Updates to the FUSIC® HD Minimum Dataset and Competency Requirements (January 2026)

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As of February 2026, the FUSIC® HD minimum dataset has been updated to include 4 additional core measurements and a change to the LAP algorithm:

1. **Left Ventricular Ejection Fraction (LVEF)**
2. **Right Ventricular Fractional Area Change (RV FAC)**
3. **RV dimensions**
4. **More detailed pulmonary hypertension assessment (including Doppler)**
5. **Left atrial pressure assessment**

These additions reflect the growing recognition of the clinical importance of ventricular-arterial coupling in critical care, and the need to better assess right ventricular function in the context of pulmonary pressures. There is also a new reporting form to encompass these changes available on the ICS website.

1. Left Ventricular Ejection Fraction (LVEF)

Why it's included:
LVEF is now formally included in the FUSIC® HD competency framework as the most practical and clinically useful surrogate of left ventricular-arterial coupling. While previously avoided in favour of fractional shortening (FS), LVEF offers a more widely understood and physiologically integrative measure that captures both contractility and afterload.

Load dependence is a feature, not a flaw:
LVEF is load dependent – and while this makes it unsuitable as a pure measure of contractility, it is *precisely* what makes it a valuable indicator of coupling. It reflects how well the ventricle adapts to the prevailing arterial load. For example, in vasodilated states such as sepsis, afterload may be so low that a failing ventricle maintains a normal-appearing LVEF. However, when vascular tone is restored (e.g. with vasopressors), the increase in afterload can lead to a reduction in LVEF, unmasking previously hidden systolic dysfunction.

Mathematical equivalence to coupling metrics:
In single-beat models (e.g. Chen method), the ratio of arterial to ventricular elastance (Ea/Ees) simplifies to a function of LVEF:

$$Ea / Ees = (1 / EF) - 1$$

This means that in most clinical scenarios, LVEF **is effectively a surrogate for the ventricular–arterial coupling ratio**, making it a pragmatic and meaningful metric at the bedside.

How to measure it:

- Some echocardiography machines offer automated or AI-derived LVEF calculations (e.g. auto-simpson or machine-learning-based algorithms). These may be used if available and image quality is sufficient.
- Use a high-quality apical 4-chamber and 2-chamber view
- Trace the endocardial borders at end-diastole and end-systole
- Apply the Simpson's biplane method if possible:

$$EF = ((EDV - ESV) / EDV) \times 100$$

Where EDV = end-diastolic volume, ESV = end-systolic volume

- If image quality is suboptimal or quantification not feasible, LVEF may be estimated visually (with appropriate experience)

Interpretation:

- **Normal:** LVEF ≥ 55%
- **Borderline-low:** LVEF 50-54%
- **Impaired:** LVEF 36-49%
- **Severely impaired:** LVEF ≤ 35%

Practical points:

- Should calculated if feasible or, if not, be estimated visually
- Must be interpreted in context of loading conditions, inotropy, LV size, and clinical state
- Supports better haemodynamic decision-making and prognostication

2. Right Ventricular Fractional Area Change (RV FAC)

Why it's included:
FAC is now the preferred metric in FUSIC® HD for assessing **right ventricular–pulmonary**

arterial (RV–PA) coupling. It offers a more comprehensive view of RV systolic performance than TAPSE or RV S1, as it integrates changes in both dimensions and better reflects the impact of afterload.

Why RV–PA coupling matters:
Right ventricular failure is a common and often under-recognised problem in critical illness, particularly in the context of ARDS, PE, and elevated pulmonary vascular resistance. Assessing how well the RV is adapting to its afterload is vital. FAC is particularly helpful because:

- It reflects both RV contractility and the effects of pulmonary afterload
- It is less angle-dependent than longitudinal measures (TAPSE, TDI)
- It correlates with prognosis in pulmonary hypertension and critical care

How to measure it:

- Acquire a good quality apical 4-chamber view
- Trace RV endocardial area at end-diastole and end-systole
- Calculate:

$$FAC = ((\text{RV diastolic area} - \text{RV systolic area}) / \text{RV diastolic area}) \times 100$$

Interpretation:

- **Normal:** FAC ≥ 30%
- **Impaired:** FAC < 30%

Note: BSE reference intervals specify sex-specific normal ranges (30–65% in men, 35–67% in women). For FUSIC® HD, a simplified cut-off of 30% is adopted to prioritise ease of bedside interpretation while maintaining clinical sensitivity.

Practical points:

- Ensure good image quality with clear endocardial borders
- Avoid foreshortening or RV outflow tract inclusion
- FAC complements other RV parameters (TAPSE, TR Vmax, RV S1, RV free wall thickness) and should be interpreted in context

3. Right Ventricular Dimensions

Why they're included:
Assessment of right ventricular (RV) size using linear dimensions is straightforward, reproducible, and clinically meaningful. Dilatation in any plane (basal, mid, or longitudinal) may indicate pressure or volume overload. These measurements complement RV FAC, TAPSE, and TR Vmax to form a comprehensive picture of RV structure and function.

How to measure them:

- Use the apical 4-chamber view
- Measure inner-edge to inner-edge at end-diastole in the following locations:
  - **Basal diameter:** widest point across the base of the RV
  - **Mid diameter:** halfway between base and apex
  - **Longitudinal length:** from base (annulus) to apex

Interpretation:

- **Basal diameter:** Normal < 45 mm
  (BSE reference: <43 mm in women, <47 mm in men)
- **Mid diameter:** Normal < 40 mm
  (BSE reference: <42 mm in men, <35 mm in women
- **Longitudinal length:** Normal < 85 mm
  (BSE reference: <87 mm in men, <80 mm in women

Note: FUSIC® HD uses simplified single cut-offs for bedside assessment. Borderline values should prompt correlation with clinical context and other imaging parameters.

4. More detailed pulmonary hypertension assessment (including doppler)

Why it's included:
Assessment for pulmonary hypertension (PH) is critical in understanding RV dysfunction. Echo indicators – particularly those derived from RVOT Doppler and pulmonary artery evaluation – can support diagnosis and help differentiate pre- from post-capillary PH in the acute setting.

Supportive features of pulmonary hypertension may include:

- RV dilatation
- Right atrial enlargement (RA area >18 cm²)
- Basal RV:LV diameter ratio >1

- D-shaped septum (septal flattening)
- IVC >2 cm

Pulmonary artery/RVOT Doppler indicators:

- **RVOT acceleration time <105 ms**
- **Systolic notching** of the RVOT Doppler trace
- **Early diastolic PR velocity >2.2 m/s**
- **PA diameter >25 mm**

Pre-capillary PH features:

- Lung disease
- Severe RV and RA enlargement
- RVOT notching (earlier with more proximal causes, e.g. pulmonary embolism)
- No features of raised LAP (left atrial pressure)

Post-capillary PH features:

- LV disease (systolic or diastolic dysfunction, mitral regurgitation, dilated LA)
- RV and RA enlargement
- Features of elevated LAP

These findings should always be interpreted in the full clinical context. Doppler findings – especially RVOT notching and acceleration time – can offer valuable insight when interpreted alongside chamber size, septal motion, and LA pressure indicators.

How to measure key Doppler parameters:

- **RVOT acceleration time:** Use pulsed wave Doppler in the parasternal short axis (PSAX) or modified high parasternal view at the level of the RVOT. Place the sample volume just proximal to the pulmonary valve. Measure the time from the onset of systolic flow to the peak velocity. A sweep speed of 100 mm/s is recommended for accuracy.
- **Early diastolic PR velocity:** Use continuous wave Doppler through the pulmonary valve (typically from the PSAX view). Identify the pulmonary regurgitation (PR) jet and measure the peak early diastolic velocity. Values >2.2 m/s may indicate elevated pulmonary artery pressures.

5. Revised LAP algorithm:

Summary

The revised FUSIC® HD LAP algorithm removes E/A measurement from the previous algorithm. It uses ASE-aligned LAP markers (E/E′, LA size, TR Vmax), ICU-specific signs (B-lines + IAS bowing), and applies TR Vmax conditionally. E/E′ ≥14 identifies high LAP; E/E′ <8 supports normal LAP; values 8-14 are indeterminate. This approach is physiologically robust, safer for ICU practice, and simpler to teach.

Purpose of the HD LAP Algorithm

The FUSIC® HD LAP tool is designed to answer a single, binary, time-sensitive question:

Is left atrial pressure (LAP) probably high in the current haemodynamic state?

This is a fundamentally different aim from ASE diastolic grading, which seeks to classify chronic diastolic dysfunction patterns.
HD requires a practical, fast, physiologically robust method for acute haemodynamic inference, not pattern phenotyping.

Any variable that adds complexity without improving accuracy for this binary question weakens the algorithm.

Why E/A was removed

The E/A ratio is a powerful tool for diastolic pattern recognition (normal, impaired relaxation, pseudonormal, restrictive), but it is not reliable for LAP estimation, especially in ICU physiology:

E/A <0.8 may reflect:

- normal LAP (classic Grade I), or
- high LAP if both E and A are large ("impaired relaxation with elevated LAP").

E/A >2 may reflect:

- very high LAP (restrictive pattern), or
- a hyperdynamic, vasodilated state with normal LAP (sepsis, tachycardia, post-MI preserved relaxation).

ICU conditions (PEEP, sedation, tachycardia, fluid shifts) make E and A highly unstable.

ASE 2025 itself de-emphasises E/A as a LAP surrogate, using it only after the primary LAP markers (E′, E/e′, TR velocity, LA size/strain) have been evaluated.

In other words, E/A can go up, down, or look normal as LAP increases – it isn't a dependable indicator.

It introduces both false reassurance (high LAP with E/A <0.8) and false alarm (normal LAP with E/A >2 in hyperdynamic physiology).

Given that our question is strictly: Is LAP high right now?, E/A contributes noise, not discriminative signal.

For FUSIC® HD, removing E/A:
• Fewer false positives (e.g., septic hyperdynamic LV with E/A >2 but normal LAP).
• Fewer false negatives (e.g., E/A <0.8 with high LAP due to massively elevated A wave).
• Cleaner ICU workflow, less cognitive branching, fewer opportunities for misinterpretation.
• Better alignment with ASE 2025, which aims to prevent exactly these E/A-related errors.
What we lose by removing E/A – and why that is acceptable:

We lose immediate access to Doppler "pattern recognition" (impaired relaxation vs pseudonormal vs restrictive).
But:
• This does not correspond closely to LAP in acutely unwell patients.
• It does not alter management decisions in the ICU.
• It does not improve the ability to call LAP high or not.

Therefore, the theoretical loss of diastolic pattern nuance is justified by a clear gain in haemodynamic precision and operational simplicity.

On balance, E/A contributes classification structure, not incremental information about LAP when the triad is available.

The ASE-aligned LAP markers: E/E′, LA size, TR Vmax

The 2025 ASE algorithm identifies three variables with the strongest correlation to mean LAP:
1. E/E′
2. Left atrial structure (LA size / LAVi / LA strain)
3. TR Vmax or PASP

These reflect different aspects of LAP physiology:
• E/E′ → instantaneous filling pressure (mitral inflow vs relaxation)
• LA size → integrated chronic LAP burden
• TR Vmax → transmitted pulmonary venous pressure (when PVR & RV function normal)

FUSIC® HD uses these core components but simplifies:

- LA size is assessed qualitatively (feasible at bedside)
- E′ is measured only to compute E/E′ (not used independently)
- TR Vmax is included conditionally (see below)

Importantly:
- These measurements already exist within the FUSIC® HD skillset.
- They are relatively robust in critically ill patients.
- They directly inform the haemodynamic profile (preload responsiveness, pulmonary venous hypertension risk, tolerance of fluids, etc.).

Thus, keeping and prioritising the triad increases both accuracy and clinical relevance for our use case.

Conditional use of TR Vmax — essential for accuracy

TR Vmax is only valid as a LAP marker when:
- RV systolic function is preserved, AND
- Pulmonary vascular resistance is not elevated

If either is abnormal, TR Vmax becomes non-specific:
- In RV failure, TR Vmax may be falsely low (RV can't generate pressure) or falsely normal (RVSP and RAP both high).
- In raised PVR (pneumonia, ARDS, high PEEP, COPD, PE, acute cor pulmonale), TR Vmax becomes falsely high – reflecting pulmonary vascular load, not LAP.

Therefore:

TR Vmax should only be used if the RV and pulmonary circulation appear normal.

If lung disease or RV dysfunction is present, TR Vmax is ignored and only LA size and E/E′ contribute to the LAP decision.

This prevents severe misclassification in common ICU scenarios.

E/E′ thresholds — why ≥14 and <8 (not <10)

ASE 2025 specifies only one firm threshold:
- E/E′ ≥14 → supports elevated LAP

ASE deliberately avoids a "normal LAP" cut-off because E/E′ becomes variable at low filling pressures, especially in older patients.

However, HD requires a binary LAP call.

We therefore introduce a pragmatic, ICU-safe threshold:
- E/E′ <8 → supports normal LAP
- Highly specific for normal LAP in invasive studies
- Avoids false reassurance
- Conservative choice appropriate for ICU

Values 8-14 are considered indeterminate unless LA size and TR Vmax strongly support low LAP.

This approach prioritises safety and avoids falsely calling LAP “normal” in borderline or load-altered situations.

Why B-lines + IAS bowing remain the first decision point

B-lines alone are non-specific in ICU (pneumonia, ARDS, fluid overload, cardiogenic oedema). IAS bowing into the RA is a direct pressure sign, highly specific for raised LAP.

When B-lines and IAS bowing coexist, the combination has extremely high predictive value for elevated LAP:

- ARDS/pneumonia → no IAS bowing
- RV failure → IAS bows towards the LA (opposite direction)
- High PEEP → increases PVR but does not cause left→right IAS bowing
- Isolated LV failure → produces both

Therefore:

B-lines + IAS bowing = LAP probably high.
No further Doppler evaluation needed.

This is an ICU-specific enhancement; ASE does not use lung ultrasound or IAS.

Why this revised LAP algorithm is superior

Accuracy:
- Removes E/A misclassification
- Uses ASE-aligned markers for LAP
- Conditions TR Vmax appropriately
- Ensures high specificity for normal LAP

Feasibility:
- The existing algo has been simplified. We are removing measurements - not adding more
- Teachable within minutes
- Uses standard FUSIC® windows

• Avoids complex measurements (LAVi, LA strain)

Safety:
• Avoids falsely reassuring “normal LAP” labels
• Avoids false positive “high LAP” designations in hyperdynamic or afterloaded states
• Integrates lung US and IAS signs without over-reliance

Conceptual clarity:
• Separates relaxation (E′) from filling pressure (E/E′, LA size, TR Vmax)
• Follows ASE 2025 principles while adapting them to ICU needs

Implementation Timeline

Candidates are encouraged to begin incorporating LVEF, and the more detailed RV and pulmonary hypertension measurements into their scans immediately. However, these measurements will become **compulsory for all FUSIC® HD logbook scans performed on or after 1st February 2026**.

Candidates already undertaking FUSIC® HD accreditation are **not expected to restart their logbooks**. Scans performed prior to this date will still be accepted without these new measurements. This phased approach ensures fairness while allowing time for adaptation to the updated dataset.

Examinations from 2026 will include these new competencies.

Summary

These updates bring FUSIC® HD into closer alignment with contemporary haemodynamic physiology and practice. They reflect an ongoing commitment to supporting meaningful, bedside-focused assessment that balances physiological depth with pragmatic application.

The additions include:

- **Left Ventricular Ejection Fraction (LVEF):** now included as a core measure of ventricular-arterial coupling.

- **Right Ventricular Fractional Area Change (RV FAC):** adopted as the preferred metric for assessing RV-pulmonary arterial coupling.

- **Right Ventricular Dimensions:** basal, mid, and longitudinal diameters provide additional structural insight into RV size and adaptation.

- **Pulmonary Hypertension Assessment:** key features and Doppler measurements, including RVOT acceleration time and early diastolic PR velocity, are incorporated to help characterise the presence and nature of pulmonary hypertension.

- **Simpler Left Atrial Pressure assessment:** with E/A ratio removed from the previous algorithm.

Simplified cut-offs have been adopted where appropriate to enhance reproducibility and bedside utility. These additions are expected to improve diagnostic clarity, guide appropriate interventions, and reinforce the physiological reasoning at the heart of the FUSIC® HD programme.