

GUIDELINES AND RECOMMENDATIONS

The Echocardiography Quality Framework: a comprehensive, patient-centered approach to quality assurance and continuous service improvement

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Abstract

The Echocardiography Quality Framework (EQF) is a unique, comprehensive, holistic approach to improving all aspects of an echocardiography service. The EQF is a patient-centered program, combining Quality Assurance and Continuous Service Improvement. The framework encompasses measures of (i) the quality of echocardiography, (ii) reproducibility and consistency, (iii) education and training, and (iv) customer feedback. The EQF is scalable and adaptable to benefit any echocardiography service. A catalogue or library of supporting documents is being developed by the British Society of Echocardiography (BSE), to be made available to any participating department. A mechanism and online infrastructure for (optional) national registration or assessment is being developed, to be used as a standalone adjunct or linked to BSE Departmental Accreditation. The principles that underpin the EQF may be applied to other imaging disciplines and, ultimately, other medical or surgical specialties.

Key Words

- ▶ echocardiography
- ▶ echocardiographic quality
- ▶ quality improvement
- ▶ quality assurance

Introduction

Developing and implementing a quality assurance (QA) program for echocardiography is a challenge. Since many aspects of echocardiography are subjective or qualitative, meaningful assessment of ‘quality’ can be difficult. Quantitative measurements have no available reference standard in day-to-day clinical practice, limiting the usefulness and applicability of intra- and inter-observer variability assessments. Since these audit and QA exercises are difficult and time consuming (and sometimes contentious – they can be interpreted as critical of individuals’ competence), their value in busy echocardiography departments can be questioned. Furthermore, while there are recent initiatives to ensure

that quality standards are regularly assessed and maintained (for example British Society of Echocardiography Departmental Accreditation, BSE DA), there remains a relentless pressure to maximize productivity to meet ever-increasing demand. How much time should be spent on QA activity by an echocardiography department at the expense of routine clinical activity? More importantly, how will this QA activity benefit patients?

Despite the challenges described earlier, audit of image quality and assessment of reproducibility are important traditional markers of QA. However, these are only two aspects of an echocardiography service. The Echocardiography Quality Framework (EQF), a comprehensive holistic approach to improving quality in all aspects of an echocardiography service, is presented



in this paper. Rather than a series of isolated, disconnected projects that may not produce lasting benefit, a program of Continuous Service Improvement (CSI) is advocated. The key principles in the development of the EQF are:

- A *holistic approach* that covers the key aspects of the echocardiography service from the points of view of all stakeholders: patients and carers, clinical and administrative staff who use the service, the echo team itself and external bodies (such as BSE).
- A *patient-centric approach* is vital; every aspect of the program should be clearly linked to this. The program can therefore be viewed as *improving patient care* rather than *measuring the performance* of the echocardiography team.
- *Every member of the team* (physiologists, cardiologists, healthcare assistants, clerical staff, others) could be engaged in some quality improvement activity. If successful, this could help foster an ‘improvement culture’ within a department, benefiting team members as well as patients. Improvement work

could be assigned to team members according to their preference or skills – effectively, this approach allows for a holistic approach to the echo team as well as the improvement activity itself.

- A *scalable, adaptable program*, which could be undertaken at a pace that suits the capacity and capability of the team.

The EQF is endorsed by the British Society of Echocardiography, who are developing – through the Clinical Standards Committee – a national program to support its implementation and further development.

The Echocardiography Quality Framework

The EQF is based on the above four key principles and structured around four main themes or questions (Fig. 1):

1. Echocardiogram quality: Are we constantly improving our echo quality? Do our reports help clinicians provide better patient care?

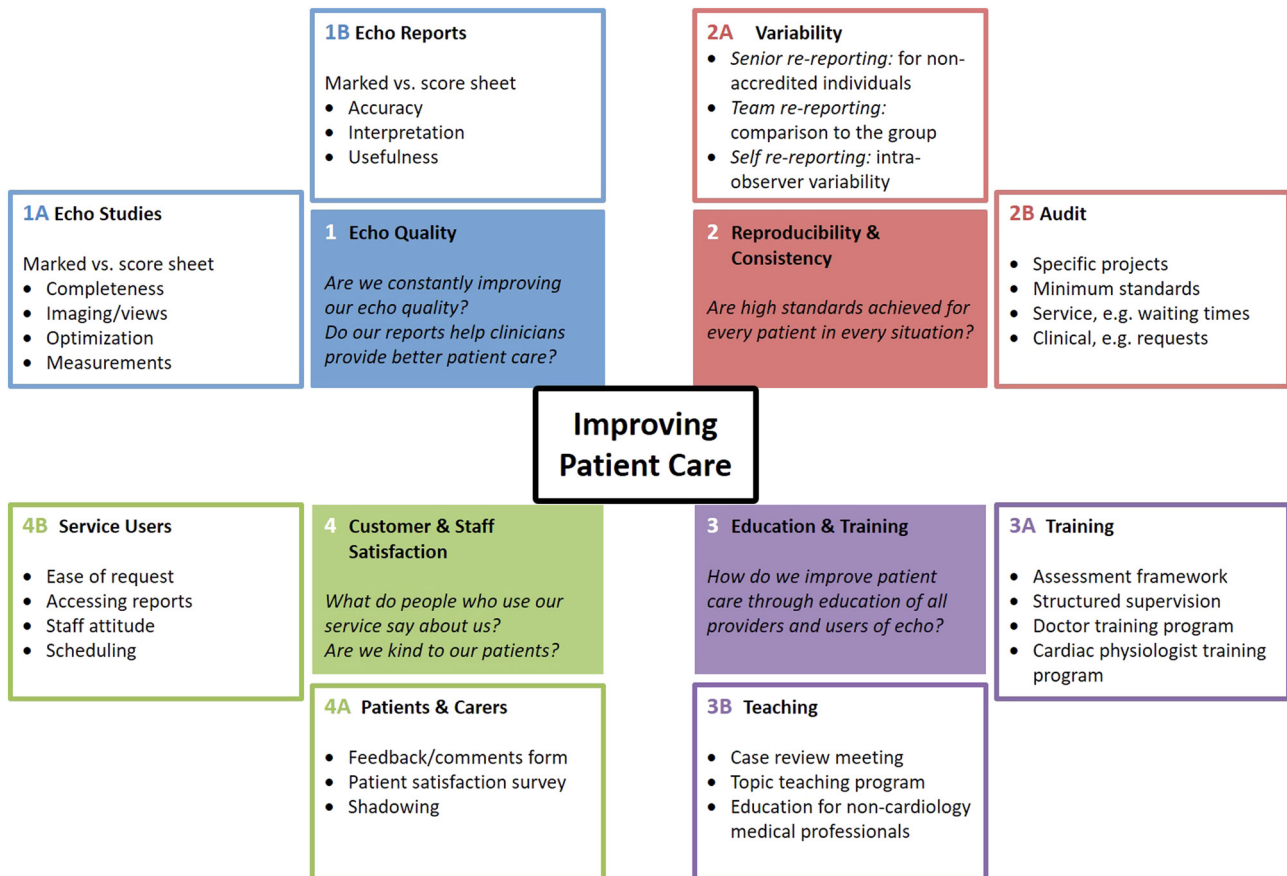


Figure 1
The four themes or quadrants of the EQF.

2. Reproducibility and consistency: Are high standards achieved for every patient in every situation?
3. Training and teaching: How do we improve patient care through education of all providers and users of echo?
4. Customer satisfaction: What do people who use our service say about us? Are we kind to our patients?

These four questions are inter-linked and comprise the four themes or quadrants of the EQF (Fig. 1), described in more detail below. Each of the quadrants is sub-divided into two domains. Within each domain, individual projects and protocols have been developed, drawing on the experience and expertise of departments around the United Kingdom, so that a catalog or library of quality improvement activities is being built up and can be drawn upon. This is described in detail by Ingram *et al.* (1). The framework provides the philosophy and structure of the program (effectively, the contents page of the EQF ‘instruction manual’), with each domain being underpinned by examples of practice that can be used or adapted by others (effectively, the chapters of the instruction manual).

Each EQF quadrant and domain is described below along with the principles of assessment and delivery. A program of implementation, including sample protocols and score sheets has been developed and are presented elsewhere (1).

Quadrant 1: Echocardiogram quality

*Are we constantly improving our echocardiogram quality?
Do our reports help clinicians provide better patient care?*

A patient-centered, holistic approach to echocardiogram quality requires consideration of (i) the technical quality of the image acquisition as well as accuracy of data measurements and calculations and (ii) the interpretation of findings and *usefulness* of the echo report – after all, it is the echo report (not the echo images), received and acted upon by the requesting clinician that affects patient care.

Domain 1A. Echocardiogram study

Are we constantly improving our echocardiogram quality?

Assessing and reassessing the quality of echocardiographic studies could be considered a conventional and compulsory starting point for an echo QA program, but it can be difficult to do well because of the subjective nature of ‘image quality’. Informal commentary on image quality within the echo reporting room and at teaching meetings

has always been part of the culture of echo departments. It is important to supplement this using a consistent, structured approach; ideally, it should be a team-based exercise involving of all echocardiographers, who would benefit from shared discussion points and learning, rather than an interaction between two individuals in isolation.

Rather than setting a rigid standard (i.e. a pass mark that will by definition result in a ‘failure’ rate), the question asks simply whether or not we are *constantly improving* – a positive goal that is beneficial for echocardiographers and patients.

Assessments

- Completeness – have all of the necessary views and modalities recorded.
- Imaging/views – are 2D imaging planes and Doppler data ‘text-book’ correct.
- Optimization – technical quality of 2D and Doppler settings.
- Measurements – appropriate choice and accuracy of 2D and Doppler quantification.

Recommended methodology

- Use of a standard score sheet (e.g. a modified BSE TTE Accreditation score sheet).
- Regular ‘group review’ of studies selected at random, marked by the group, facilitated by a senior echocardiographer (cardiologist or physiologist) with recorded outcomes.

Domain 1B. Echocardiogram report

Do our reports help clinicians provide better patient care?

The echocardiogram itself does not improve patient care. Providing the referring clinician with a useful report is what impacts patient care. There is little value in obtaining high-quality images if the echo report is incorrect or impossible to interpret. Since patients are referred for echocardiography by a wide variety of clinicians – physicians, anesthetists, GP’s, nurses, cardiologists and others – it is important to provide a report that is comprehensible and relevant to these referrers.

Assessments

- Accuracy – complete and correct observations made and reported.
- Interpretation – findings collated and contextualized to provide suitable, detailed interpretation, rather than simple observations.

- Usefulness – answering the question. Presenting the findings in a comprehensible manner that helps the referring clinician to manage the patient.

Recommended methodology A similar approach to domain 1: assessing the Echocardiogram Study.

- Use of a score sheet that includes assessment of end-user factors: *interpretation* and *usefulness*.
- Regular ‘group reading’ sessions with recorded outcomes.

Quadrant 2: Reproducibility and consistency

Are high standards achieved for every patient in every situation?

While an echocardiography team may have dedicated clinical leaders, a highly skilled physiology team and high-end equipment, the service received by patients can depend on the circumstances and time of day. Ironically, the most acutely ill patients may be scanned by the least expert echocardiographer, using the lowest specification machine, in the most difficult environment, producing an incomplete or informal report. It may, of course, be entirely appropriate to perform an urgent or emergency echocardiogram, focused on a specific question. However, in most circumstances, our aim would be for every echocardiogram to reach a consistently high standard, regardless of the time of day, the day of the week or the clinical environment.

Within the echocardiography department, the importance of accurate and reproducible quantitative measurements (‘traditional’ QA) cannot be overstated. Inaccurate or poorly reproducible measurements can adversely affect patient care (e.g. inaccurate ejection fraction may result in harmful treatment or withdrawal of chemotherapy) and the overall value of echocardiography in clinical research and practice.

What can we do to ensure that we are endeavoring to achieve a high level of consistency and reproducibility within the echocardiography department as well as at the ‘point of care’? This quadrant addresses these questions in the following two domains in the EQF: (i) minimizing unwarranted variability and (ii) conducting meaningful audits of our practice and completing audit cycles where appropriate.

Domain 2A. Variability

Senior review of a selection of echocardiograms – either selected randomly or targeted at a particular subset of patients and/or echocardiographers – is an important, conventional element of quality control. Rather than

assessing the technical quality of the study (as in domain 1), the aim of this exercise is simply to determine whether or not the same findings and conclusions are reached, when reviewing a previously performed echocardiogram.

Assessments

Reassessing inter-observer variability of an entire study:

- Senior re-report highlighting ‘minor’ (unlikely to change management) or ‘major’ (likely to change management) discrepancies. Discussion in a team forum.
- Team re-reports – including discussion of variances with the original report and variations in interpretation or measurement.

Reassessing inter-observer variability in selected key areas of practice. For example:

- In departments assessing post-chemotherapy patients, assessing the variability of ejection fraction measurement.
- In valve disease clinics, assessing the variability of aortic valve area measurement.
- In acute services, assessing the variation in grading of mitral regurgitation post-myocardial infarction.

Recommended methodology

- A structured system of senior re-report and team re-report adapted to meet the requirements of each department.
- Random selection of entire studies.
- Targeted selection in key areas.

Domain 2B. Audit

A holistic approach to quality and service improvement should include good quality audit against (i) best clinical standards and (ii) service delivery requirements. The principle of the EQF is to target audit projects to a demonstrable link to improving patient care and the question posed in this quadrant: ‘Are high standards achieved for every patient in every situation?’

Assessments

- Specific projects – these could be audits of image acquisition, measurements or reporting, for example, audit of patients referred with breathlessness/suspected heart failure:
 - What parameters of LV systolic function, diastolic function and pulmonary artery pressure were *reported* (against recommended standards)?

- Were they reported in a way that was explicable to the referring clinician? This topic illustrates the patient-centric rather than technical approach we are trying to achieve, addressing questions (and hopefully driving up standards) that matter to the users of our service.
- Minimum standards – audits of adherence to BSE Standards and Recommendations.
- Service, for example, waiting times.
- Clinical, for example, requests – the approach to this type of audit would, again, be centered on improving patient care and therefore would ideally be a collaborative project. For instance, an audit of pre-operative echocardiogram requests for appropriateness (e.g. ‘heart murmur, pre-hip surgery’) could be done in collaboration with the surgical or anesthetic department with a view to improving accessibility and minimizing unnecessary pre-operative delays.

In keeping with the cohesive structure of the EQF, there are links between audit, as described earlier, and education. In the latter example, the audit would lead naturally into an educational dialog between providers and users of the service.

Quadrant 3: Education and training

How do we improve patient care through education of all providers and users of echo?

The aims of this quadrant are to better align the training and teaching activities in our echocardiography department with the needs of the service – for both providers and users. This is particularly relevant at a time when there is a tension between more demanding requirements for training (e.g. the cardiology Specialist Training curriculum) and increased service demand. Demonstrating a link between training, teaching activities and patient outcomes provides justification and support for their incorporation into the departments' core activity.

A structured approach to training and teaching is closely allied to all the other quadrants of the EQF.

Domain 3A. Training

While many echocardiography departments can be proud of their record of training physiologists and cardiologists to achieve BSE Accreditation, feedback from trainees (e.g. the General Medical Council Cardiology Trainee survey) reveals an inconsistent, informal approach that could be improved upon. Accordingly, a structured approach is recommended, drawing on exemplars of excellence provided by senior and junior physiologists and cardiologists from around the United Kingdom.

Methodology

- Assessment framework – a formal protocol for assessing baseline knowledge and skills prior to training. Repeat assessments and sign off at specified stages e.g. novice, fully supervised scanning, supervised on call (SpR's), pre-BSE stage (independent scanning with report sign off), full BSE Accreditation.
- Structured supervision – a graded program of supervision from initial experience, through supervised scanning, to independent scanning and reporting with senior overview. This links with the Assessment Framework, above.
- Cardiac Physiologist training program – formalization of BSE curriculum training with a trainee held portfolio.
- Cardiology Specialty training program – formalization of BSE curriculum training with a trainee held portfolio.

Domain 3B. Teaching

In addition to teaching our own teams and the wider echocardiography community (i.e. *providers* of the service), the EQF approach includes development of a more patient-centered approach involving educational activity for *users* of the service. This should include clinicians who refer patients and receive our reports. Ultimately, education for patients is recommended.

Methodology

- Case review meeting – regular teaching session, discussing interesting and informative cases. Predominantly teaching for the echocardiography department; further developed to target other invited groups – interesting Critical Care cases, echocardiography for oncologists, etc.
- Topic teaching program – a series of tutorials, lectures or presentations by the echocardiography team, covering the BSE curriculum.
- Non-cardiology education – a program of tutorials, lectures or presentations for our users: junior doctors, hospital clinicians, GPs. Topics could include:
 - How to read an echocardiogram report?
 - Understanding the echo assessment of left ventricular function.
 - How does echocardiography help stroke management?
 - When is trans-esophageal echocardiography indicated in suspected endocarditis?



Quadrant 4: Customer satisfaction

What do people who use our service say about us? Are we kind to our patients?

Key elements of a service improvement approach are feedback, reflection and stakeholder engagement: *What do people who use our service say about us?*

The EQF approach is to frame this question as broadly as possible, covering as many aspects of the service as possible, in a variety of different ways, and being receptive about the answers. A natural place to start is to undertake patient satisfaction surveys, extending to feedback from *all* the people who use our service. Thus, the two domains in the customer satisfaction quadrant are (i) patients and carers and (ii) service users.

Domain 4A. Patients and carers

The EQF approach is to view our service from the patient perspective – how would we wish to be treated in our own department? This is articulated by the question: *Are we kind to our patients?*

Methodology

- Feedback/comments forms – simple, anonymous, immediate comments box or alternative electronic feedback form.
- Patient/carer satisfaction surveys – using a combination of media: paper forms, electronic forms, touch pad (tablet). Recommended aspects to be covered include:
 - overall experience
 - access
 - dignity
 - communications.
- Shadowing – using volunteer students or junior staff in which patients are followed through the experience of attending an echocardiography appointment. Their observations may be particularly helpful for patient groups who do not wish to, or cannot, complete surveys.

Domain 4B. Service users

This includes the clinicians and support teams (including administrative staff) whom, ultimately, affect patient care using our echocardiography reports. It is understandable that some of the processes involved in a diagnostic service are designed for the efficient running of that service but are they truly for the benefit of the patient or to suit the team? There needs to be an appropriate balance. Of more concern is the knowledge that some departments can appear intimidating or unhelpful, particularly to junior or non-specialist service users. The EQF is an opportunity to

reflect on feedback from these users and develop a dialog aimed at overall service improvement.

Methodology

- Feedback/comments forms.
- User satisfaction surveys – aspects to be covered include:
 - Ease of request.
 - Accessing and interpreting reports.
 - Staff attitude.
 - Waiting times and scheduling.

Implementation of the EQF

The EQF is designed to be scalable, adaptable and undertaken at a pace that suits the capacity and capability of the team. With local modifications or improvements where required, it should be possible to implement it in any hospital-based echocardiography department, regardless of size. Guidance on the frequency of EQF activity and linkage to the BSE Departmental Accreditation process has been developed by the BSE Clinical Standards Committee and are described in detail elsewhere (in this issue) (1).

The design principles for implementation are explained below:

The continuous EQF cycle

A strength of the EQF is that it naturally dovetails into a Continuous Service Improvement (CSI) environment that is responsive to local demands, rather than creating a series of isolated and unconnected projects that fail to gain wider traction. This approach encourages the involvement of the entire echo team (it would be impossible for one individual to lead or implement every domain) that, with appropriate nurture, will have a positive impact on the culture of the host department. In order to achieve this goal, regular time within the normal working week has to be set aside for ‘quality’ or ‘service improvement’ activity. However, this is crucial work that will benefit patients, staff and host institutions. It is also a resource requirement that is in keeping with the QA processes required of other diagnostic services. Lastly, there will likely be efficiency gains as a result of activity performed in several of the domains.

A framework for (self) assessment

Rather than prescribing rigid targets, the EQF represents a ‘journey’ for many echo departments that will be of

benefit, regardless of the end product or final ‘destination’. Nevertheless, some guidance is necessary, particularly to provide a future link with BSE Departmental Accreditation. A framework outlining the recommended frequency and duration of each domain has been developed by BSE and is described in detail by Ingram *et al.* (1).

A catalog of supporting documents

The format of the EQF (Fig. 1) describes its underlying principles as well as its structure. Effectively, it is also the ‘contents page’ of the EQF program. Underpinning each domain, each echocardiography department will need plans, protocols or projects that will be used to for implementation. In discussions with colleagues around the United Kingdom, it became evident that many departments already do some QA, audit or service improvement activity, often of excellent quality but not always in a connected or structured way.

BSE has collected examples of protocols or projects that will be adapted and made available to others, e.g. Patient Satisfaction surveys, audit projects, training programs, etc. By collating examples from diverse departments of different sizes, we hope to give a head start to teams. Again, these are described in detail by Ingram *et al.* (1).

Assessment and links to departmental accreditation

While any EQF activity would benefit an echocardiography team and facilitate improvement of its service, linking local activity to a national framework has potential benefits: external oversight and support, guidance and recommendations with regards to ‘standards’, and a means of assessment.

For the BSE, the mechanism for doing this is under development and is described by Ingram *et al.* (1). An exciting possibility is an online portal whereby evidence of EQF activity can be uploaded and recorded. Departments will be able to chart their progress against the domains of the EQF over a multi-year cycle. The EQF can be used as a standalone tool or integrated into the BSE Departmental Accreditation process.

Summary

- The Echocardiography Quality Framework is a cohesive, patient-centered program, combining QA and Continuous Service Improvement, which can be adapted to suit the needs of any echocardiography department.
- The framework encompasses measures of the quality of care, reproducibility and consistency, education and training and customer feedback.
- The EQF is scalable and adaptable to benefit any echocardiography service.
- A catalog or library of supporting documents is being developed, drawing on expertise around the United Kingdom, to be made available to any participating department.
- A mechanism and online infrastructure for national registration or assessment is being developed, to be used as a standalone adjunct or linked to BSE Departmental Accreditation.
- The principles that underpin the EQF may be applicable to other imaging disciplines and, ultimately, other medical or surgical specialties.

Declaration of interest

The author declares that there is no conflict of interest that could be perceived as prejudicing the impartiality of this guideline.

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Reference

- 1 Ingram TE, Baker S, Allen J, Ritzmann S, Bual N, Duffy L, Ellis C, Bunting K, Black N, Peck M, *et al.* A patient-centred model to quality assure outputs from an echocardiography department: consensus guidance from the British Society of Echocardiography. *Echo Research and Practice* 5 25–33. (<https://doi.org/10.1530/ERP-18-0053>)

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