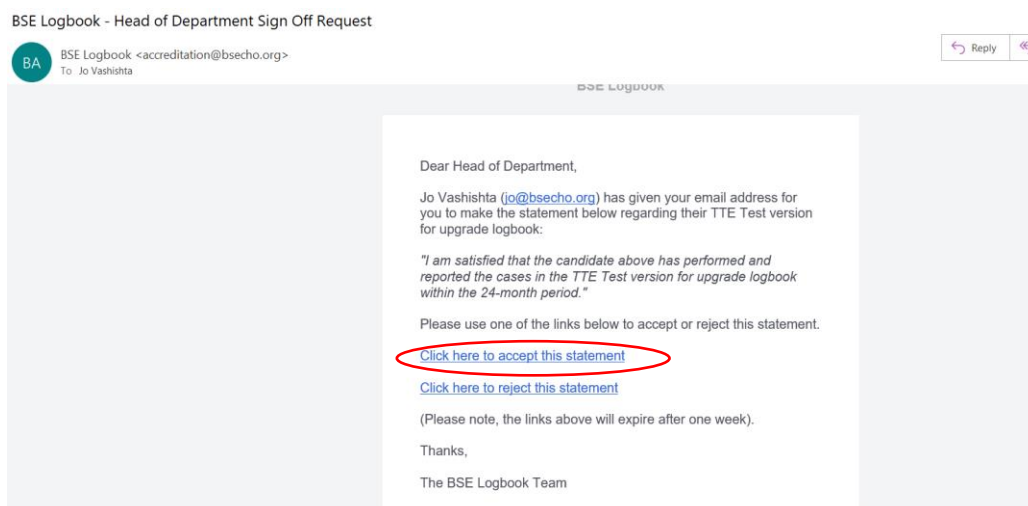
a. Head of Department varified

After clicking the statement, the Head of Department receives the message below.

Please note that some NHS emails may block messages from the logbook portal- accreditation@bsecho.org. In this case, candidates should consider providing an alternative email address, e.g. non-NHS email addresses.

7. Logbook submitted

Once the logbook has been validated, it is ready for an assessor to mark.

Candidate Dashboard

ACCREDITATION	WRITTEN EXAM DATE	LOGBOOK	COMPETENCIES	MENTOR STATEMENTS	STATUS
TTE Test version for upgrade	10/11/2021	1 of 1 100%	3 of 3 100%	7 of 7 100%	Submitted

- No further action is required from this point.
- Candidates will be notified when marking is complete.

Updated: JV- 29/11/2021

End of guide.

Appendix 8: Logbook guidance and marking criteria

In order to meet all competencies of this accreditation process the logbook should represent good/excellent examples of a candidate's daily workload. Ideally, it should reflect the most up to date BSE guidance (see page 6 if your department has different locally agreed working practices).

Whilst we encourage the use of good / excellent work to be included in the logbook, it is acknowledged that not every report in the logbook will meet this standard. Therefore, when considering whether to include a report, please refer to the following as an absolute minimum.

If a report does not meet the below, it should not be included as a logbook report

Demographic and other Identifying Information:

Referral information Indications for echo

Inotropic support

Ventilatory support

Rate and rhythm

Date of study

Patient's age

A report should have a section for objective 2D dimensions and Doppler measurements. There should be a section for describing observations and a short conclusion.

Measurements section:

LV dimensions, wall thickness dimensions.

LA volume (monoplane)

RA area

RV dimension where able to measure accurately

AV VTI, AV Vmax and mean gradient, LVOT VTI, LVOT Vmax and mean gradient

E/A ratio, DT, TDI's (minimum of one)

Aortic root, proximal ascending aorta dimensions if seen

RV dimensions where appropriate

TAPSE

Description of all parts of the heart:

This should include a description of observations and should include:

A comment on structure and function of all valves

A comment on size and function of the LV

A comment on size and function of the RV
A comment on size of the atria

A comment on the absence / presence of pericardial effusion

A comment on assessment of the IVC

A comment on the assessment of the atrial and ventricular septum

If a particular part of the heart cannot be fully assessed this along with the reason must be standard

Conclusions:

This should summarize the whole study and be easily understood by a non-echocardiographer.

It should identify key abnormalities, their cause and any secondary effect. Key normal information should also be included. Differences from repeated studies and technical difficulties should be mentioned.

Logbook marking criteria

When marking a candidate's logbook, the Assessor will review a selection of reports in the candidate's logbook.

The following marking criteria is used when assessing each logbook report

Does the report meet the following criteria?	Yes / No (if no, state reasons why)
Fully Anonymised	
Indication for echo present	
Appropriate measurements present	
Appropriate Doppler calculations present	
Do measurements / Doppler calculations match descriptions	
All parts of heart described	
Descriptions complete	
Appropriate to request	
Conclusion present	

Logbook outcomes include:

Satisfactory log-book for BSE accreditation OR Unsatisfactory at present and a resubmission is required.

If a logbook is unsatisfactory, the candidate will be asked for one of the following resubmissions.

- **10-20 further specified reports:** To address persistent inaccuracies in certain measurements or observations (e.g. lack of diastolic function assessment).

- **25-75 further specified reports**: To address repeated inaccuracies, lack of correct conclusion or lack of sequential systematic comments on all parts of the heart. (e.g. lack of RWMA description + lack of quantitative valve pathology measurements).

- **250 reports**: To address significant errors, inaccurate or lack of systematic comments. The presence of Patient ID on any report will require a complete resubmission of the logbook.

To ensure consistency across logbook marking, all logbooks are discussed with the national logbook leads and chief assessor prior to a resubmission being requested.

Appendix 9: Guidance for the removal of patient identifiable data

The duty of confidentiality arises out of the common law of confidentiality, professional obligations and also staff employment contracts. Breach of confidence may lead to disciplinary measures, bring into question professional reputation and possibly result in legal proceedings.

Guidance is provided to Healthcare Professionals in the 'NHS Code of Practice on Confidentiality' (November 2003): http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4069254.pdf

Patient information that can identify individual patients is confidential and must not be used or disclosed in any part of the submission required for this accreditation process. In contrast, anonymised information is not confidential and may be used.

Key identifiable information includes:

- Patient's name
- Address
- Full post code
- Date of birth
- NHS number and local identifiable codes

Key identifiable information may also include information that may be used to identify a patient directly or indirectly. For example, rare diseases, drug treatment or statistical analyses which have very small numbers within a small population may allow individuals to be identified.

Guidance to candidates submitting Logbooks and Cases for Accreditation

The NHS Code of Practice on confidentiality means that evidence submitted for this accreditation process must have removed **ALL** patient identifiable information beyond that of gender and age/year of birth.

Reports – Please use the BSE online portal and electronically delete all patient information except age and gender.

We would advocate against the use of other electronic anonymisation as sometimes data is still present. If in doubt, manually remove patient identification information prior to use.

Video cases - We appreciate that the removal of patient ID may be difficult. Therefore advise that the video cases are specifically collected, and the data inputs are made relevant to your cases (E.g. Patient Name could be 'BSE Case 1', Patient Number could be your membership number followed by case number, '1111-1').

The final decision remains at the discretion of the Chair of the Accreditation Committee.

Appendix 10: Practical scanning marking criteria

The marking criteria used for the practical scanning assessment can be seen below.

2 minutes:	• Familiarisation of echo machine / equipment. • Assessor will be on hand if assistance is required.
20 minutes:	• Candidate to have 2 minutes to obtain and acquire each image. • The Assessor will instruct the candidate on the images to acquire. • The Assessor can alter echo machine / equipment setting to optimise images at the direction of the candidate.

The pass mark is set at 66%. Once this mark is achieved the candidate will be deemed as being successful at this station.

Each image the candidate acquires is scored as per the marking scheme below.

Appendix Four - Practical Scanning Mark Scheme

F = Fail = 0 points:	unable to demonstrate appropriate skill set
BF = Borderline Fail = 1 point:	unable to demonstrate appropriate skill set, is able to describe reasons how improvement could be achieved
BP = Borderline Pass = 2 points: quality	able to acquire/demonstrate skill set although fails to optimize image acquisition
P = Pass = 3 points: optimization of images	able to fully demonstrate high quality image acquisition with appropriate

All images used in the practical scanning assessment are taken from the BSE minimum dataset. An example of the imaging list used in this assessment can be seen below.

Image List One

2 minutes per acquisition Encourage candidates to move on if necessary	Image (Score Weighting)
1	2D Parasternal Long Axis (5)
2	2D Parasternal Short Axis Left Ventricle (5)
3	2D modified Short Axis demonstrating Main Pulmonary Artery (3)
4	PW Doppler RVOT (1)
5	2D Apical 4 Chamber (5)
6	PW Doppler Mitral Valve (1)
7	2D Apical 2 Chamber (5)
8	2D A4C modified to show RV, with Colour Doppler, demonstrating TR if present (3)
9	2D Subcostal 4 Chamber (3)
10	Blind CW Doppler Descending Aorta (3)
	Modification of Patient Position to Optimise Image Quality (5)
	Image Optimisation (3)

Appendix 11: Patient case studies viva marking criteria

The next few pages show the individual marking criteria for each of the patient video case studies. All criteria must be met to a satisfactory standard in order for the patient case study to be passed.

A minimum of two patient case studies will be assessed. The British Society of Echocardiography reserves the right to assess all five patient case studies.

Adult Critical Care Echo Accreditation. **Case 1 – No significant pathology**. Practice must be satisfactory in all areas to pass			
Evidence of satisfactory practice	Tick	Evidence of unsatisfactory practice	Tick
ECG Largely present throughout without 2D image interference		ECG Unstable or frequently absent, making timings inaccurate	
Optimization Infrequent, non-repetitive optimization errors which do not detract from the case conclusion		Optimization Frequent, repetitive optimization errors which detract from the case conclusion	
Complete study Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements		Incomplete study Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated.	
2D measurements Accurate throughout with minor errors that do not change the categorisation of the chosen pathology		2D measurements Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology	
Colour Doppler Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly		Colour Doppler Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy	
Spectral Doppler Accurate use with good cursor alignment and optimised waveforms		Spectral Doppler Inaccurate use with poor cursor alignment or waveform optimization altering pathology assessment	
Pathology assessment No images missing which are key to pathology assessment No measurements significantly inaccurate that are key to pathology assessment		Pathology assessment Poor quality or missing images missing which are key to pathology assessment Measurements key to pathology assessment significantly inaccurate and change the categorisation of the pathology	
Report is complete and accurate Comprehensive/accurate description of all parts of the heart Correct categorisation of chosen pathology (NB non-significant abnormalities may be included in this case) Correct interpretation of findings in the clinical context		Report is incomplete or inaccurate Partial/inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context	

Adult Critical Care Echo Accreditation. **Case 2 – Fluid responsiveness case: this case must be performed on a critically ill patient.** Practice must be satisfactory in all areas to pass			
Evidence of satisfactory practice	Tick	**Evidence of unsatisfactory practice**	Tick
ECG Largely present throughout without 2D image interference		ECG Unstable or frequently absent making timings inaccurate	
Optimization Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion		Optimization Frequent, repetitive optimisation errors which detract from the case conclusion	
Complete study Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements		Incomplete study Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated	
2D measurements Accurate throughout with minor errors that do not change the categorisation of the chosen pathology		2D measurements Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology	
Colour Doppler Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly		Colour Doppler Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy	
Spectral Doppler Accurate use with good cursor alignment and optimised waveforms		Spectral Doppler Inaccurate use with poor cursor alignment or waveform optimization altering pathology assessment	
Pathology assessment *Ventilated:* 1. Inferior vena cava (IVC) diameter and reactivity is correctly measured and interpreted 2. Stroke volume variation or aortic Vmax variation with respiration is correctly measured and interpreted 3. Velocity time integral (Vti) response to passive leg raise or fluid bolus is correctly measured and interpreted *Non-ventilated:* 1. IVC diameter and reactivity is correctly measured and interpreted 2. Vti response to passive leg raise or fluid bolus is correctly measured and interpreted		Pathology assessment Evidence of fluid responsiveness is incomplete such that assessment cannot be made There are significant errors in the measurement of fluid responsiveness	
Report is complete and accurate Comprehensive and accurate description of all parts of the heart Correct categorisation of evidence of all parts of the heart Correct contextualisation		**Report is incomplete or inaccurate** Partial and inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context	

Adult Critical Care Echo Accreditation. **Case 3 – Cardiogenic shock case: this case must be performed on a critically ill patient** Practice must be satisfactory in all areas to pass			
Evidence of satisfactory practice	TICK	Evidence of unsatisfactory practice	TICK
ECG Largely present throughout without 2D image interference		ECG Unstable or frequently absent making timings inaccurate	
Optimization Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion		Optimization Frequent, repetitive optimisation errors which detract from the case conclusion	
Complete study Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements		Incomplete study Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated	
2D measurements Accurate throughout with minor errors that do not change the categorisation of the chosen pathology		2D measurements Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology	
Colour Doppler Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly		Colour Doppler Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy	
Spectral Doppler Accurate use with good cursor alignment and optimised waveforms		Spectral Doppler Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment	
Pathology assessment EF is correctly measured using Simpsons measurement **AND** Correlated with visual impression and other methods CO is correctly and accurately measured using LVOT diameter and LVOT Vti **Or** Simpsons method		Pathology assessment Simpsons is measured inaccurately and changes the categorisation of the reported EF CO is incorrectly or inaccurately measured (> 10% error)	
Report is complete and accurate 1. Comprehensive accurate description of all parts of the heart 2. Correct categorisation of EF and CO 3. Correct interpretation of EF and CO in the clinical context		Report is incomplete or inaccurate 1. Inaccurate or incomplete description of the heart 2. Incorrect categorisation of EF and CO 3. Incorrect interpretation of EF and CO in the clinical context	

Adult Critical Care Echo Accreditation. **Case 4 – Non-FR/CO case: these cases may or may not be performed in a critical care setting** Practice must be satisfactory in all areas to pass			
Evidence of satisfactory practice	Tick	Evidence of unsatisfactory practice	Tick
ECG Largely present throughout without 2D image interference		ECG Unstable or frequently absent making timings inaccurate	
Optimization Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion		Optimization Frequent, repetitive optimisation errors which detract from the case conclusion	
Complete study Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements		Incomplete study Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated	
2D measurements Accurate throughout with minor errors that do not change the categorisation of the chosen pathology		2D measurements Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology	
Colour Doppler Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly		Colour Doppler Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy	
Spectral Doppler Accurate use with good cursor alignment and optimised waveforms		Spectral Doppler Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment	
Pathology assessment No images missing which are key to pathology assessment No measurements significantly inaccurate that are key to pathology assessment		Pathology assessment Images missing which are key to pathology assessment Measurements key to pathology assessment significantly inaccurate and change the categorisation of the pathology	
Report is complete and accurate 1. Comprehensive and accurate description of all parts of the heart 2. Correct categorisation of chosen pathology 3. Correct interpretation of findings in the clinical context		Report is incomplete or inaccurate 1. Partial and inaccurate description of parts of the heart 2. Incorrect categorisation of chosen pathology 3. Incorrect interpretation of findings in the clinical context	

Adult Critical Care Echo Accreditation. **Cases 4 & 5 – Other pathology**. Practice must be satisfactory in all areas to pass			
Evidence of satisfactory practice	Tick	Evidence of unsatisfactory practice	Tick
ECG Largely present throughout without 2D image interference		ECG Unstable or frequently absent making timings inaccurate	
Optimization Infrequent, non-repetitive optimisation errors which do not detract from the case conclusion		Optimization Frequent, repetitive optimisation errors which detract from the case conclusion	
Complete study Images are complete enough to allow full assessment of the selected pathology, including Doppler study and measurements		Incomplete study Images are missing which are relevant to the accurate assessment of the selected pathology, including inadequate Doppler study or relevant measurements quoted in report but not demonstrated.	
2D measurements Accurate throughout with minor errors that do not change the categorisation of the chosen pathology		2D measurements Frequent inaccuracies or isolated inaccuracies that change the categorisation of the chosen pathology	
Colour Doppler Accurate box size, gain, scale and baseline settings demonstrating anatomy clearly		Colour Doppler Frequent inaccuracies of box size, gain, scale and baseline settings which prevent clear demonstration of the anatomy	
Spectral Doppler Accurate use with good cursor alignment and optimised waveforms		Spectral Doppler Inaccurate use with poor cursor alignment or waveform optimisation altering pathology assessment	
Pathology assessment No images missing which are key to pathology assessment No measurements significantly inaccurate that are key to pathology assessment		Pathology assessment Images missing which are key to pathology assessment Measurements key to pathology assessment significantly inaccurate and change the categorisation of the pathology	
Report is complete and accurate Comprehensive and accurate description of all parts of the heart Correct categorisation of chosen pathology Correct interpretation of findings in the clinical context		Report is incomplete or inaccurate Partial and inaccurate description of parts of the heart Incorrect categorisation of chosen pathology Incorrect interpretation of findings in the clinical context	