Consortium for the Accreditation of Sonographic Education

Standards for Sonographic Education

September 2025

version 4.0, 09-25

Contents

1. Introduction

The purpose of this document is to assert Health Education England's views on the standards that need to be met within/through sonographic education and training for non-medical practitioners, known as 'Sonographers'. If 'Sonographer' becomes a protected title in the future, and the Health & Care Professions Council (HCPC) becomes the regulatory home for sonographers, the HCPC will define the Standards for Education and Training (SETS) that education and training programmes must meet before they can be approved. The work was funded by NHS England, but applies to all CASE accredited programmes.

The Society & College of Radiographers (SCoR) (2018) definition of a sonographer is:

"A healthcare professional who undertakes and reports on diagnostic, screening or interventional ultrasound examinations. They will hold as a minimum qualifications equivalent to a postgraduate certificate or diploma in medical ultrasound, BSc (Hons) clinical ultrasound or an honours degree apprenticeship in clinical ultrasound that has been accredited by the Consortium for the Accreditation of Sonographic Education (CASE). They are either not medically qualified or hold medical qualifications but are not statutorily registered as a doctor in the UK"[1]

The Centre for Workforce Intelligence, in their report on the sonography workforce, state that "sonographers therefore assess referrals for ultrasound imaging; undertake the most appropriate examination to aid the diagnosis; and record images appropriate to the diagnosis. Sonographers in the UK are also responsible for interpreting images and issuing diagnostic reports, so have a high degree of responsibility in the diagnostic process".[2]

Medical ultrasound is a real-time, dynamic imaging investigation where high frequency soundwaves are used to assess organs and structures within the body to assist in the screening and diagnosis of a wide range of conditions. Sonographers work closely with other clinical colleagues such as Radiologists, Obstetricians and Gynaecologists, to provide safe, effective patient care. Medical ultrasound is practised by a range of professionals and, until 2016, was practised by healthcare professionals who had undergone postgraduate education and training to become sonographers. There were a small number of non-healthcare professionals entering traditional postgraduate ultrasound education and training prior to 2016; however, this was not the norm. In 2016 the first full-time direct-entry postgraduate programme was developed in England. The programme admitted students with a degree in a range of subjects, not always health care related, to train in ultrasound, by providing

placements in local National Health Service (NHS) hospitals and/or with independent healthcare providers. At the same time the first BSc (Hons) Medical Ultrasound programme began in England, admitting students straight from school or college to undertake the three-year full-time programme. Additionally, in 2017, degree level (academic Level 6) apprenticeship standards were being developed for medical ultrasound.

This document relates to sonographers who practise ultrasound as their main occupation, as opposed to healthcare practitioners who use ultrasound some of the time as part of their extended scope of practice.[1] It has been produced to assist programme teams develop appropriate, sustainable medical ultrasound education and training programmes to meet the future needs of ultrasound services, encouraging transition from practitioner to advanced and consultant levels of practice. This document was written in consultation with a range of stakeholders to illustrate the career development from academic Level 6 (BSc) to Level 7 (MSc) and Level 8 (Doctorate) for the proposed career pathway.

Many sonographers are currently able to be registered with a regulatory body because of their primary background profession. For example, diagnostic radiographers working as sonographers are registered with the HCPC and midwife-sonographers are registered with the Nursing & Midwifery Council (NMC). However, those who complete one of the direct-entry ultrasound programmes will have no automatic regulatory home, as 'Sonographer' is not currently a protected title.[3] As more students who are not from a health care background enter ultrasound practice, it is increasingly apparent that regulation is paramount to protecting the public and the new profession of sonography. The Register of Clinical Technologists[4], is currently the only way for non-regulated healthcare professionals to be recognised as appropriately qualified to undertake the work of a sonographer. At the time of writing, work is currently being undertaken to lobby Government to provide regulation and protected status for the title 'Sonographer'.

In addition to sonographers, who undertake ultrasound as their primary role, many other professionals use ultrasound as a tool within their practice. The standards within this document are also relevant for programme development for point of care (POCUS) courses wishing to apply for CASE accreditation.

2. Rationale for Change

Sonographic education and training has traditionally been undertaken, in the main, by diagnostic radiographers wishing to formally extend their scope of clinical practice to include medical ultrasound.[5] Until 2016 this model of education and training, used throughout most of the United Kingdom (UK), remained essentially unchanged for several decades and was no longer producing sufficient staff to meet workforce demands and service delivery needs.

It is no longer tenable to train future sonographers mainly from the diagnostic radiographic workforce, as both occupations are currently listed on the UK Shortage Occupation List.[6] This is supported by the Society of Radiographers Diagnostic Radiography Workforce UK Census (2022) which identified a vacancy rate for the diagnostic radiography workforce of 12.8%.[7] In the 'Securing the Future Workforce Supply – Sonography Workforce Review', published in March 2017, the Centre for Workforce Intelligence identified a sonographer vacancy rate of approximately 10% which varied significantly across England from 5% to 25%.[2]

In addition, the Society and College of Radiographers Sonographer Workforce Survey Analysis (2019) found that 30% of sonographers in post in the responding departments were over 50 years of age.[8] The implication of this is that, not only would a third of the ultrasound workforce be retiring during the next ten years, but that the majority of highly experienced clinical educators will be lost to the system.

The increasing demand for ultrasound investigations is multi-factorial and, based on previous trends, is likely to continue for the foreseeable future. In January 2018, the House of Commons Briefing Paper on NHS Key Statistics identified that 20.25 million diagnostic tests had been performed in England's hospitals during 2017. This represented a 5.6% increase from 2016 and a 32.7% increase since 2011/12. Importantly, the number of non-obstetric ultrasound examinations had increased significantly by 24% in one year.[9] This is partly due to the fact that the excellent diagnostic capability, safety, accessibility, cost-effectiveness and patient acceptance of ultrasound make it the first imaging modality of choice for screening programmes and for confirming or excluding the presence of pathology or trauma. In addition, ultrasound has a key role to play in monitoring patients for recurrence of disease and response to treatment, and is especially relevant for paediatric patients, as it does not require the use of ionising radiation to create the images.

Over recent years, ultrasound has become an established part of an increasing number of patient care pathways due to Government initiatives such as the Fetal Anomaly Screening

Programme[10] and the Two-Week Cancer Referral Pathway.[11] Linked to this, the Next Steps on the NHS Five Year Forward View (2017) states that "an estimated 7,000 more people are surviving cancer after NHS treatment than would have three years before. Identifying cancer earlier is critical to saving more lives. So we will speed up and improve diagnosis, increase current capacity and open new Rapid Diagnostic and Assessment Centres".[12] Importantly, technological advances, such as contrast-enhanced ultrasound, elastography and interventional procedures, improve the versatility of ultrasound and lead to new clinical applications, thereby making it more likely to become a core part of future patient care pathways.[13,14]

An ageing population and the associated increase in people living with complex health needs and multiple co-morbidities will almost certainly intensify the demand on ultrasound service delivery. The MODEM Project (2018) proposes that "between 2015 and 2035, multi-morbidity prevalence is estimated to increase, with the proportion of patients with four or more diseases almost doubling (2015:9.8%; 2035:17.0%)".[15]

The need for a fresh approach to creating the ultrasound workforce of the future is, therefore, more important now than ever before; particularly as the output from traditional education and training routes is barely able to keep pace with the natural reduction in sonographers due to retirement.[8] In addition to growing the sonographer workforce, POCUS is expanding to enable patients to be scanned by appropriately trained professionals within their scope of practice.

3. Educating the Future Ultrasound Workforce

3.1 Consortium for the Accreditation of Sonographic Education

The Consortium for the Accreditation of Sonographic Education (CASE)[16] was formed in 1993. It consists of seven member organisations "drawn together by a common desire to ensure that the education and training of sonographers in the United Kingdom is delivered at an appropriate level to ensure that those completing programmes or courses achieve a standard of competency to practise as professional practitioners. The primary role of the Consortium is to accredit high quality training programmes and focused courses that promote best ultrasound practice and ensure that ultrasound practitioners are safe and competent to practise, whilst considering informed views of service needs. In 2015 the Consortium agreed the following four principles that should be adhered to in respect to ultrasound practice and ultrasound education:

1. Reporting should not be separated from scanning.

2. Scanning is a 'dynamic' investigation in which the acquisition of suitable images and assessment of them is entirely operator-dependent at the time of the scan. Deficiencies in acquisition cannot be rectified by involving a more skilled practitioner at a later stage. Assessment and interpretation of saved images is recognised as sub-optimal practice although, as with all image interpretation, dual reporting can be helpful in increasing specificity.

3. The risk of patient harm and consequent litigation against any healthcare organisation providing a poor-quality service is very high and therefore the need for competence at the point of scanning is paramount.

4. Workforce modelling and the development of innovative training routes to meet the demand for sonography services should demonstrate increased efficiency of provision and effectiveness in delivery of diagnosis and treatment to patients".[17]

The first CASE principle is of key importance and has been recognised as such by the Society of Radiographers (SCoR) and the British Medical Ultrasound Society (BMUS) in their joint publication 'Guidelines for Professional Ultrasound Practice' in which they state the "the ultrasound report should be written and issued by the operator undertaking the ultrasound examination and viewed as an integral part of the whole examination".[1]

3.2 Direct Entry Programmes

As discussed previously, it is no longer appropriate to restrict ultrasound education and training to current healthcare practitioners such as radiographers and midwives. A long-term, sustainable source of future sonographers is therefore required through a process of direct entry to programmes such as:

- Bachelor of Science e.g. BSc (Hons) Clinical Sonography or BSc (Hons) Medical Ultrasound;
- Apprenticeship in Clinical Sonography or Medical Ultrasound;
- Integrated Masters e.g. MSon (combines undergraduate and postgraduate study into a single four-year programme);
- Master of Science e.g. MSc Clinical Sonography or MSc Medical Ultrasound.

The Educating the Future Sonographic Workforce: Membership Survey Report from the British Medical Ultrasound Society (2015) identified that the "benefits of direct entry to ultrasound

training were perceived to be increasing the number of sonographers trained each year, whilst training people in their first-choice profession with skills developed specific to the sonographer role".[5]

Widening participation to include candidates without and with a first degree will allow universities to increase the potential market for the ultrasound programmes on offer; however, the recruitment process must be robust and thorough to ensure that the right candidates are offered places. Ultrasound is acknowledged as a difficult skill to learn, as it requires excellent spatial ability and complex psychomotor skills.[18] The selection process must therefore include activities that test natural scanning ability, along with values-based recruitment[19] scenarios in keeping with other pre-registration health programmes. Investment of staff time in the recruitment process is vital in order to select those who are right for the profession, so that successful completion is maximised and attrition minimised.

There are currently two CASE accredited direct-entry Level 7 programmes running in the UK; the MSc Medical Imaging (Ultrasound) at the University of Cumbria and the MSc Medical Ultrasound at the University of Derby, that include education and training in areas such as obstetric, gynaecological and general medical ultrasound. These programmes are designed for students wishing to work as sonographers in general ultrasound departments, as opposed to established direct-entry MSc programmes catering for those wishing to specialise in vascular or musculoskeletal ultrasound only. In order to future-proof their programmes and prepare their students for professional registration at some point in the future, the Programme Leads created 'proposed' standards of proficiency for the role of sonographer by adapting the existing standards of proficiency for the role of the radiographer[20] (Appendix 1). A similar exercise was also undertaken for the SCoR Public Voluntary Register of Sonographers (PVRS)[2] at the time of the upgrade in 2012. These are extremely useful documents, as they also facilitate the work of CASE accreditors when reviewing direct-entry programmes.

3.3 Education and Training Requirements

The role of CASE is to maintain rigorous standards of academic and clinical training for sonographers, provide expert guidance on programme design and delivery and accredit courses meeting the minimum standard.[16]

PLEASE NOTE: Various levels are referred to throughout this document. In order to aid clarity and understanding, the source and relationship of these levels is shown in Table 1.

It should be noted that Scottish academic levels differ to those in England, with the English level 6 (Bachelor's degree) being equivalent to Scottish level 10, level 7 (Postgraduate level) equivalent to level 11 and level 8 (Doctoral level) equivalent to level 12.[21] This document has used QAA descriptors for England when describing academic levels.[21]

able 1: Source and Relationship of Levels

SOURCE	LEVELS				
Academic Levels defined by the Quality Assurance Agency Frameworks for Higher Education Qualifications[21]	4	5	6	7	8
Career Levels defined by NHS England in the Sonographer Career Framework [22]	4		5	6 & 7	8
Royal College of Radiologists' Ultrasound Training Recommendations for Medical & Surgical Specialties (i.e. non-radiologists)[23]				1 & 2	3

When designing and developing direct-entry programmes, it is vital to consider the requirement for parity across different BSc (Hons) programmes, and across different MSc programmes, both in terms of the level of complexity and the amount of student effort required. The Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies (2024) published by the Quality Assurance Agency suggest that "assigning levels to qualifications promotes the accurate and consistent description and marketing of qualifications by those who award them", which "promote a shared understanding of the demands and outcomes associated with typical qualifications by promoting a consistent use of qualification titles across the higher education sector".[21] In other words, a BSc (Hons) Medical Ultrasound must be equal to any other BSc, such as a BSc (Hons) Diagnostic Radiography or a BSc (Hons) Midwifery.

National Occupational Standards for Sonography developed as part of the NHS Knowledge and Skills Framework describe the "skills, knowledge and understanding needed to undertake ultrasound examinations to a nationally recognised level of competence. They focus on what the sonographer needs to be able to do, as well as what they must know and understand to work effectively. They cover the key activities undertaken within sonography under all the circumstances the sonographer is likely to encounter. Each National Occupational Standard contains an agreed set of knowledge, understanding and performance criteria that must be met before a sonographer can be deemed competent. They describe the minimum standard to which a sonographer is expected to work in sonography".[24]

The SoR and BMUS support the minimum training requirements for the practice of medical ultrasound in Europe proposed by The European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB),[25] which includes theoretical and clinical education, with clinical competency assessment. However, in the absence of published National Occupational Standards for Sonography, UK Higher Education Institutions (HEIs) refer to the minimum training requirements identified in the 'Ultrasound Training Recommendations for Medical and Surgical Specialities' published by The Royal College of Radiologists (RCR) (20217[23] when developing ultrasound programmes and courses. These documents have been used to inform the development of ultrasound educational standards.

4. Programme Philosophy

Ultrasound programmes must support the development of sonographers with the underpinning knowledge, skills and attributes required for safe and effective ultrasound practice. Sonographers should also develop critical thinking skills to enable them to deal with situations arising within their scope of practice and demonstrate a clear understanding of their strengths and limitations and role within the patient care pathway.[1] Sonographers should have a sound understanding of patient care pathways, local and national guidelines,[1] develop inter-professional and team working,[26, 27] perform audits and engage in research collaborations to make service improvements.[1] The importance of and engagement with service users and carers within their work is an essential element of the role and education of sonographers. As a practitioner progresses through their career, they should develop expertise that can be adapted to new and increasingly complex situations and, at all levels, be supported through a formal, structured preceptorship period (see section 7.1), with appropriate on-going mentoring, continuing professional development (CPD) and support to undertake further educational study and research.[1, 22]

At all levels, it is important that sonographers follow RCR guidance[26,27] and:

- Acknowledge the importance of robust clinical governance and inter-professional relationships within Radiology Departments;
- Practise within their level of competency;
- Practise in accordance with their local clinical protocols, an approved scheme of work and agreed delegation of clinical responsibility;
- Refer to more experienced sonographic and radiological colleagues when uncertain of the findings and/or seek advice about patient management/further investigations;
- Practise according to current evidence-based professional standards and requirements.[26]

Where the practice is outside the radiology department setting, medical input may be from other colleagues such as vascular surgeons, rheumatologists, orthopaedic surgeons, obstetricians, gynaecologists.

Although sonography is not yet subject to statutory registration, the Health and Care Professions Council standards relating to scope of practice are relevant to each level of practice and, as such, sonographers should work within their scope of practice at all times. The scope of practice is the area or areas of your profession in which you have the knowledge, skills and experience to practise lawfully, safely and effectively, in a way that meets the standards and does not pose any danger to the public or to yourself."[20]

5. Programme Aims

The following programme aims relate to academic levels 6, 7 and 8.[21] Primarily these are aimed at the career sonographer, but apply equally to anyone wanting to complete a CASE accredited ultrasound course or programme of study.

5.1 Academic Level 6

The role is at the initial undergraduate qualificatory level, supported by a well-defined, structured preceptorship period to assist the practitioner to develop knowledge, skills and competence to progress to independent reporting practice, either across a wider scope of practice or with less direct supervision (see section 7).

Level 6 programme aims are:

- To produce a competent, safe sonographer with the knowledge, understanding and ability to independently undertake, interpret, analyse and report ultrasound scan findings within their focused scope of practice, with appropriate supervision available;
- To equip the sonographer with the appropriate professional attributes including the six C's of care, compassion, courage, commitment, competence and communication skills,[28] to work effectively and empathetically with a wide range of service users and carers, and meet core skills required for professional practice;
- To ensure that the sonographer has a thorough understanding of their scope of practice and the importance of working under the supervision and mentorship of senior staff to develop personal, professional, clinical and research skills;
- To develop sonographers who are safe, reflective practitioners, responsive to patient and service needs, with analytical and problem-solving skills, the ability to critically review evidence and clinical practice and disseminate knowledge to others;
- To ensure the sonographer has a comprehensive understanding of how to evidence and develop their skills, knowledge, reporting practice and clinical competency to progress to the next level of practice.

5.2 Academic Level 7

There are currently two different routes of entry to ultrasound education as a sonographer at academic level 7. The full-time direct-entry route for those with a BSc (Hons), with or without a health-care background, and the part-time career progression pathway for those already having completed a BSc (Hons) in a relevant health care profession. As previously stated, there are currently two CASE accredited direct-entry Level 7 programmes running in the UK; the MSc Medical Imaging (Ultrasound) at the University of Cumbria and the MSc Medical Ultrasound at the University of Derby. In each of these Higher Education Institutions, the full-time and part-time ultrasound students are on different pathways of the same programme of study and are co-taught whenever possible; the aim being to achieve parity across the full-time and part-time pathways. Traditionally, part-time students have had the option of undertaking a PgC, PgD or MSc ultrasound award and it is envisaged that this flexibility will continue for those wishing to formally extend their scope of clinical practice to include ultrasound; however, full-time students on the direct-entry route will normally exit with an MSc.

The sonographer exiting with a level 7 qualification should, following a period of preceptorship and/or further post-qualification learning, have the underpinning knowledge to develop skills

and competence, over time, to fulfil the role of an advanced practitioner working with a “high degree of autonomy and designated responsibility for complex decision making”.[29]

There is an expectation that the sonographer working at advanced practice level has a relevant master’s level award in sonography and is working within all four pillars of advanced practice as follows[29, 30]:

- Clinical practice (advanced clinical competence);
- Leadership and management;
- Education;
- Research[29,30].

Whilst there is currently no evidence available, it is thought that students exiting with an MSc may be better positioned to achieve the four pillars of advanced practice, due to the fact that they will have studied research methods and completed a research dissertation.

Sonographers working at advanced practice level are able to address complex and challenging cases, and manage risk appropriately in unpredictable situations. They will use advanced critical thinking to deliver competent, safe care to patients with complex needs and/or in complex cases.

Level 7 programme aims, in addition to academic level 6 aims, are:

- To produce a competent, safe, reflective sonographer with the knowledge, understanding and ability to independently undertake, interpret, analyse and report ultrasound scan findings within their scope of practice, with appropriate supervision available. They will have the skills to develop and become capable of managing and independently reporting complex case-loads within their scope of practice;
- To equip the sonographer with the skills and attributes to communicate effectively with a wide range of service users and carers, use evidence-based practice and clinical decision-making skills in a range of situations, suited to their scope of practice, with the ability to progress to managing complex and uncertain situations;
- To ensure the sonographer has the underpinning knowledge and ability to develop their leadership and management skills, education of self and others, and engage in research;
- To develop sonographers who are able to mentor and support others to ensure safe practice that is responsive to patient and service needs;

- To ensure the sonographer has a comprehensive understanding of how to evidence and develop their own skills, knowledge and practice, and those of others to implement change and improve the service provision.

5.3 Academic Level 8

Consultant level sonographers are expert clinical practitioners, working in complex, unpredictable environments. They provide innovation, education, research and leadership both locally and nationally, influencing policy and practice to ensure service delivery is safe, effective, progressive and patient-focused. Consultant sonographers challenge barriers that limit service and professional development, provide consultancy as appropriate and engage in research activity to inform practice developments. Consultant sonographers within the new professional framework will have or be working towards a doctoral level award.[30] Doctoral level attributes and doctoral level activities should be evidenced at this level. Established, experienced sonographers, working prior to the development of the full career framework, may enter consultant level roles via other routes.

Level 8 programme aims, in addition to academic level 6 and 7 aims, are:

- To produce a competent, reflective and autonomous expert clinical practitioner capable of managing and independently reporting complex case-loads, providing advice on further management or undertaking diagnostic investigations or treatment, within their scope of practice;
- To equip the sonographer with the skills, knowledge and confidence to engage in effective team-working with senior clinical and radiological colleagues, along with the ability to contribute meaningfully to multi-disciplinary team meetings;
- To ensure that the practitioner has high-level communication skills to communicate highly complex, conflicting and sometimes ambiguous information clearly, to influence policy makers and inform decisions about future directions within the profession;
- To provide support to enable the sonographer to proactively engage in leadership and management, consultancy, education and research at local, national and international levels and support the professional development of others;
- To equip the sonographer with a thorough understanding of the need for and complex nature of reflective practice, staff development, preceptorship, mentoring and coaching, to enable them to ensure practice and ultrasound reports of junior colleagues are sufficient to guide effective patient management;

- To provide the sonographer with the skills, knowledge and confidence to engender a leadership culture for positive change and improvements to service delivery to ensure high standards of patient-centred care.

6. CASE Learning Outcomes for Academic Levels 6, 7 and 8

The learning outcomes are designed to support programme teams in developing programmes of study to meet CASE requirements and assist clinical departments determine the level of working for staff at these academic levels.

CASE Learning Outcomes		
Level 6	**Level 7**	**Level 8**
Core Skills		
HCPC Standards of Proficiency should be adapted for ultrasound and mapped to the programme and module learning outcomes[20] (Appendix 1) http://www.hcpc-uk.org/publications/standards/index.asp?id=51	Core skills are expected, as part of the original qualification in health care for those progressing from a healthcare profession background **Direct entry:** HCPC Standards of Proficiency should be adapted for ultrasound and mapped to the programme and module learning outcomes[20] (Appendix 1)	A high level of core skills is required for anyone working at this level of practice
Consideration of graduate attributes should be evident within the programme	Consideration of post-graduate attributes should be evident within the programme	Consideration of doctoral (e.g. PhD) attributes should be evident within the programme
Clinical Education		
Carry out a medical ultrasound examination, interpret and analyse scan findings under appropriate supervision, within a defined scope of practice, safely and competently. Produce written reports, within a focused scope of practice, for ultrasound examinations undertaken	Carry out and supervise a range of complex medical ultrasound examinations and other appropriate actions, including actionable reporting safely, competently and independently. Provide appropriate supervision, mentorship and leadership for less experienced colleagues	Carry out and supervise a range of complex medical ultrasound examinations and other appropriate actions, including actionable reporting safely, competently and independently. Provide leadership and consultancy within and external to the field, and quality assure reports produced by less experienced colleagues, to ensure safe, effective service delivery and guide effective patient management

Critically relate theory to practice in the clinical setting and nationally in order to contribute to patient diagnosis and management	Critically relate theory to practice in the clinical setting and nationally in order to contribute to patient diagnosis, management and service delivery	Critically relate theory to practice in the clinical setting, locally, nationally and internationally, in order to contribute to patient diagnosis, management and service delivery
Recognise the limitations of practice and the need to consult other senior colleagues. Identify sources with whom to consult in order to influence patient management	Recognise the limitations of practice and the need to consult other senior colleagues. Identify sources with whom to consult in order to influence patient management and change practice. Engage in audit and research, present findings and make recommendations as appropriate	Recognise the limitations of practice and the need to consult other senior colleagues. Lead negotiations and research in order to influence patient management and change practise. Promote a culture that encourages audit, research and leadership
Critically reflect on self to demonstrate continuing professional development within clinical practice	Critically reflect on self to demonstrate continuing professional development within clinical practice and assist others in developing skills locally and nationally	Critically reflect on self to demonstrate continuing professional development within clinical practice, and lead development and review of learning locally, nationally and internationally
Function independently and as part of a team with critical awareness of scope i.e. extent and limitations of practice	Function independently and as part of a team, whilst developing collaborations and engaging in inter-professional team working, education and research	Lead the development of inter-professional team working, education, collaboration and research
Enhance the service by engaging with service users and carers to promote and improve personalised care	Demonstrate originality and self-direction in tackling and solving problems, and engaging service users to promote personalised care	Undertake research and development, and lead educational developments to contribute substantially to tackling and solving complex and challenging problems whilst engaging service users to promote personalised care
Science and Technology		
Demonstrate and apply a systematic knowledge and understanding of the physical and technological principles and processes of diagnostic ultrasound, describing their relevance to the ultrasound image and the equipment utilized	Demonstrate and apply a systematic and thorough knowledge and understanding of the physical and technological principles and processes of diagnostic ultrasound and show a comprehensive understanding of their relevance to the ultrasound image and the equipment utilized	Demonstrate and apply a thorough and critical knowledge of the physical and technological principles and processes of diagnostic ultrasound and show a comprehensive understanding of their relevance to the ultrasound image and the equipment utilized.

		Be able to disseminate this knowledge to learners
Deploy appropriate techniques to effectively produce diagnostic ultrasound images and spectra, ensuring image quality is optimised and exposure to ultrasound is minimised according to clinical need	Deploy appropriate advanced techniques to effectively produce diagnostic ultrasound images and spectra, ensuring image quality is optimised and exposure to ultrasound is minimised according to clinical need. Critically evaluate images within a wide range of complex clinical settings, implement new technology and support colleagues in the use of advanced techniques	Deploy appropriate advanced techniques to effectively produce diagnostic ultrasound images and spectra, ensuring image quality is optimised and exposure to ultrasound is minimised according to clinical need. Critically evaluate images in highly complex cases, evaluating new applications, cutting-edge technology and innovations to find solutions and drive change
Demonstrate proficiency in recording ultrasound images and Doppler outputs	Demonstrate proficiency in recording ultrasound images and Doppler outputs, evidencing a comprehensive understanding of the findings in relation to clinical practice	Demonstrate proficiency in recording ultrasound images and Doppler outputs, evidencing a comprehensive understanding of the findings in relation to clinical practice in complex cases
Critically evaluate and discuss the safety issues related to diagnostic ultrasound to enable optimal use of the equipment within the current, internationally recognised recommendations for safe practice, actively reducing any hazard to patients and staff	Critically evaluate, analyse and debate the safety issues related to diagnostic ultrasound to enable optimal use of the equipment within the current, internationally recognised recommendations for safe practice, actively reducing any hazard to patients and staff	Critically evaluate, analyse and contribute to the body of research evidence relating to safety issues in diagnostic ultrasound, to enable optimal use of the equipment within the current, internationally recognised recommendations for safe practice, actively reducing any hazard to patients and staff in a wide range of clinical cases
Deploy accurately established techniques of analysis and enquiry to evaluate the role of current ultrasound equipment, latest technology and associated quality assurance procedures for pertinent use to assist in the selection of new machines	Critically appraise current ultrasound equipment, latest technology and associated quality assurance procedures for pertinent use to identify and select new machines	Critically appraise current ultrasound equipment, latest technology and associated quality assurance procedures for pertinent use to identify and select new machines for service development and delivery of new techniques
Demonstrate a systematic understanding of graphical and numerical data commensurate with ultrasound practice	Develop a comprehensive understanding and utilise graphical and numerical data commensurate with ultrasound practice	Synthesise and explore complex graphical and numerical data commensurate with ultrasound practice in a range of complicated clinical situations

Demonstrate awareness of the principles of Artificial Intelligence (AI) and deep learning technology, and its application to practice. This includes having an understanding of the sonographer's legal, ethical and moral duties when using AI	Demonstrate a critical awareness of the principles of AI and deep learning technology, and its development and application to practice. This includes having an understanding of the sonographer's legal, ethical and moral duties when using AI	Critically evaluate AI tools and their implementation into clinical pathways, to ensure patient safety and a wider understanding of the sonographer's legal, ethical and moral duties when using AI across the service
Professional Issues		
Critically evaluate the emotional impact of the ultrasound examination on the client, carers and relevant healthcare professionals, whilepromoing person-centred care to meet HCPC core proficiencies	Critically evaluate the emotional impact of the ultrasound examination on the client, carers and relevant healthcare professionals, while promoting person-centred care. Demonstrate a critical awareness of clinical problems and identify potential solutions **Direct entry:** Meet HCPC core proficiencies	Critically evaluate the emotional impact of the ultrasound examination on the client, carers and relevant healthcare professionals, while promoting person-centred care. Demonstrate a critical awareness of clinical problems and make informed judgements when implementing improvements to care
Devise and sustain arguments relating to national and local legal, ethical, professional and organisational principles that underpin diagnostic ultrasound practice	Critically analyse international, national and local legal, ethical, professional and organisational principles that underpin diagnostic ultrasound practice and assist in the leadership of change	Critically analyse international, national and local legal, ethical, professional and organisational principles that underpin diagnostic ultrasound practice and provide leadership for service delivery improvements
Demonstrate a conceptual understanding of the changing national and local health care needs of clients, patients, carers and organisations	Critically discuss the changing national and local healthcare needs of clients, patients, carers and organisations. Suggest improvements and ways to implement change	Show self-direction and originality in tackling and solving problems associated with the changing national and local healthcare needs of clients, patients, carers and organisations and lead change
Identify qualitatively and quantitatively the limitations and constraints associated with ultrasound imaging	Critically evaluate qualitatively and quantitatively the limitations and constraints associated with ultrasound imaging and suggest alternative solutions to improve service provision	Explore qualitatively and quantitatively the limitations and constraints associated with ultrasound imaging, identify and lead the implementation of alternative solutions to improve service provision
Demonstrate a systematic understanding of the need for life-long learning in medical ultrasound practice	Evaluate the need for life-long learning in medical ultrasound practice. Relate this to the development of self and others	Critically evaluate the need for life-long learning in medical ultrasound practice and engage in teaching, learning and assessment at a higher level

Develop negotiation and time management skills to achieve the core knowledge, skills and clinical practice learning outcomes for your level of practice. Mentor and teach others	Develop negotiation and time management skills to advance knowledge, skills and clinical practice to a higher level. Mentor and teach learners, support staff and other professionals through the development of relevant learning materials	As an independent and self-critical learner, review current solutions and/or develop innovative solutions to achieve the core knowledge, skills and clinical practice learning outcomes for your level of practice. Lead and promote the education of staff, students and other groups, contributing to relevant academic programmes
Critically reflect on the leadership roles needed within practice and personal contributions to leadership	Critically evaluate arguments and assumptions relating to the leadership roles needed within practice and develop leadership roles within the clinical setting and at a national level. Lead a team to ensure workload is delivered effectively	Conceptualise, design and implement leadership strategies at a local, national and international level for service delivery and improvement
Have due regard to patients' health status and co-morbidities, promoting healthy living	Develop, implement and review pathways of care, having regard to patients' health status and co-morbidities, promoting healthy living	Lead on the delivery of a whole-system, person-centred approach rooted in multidisciplinary team working
Critically evaluate the effectiveness of quality assurance procedures and engage in quality monitoring within the clinical setting	Critically evaluate the effectiveness of quality assurance procedures and quality management systems. Lead on local quality delivery management and implement change as required	Conceptualise, design and implement quality assurance procedures and quality management systems. Lead on national and international quality management and implement change as required
Clinical Topic		
Identify, evaluate and interpret normal and abnormal anatomy and pathophysiology relevant to the level and scope of clinical practice	Identify, evaluate and interpret normal and abnormal anatomy and pathophysiology relevant to advanced practice. Assess patients and make reasoned decisions to initiate, continue, modify, suspend or cease ultrasound imaging examinations	Identify, evaluate and interpret normal and abnormal anatomy and pathophysiology in highly complex cases. Exercise high levels of professional judgement and decision making in complex clinical situations
Synthesise and apply scientific, ergonomic and safety principles in	Critically synthesise and apply scientific, ergonomic and safety	Critically synthesise and apply scientific, ergonomic and safety principles in order to identify,

order to identify, select and manipulate equipment	principles in order to identify, select and manipulate equipment	select and manipulate equipment to enable safe practice and provide leadership for all users
Show a systematic understanding of and utilise all information from various sources to ensure the most appropriate examination is undertaken	Critically appraise and utilise all information from various sources to ensure the most appropriate examination is undertaken	Critically appraise and utilise all information from various sources to improve processes and practice and ensure the most appropriate examination is undertaken
Analyse the needs of the patient to perform all aspects of the ultrasound examination safely and competently	Analyse the needs of the patient to perform all aspects of the ultrasound examination safely and competently, adapting to challenging circumstances	Analyse the needs of the patient to perform all aspects of the ultrasound examination safely and competently. Provide support to others in challenging and complex circumstances
Competently carry out ultrasound examinations and provide a report according to the evidence base, demonstrating an awareness of limitations within scope of practice	Competently carry out and independently report ultrasound examinations according to the evidence base, demonstrating an awareness of limitations within scope of practice	Competently carry out, supervise and support the development of independent reporting of ultrasound examinations according to the evidence base and undertake complex case-loads, demonstrating an awareness of limitations within scope of practice
Evaluate the ultrasound findings and, where necessary, arrange for a second opinion and/or arrange further investigations, following appropriate consultation, in line with local policies and practices	Critically evaluate the ultrasound findings and, where necessary, arrange, advise or undertake further investigations, following appropriate consultation, in line with local policies and practices. Provide support for less experienced staff	Critically evaluate the ultrasound findings within a complex case-load and, where necessary, arrange, advise or undertake further investigations, following appropriate consultation, in line with local policies and practices. Provide support, leadership and education for less experienced staff
Actively demonstrate proficiency in the interpretation and analysis of ultrasound appearances of organs and structures to reflect the clinical question raised and show an awareness of the limitations of level of competence. Provide a report with appropriate supervision	Actively demonstrate proficiency in providing interpretative, actionable reports for ultrasound examinations to reflect the clinical question raised. Provide support for less experienced staff[23]	Actively demonstrate proficiency in providing interpretative, actionable reports for complex and demanding ultrasound examinations to reflect the clinical question raised. Provide support, leadership and education for less experienced staff[23]
Communicate clearly, effectively and appropriately with patients, carers and other healthcare professionals	Communicate clearly, effectively and appropriately with patients, carers and other healthcare professionals in challenging situations. Support on-going development of	Communicate complex information clearly, effectively and appropriately with patients, carers and other healthcare professionals in challenging situations. Support

	communication to improve service provision	and lead on-going development of communication at a local, national and international level, to improve service provision
Demonstrate an understanding of the principles of problem solving within the ultrasound profession in order to resolve issues in practice and service delivery	Demonstrate a comprehensive knowledge and application of the principles of problem solving within the ultrasound profession in order to resolve issues in practice and service delivery	Demonstrate a comprehensive knowledge of the principles of problem solving within the ultrasound profession in order to resolve issues in practice and service delivery. Implement, monitor and disseminate changes within practice as a result of this knowledge and understanding
Contribute to case management and service delivery by discussion and debate about patient diagnosis and prognosis	Contribute to case management and service delivery by discussion and debate at all levels in patient diagnosis, prognosis and management	Contribute to case management and lead service delivery innovations by discussion and debate at all levels in patient diagnosis, prognosis and management
Reflect on personal and professional practice in order to challenge, develop, maintain and enhance local professional standards in clinical ultrasound	Critically reflect on personal and professional practice in order to challenge, develop, maintain and enhance local and national professional standards in clinical ultrasound	Critically reflect on personal and professional practice. Synthesise and apply new approaches to challenge, develop, maintain and enhance local, national and international professional standards in clinical ultrasound
Scope of Practice		
Demonstrate an awareness of how to take practitioner level skills to the next level, providing clear goals to work towards independent interpretative reporting practice	Demonstrate independent interpretative clinical reporting practice and show systematic and creative evidence of how the other domains of advanced practice are being used in the development of the profession	Demonstrate continuing expert clinical practice and work within all core advanced practice domains. Demonstrate evidence of creation and interpretation of new knowledge through research and advanced scholarship to extend the forefront of the ultrasound profession at a local, national and international level
Apply methods and techniques to review, consolidate, extend and apply knowledge and understanding of ultrasound. Initiate and carry out projects to improve the service locally	Deal with complex ultrasound issues both systematically and creatively, make sound judgements and communicate conclusions clearly to specialist and non-specialist audiences	Make informed judgements on complex ultrasound issues and be able to communicate ideas and conclusions clearly and effectively to specialist and non-specialist audiences

Synthesise, appraise and evaluate theory and research relevant to ultrasound practice in order to improve patient care. Judge the reliability, validity and significance of evidence to support conclusions and/or recommendations. Suggest reasons for contradictory data/results	Synthesise, appraise and critically evaluate complex theory and research relevant to advanced ultrasound practice in order to improve patient care and inform future practice and the profession. Judge the appropriateness of the methodologies used. Recognise and argue for alternative approaches	Undertake, synthesise, appraise and critically evaluate research relevant to advanced ultrasound practice in order to improve patient care and inform future practice and the profession. Manage complexity, incompleteness of data or contradictions in areas of knowledge
Develop and enhance skills in critical reflection and evaluation of theoretical concepts in order to inform and enhance personal learning and professional medical ultrasound practice	Show comprehensive understanding and critical reflection and evaluation of theoretical concepts in order to inform and enhance personal learning and professional medical ultrasound practice	Demonstrate autonomous skills in critical reflection and evaluation of theoretical concepts in order to inform and enhance personal learning, that of others and professional medical ultrasound practice in complex and unpredictable situations
Apply the methods and techniques learnt to assist with research projects and audit	Undertake research studies as part of a research team and present the findings locally and nationally. Autonomously plan and implement clinical audits	Undertake and lead on pure and/or applied research at an advanced level, contributing to improving the body of evidence in ultrasound and wider professional areas
Plan, negotiate and manage own learning whilst developing a team approach in support of self-directed learning	Plan, negotiate and manage own learning whilst demonstrating a team approach in support of self-directed learning. Support and implement local and / or national level learning initiatives	Lead learning and development within the local, national and international setting and implement plans to increase an inter-professional team approach in support of self-directed learning

7. Career Development

This section provides an initial overview of possible development opportunities for each career level of practice. The document should be used in conjunction with other publications and the sonographer career framework, including the Preceptorship and Capability Development Framework for Sonographers.[22]

7.1 Preceptorship period and the development of autonomous practice

Preceptorship has been defined as:

"A period of structured transition for the newly registered practitioner during which he or she will be supported by a preceptor, to develop their confidence as an autonomous professional, refine skills, values and behaviours and to continue on their journey of life-long learning".[31]

In order for sonographers to develop skills, competence and experience to progress to higher levels of practice and fulfil the expectations for practice at their educational levels, it is essential to have a preceptorship period in addition to structured time and support to further develop autonomous practice[31] and report writing skills.[22] This will partly be influenced by their initial educational level and previous experience, but also on their ability to evidence progression and safe, competent practice at the expected level.

NHS England funded a multi-stakeholder document to support sonographers in their preceptorship period and to develop their capabilities to progress in the career framework [22]. This provides minimum recommendations for preceptorship, depending on experience and competency, aligning to the career framework. The British Medical Association (BMA) highlight that 'autonomous working must be on the basis of an individual's competence', but that 'nobody in the NHS works truly autonomously'.[32] The document emphasises the work of multidisciplinary teams to provide safe and high quality patient care.[32] Additional support, time and/or education should be available to ensure sonographers can develop their competence and report writing skills in collaboration with more experienced sonographers and medical colleagues, to develop increasing levels of autonomy.[33]

7.2 Transition from Career Level 5 to Career Level 6 Practitioner

The current minimum qualification a sonographer would be expected to hold in order to practise in the UK is a BSc (Hons) in medical ultrasound that has been accredited by the Consortium for the Accreditation of Sonographic Education (CASE) or comparable qualification. To perform some examinations and progress in their career a postgraduate certificate is recommended. Individuals without a recognised qualification, including student sonographers, should always be supervised by qualified staff at a level commensurate with their ability.[34] A newly-qualified practitioner sonographer would therefore be expected to complete a mandatory transitional period of preceptorship, as detailed in the preceptorship and capability development framework[22] , to consolidate their learning, increase their confidence and gain valuable, additional clinical experience (see section 7.1).[1]Throughout an undergraduate programme of education and training, students will be taught all of the required clinical competencies associated with protocol-led ultrasound scanning technique and report writing within the areas studied, e.g. obstetric, gynaecological, general medical ultrasound. Final qualificatory end-point clinical assessments will be undertaken to determine whether the

students have achieved the required clinical competencies associated with these ultrasound examinations.

“Preliminary Clinical Evaluation (PCE) describes the practice of diagnostic radiographers assessing imaging appearances, making informed clinical judgements and decisions, and communicating these in unambiguous written form to referrers”.[35] The College of Radiographers requires this core competence for diagnostic radiographers to be embedded in pre-registration undergraduate BSc (Hons) Diagnostic Radiography programmes.[30] As CASE expect the ultrasound practitioner undertaking the examination to write the report, the newly qualified sonographer would be expected to write a report within their limited scope of practice and with supervision from appropriate clinical colleagues available. This is likely to be identifying normality, which is similar to the PCE for BSc (Hons) Diagnostic Radiography.

PCE might be used in the initial training of sonographers. This would increase in difficulty as students progressed through academic levels 4, 5 and 6 of their BSc (Hons) programme. For example, Level 4 study would enable students to systematically evaluate the quality of ultrasound images and understand the physical principles of ultrasound that affect image optimisation. Level 5 study would enable students to evaluate the anatomy demonstrated during the scan, with a strong focus on the ultrasound appearances of normal anatomy and normal variants. Level 6 study would enable students to evaluate and provide a formal report on normal examinations and common abnormal ultrasound findings within a focused and clearly defined scope of practice, with awareness of their limitations and the need for further opinion.

Due to the high clinical risk posed by ultrasound performed by practitioner sonographers, reports must be undertaken within a clear clinical governance framework to include structured departmental education, audit and performance review, personal development review and clinical supervision as a minimum.[1, 33] Practitioner and enhanced practice sonographers must also undertake regular continuing professional development (CPD) related to their clinical role.[1,33, 36, 37]

Finally, it is recommended that a robust vetting process is undertaken by an advanced practitioner sonographer, consultant sonographer or radiologist to minimise the chance of patients being allocated to the incorrect list and ensure the smooth running of the ultrasound service. The caveat being that patient care and safety must not be compromised by the introduction of a new way of working or career framework.

Report writing skills, in particular, may need further development during the preceptorship period, in conjunction with experienced enhanced, advanced and consultant sonographers and medical colleagues e.g. radiologists, obstetricians, orthopaedic surgeons and rheumatologists. Report writing should be a major focus of a practitioner sonographer's CPD. The College of Radiographers and the Department of Health through e-Learning for Healthcare (elfh) have produced the e-learning resource known as 'Clinical Imaging' which currently includes several ultrasound modules.[38] This could be a valuable resource for development of skills. Additionally, elfh hosts mandatory training resources for example Fetal Anomaly Screening Programme elearning modules.

Following their period of preceptorship, practitioner sonographers working at career Level 5 or career Level 6 may commence a postgraduate programme of study. It could be that they move to career Level 7 upon the successful completion of a PgC in clinical sonography/medical ultrasound, with a view to completing either a PgD or MSc. For those with a level 7 academic qualification, namely the PgC, PgD or MSc, they would have an initial preceptorship period and then progress through to career levels 6 and 7 via further post-qualification learning, when additional competencies and skills have been demonstrated to meet a threshold level of practice.

7.3 Transition from Career Level 6 Practitioner to Career Level 7 Advanced Practitioner

The Multi-professional framework for advanced practice in England (2025) identifies the core capabilities for health and care professionals at the level of advanced practice that will apply across all advanced practice roles, regardless of the health and care professional's setting, subject area and job role. Advanced practitioners are adaptable to change and can generate new knowledge and apply it in diverse ways to formulate and problem solve within a context of complexity and uncertainty.[29]

This framework states that "all health and care professionals working at the advanced practice level are expected to have developed the knowledge, understanding and skills required to meet all the capabilities outlined" within the framework. The core capabilities across the four pillars of advanced practice are clinical practice, leadership and management, education and research.[29]

"The joint publication of the Royal College of Radiologists and the College of Radiographers 'Team Working in Clinical Imaging'[27] sets out that "clinical imaging services

need to deliver the right test at the right time with the report available in time to support and influence patient management. In 2013 and beyond, radiographers must play their full part in delivering this goal across the spectrum of image acquisition, image interpretation and integration of these roles into patient care pathways".[27]

With appropriate skills development, practitioner sonographers should be able to work at the same level as radiographers by making first line interpretations of ultrasound examinations in support of patient management and, following a structured preceptorship period and post-qualification learning, provide definitive reports for a wide range of examinations.[36] In other words, in the context of clinical reporting, sonographers' scope of practice is bound by the extent of their knowledge, skills and competences.[26, 35]

Clinical reporting across a wide range of examinations is an advanced practice skill and is the term used to describe the practice of sonographers who have successfully completed postgraduate education and training accredited by CASE to enable them to produce diagnostic reports in relation to the ultrasound examinations they perform. The quality of the reports produced by sonographers "must at least be at the same standard as reports produced by other recognised reporting practitioners, medical or non-medical."[26, 35]

Due to the high clinical risk posed by complex ultrasound examinations, they must be undertaken within a clear clinical governance framework to include structured departmental education, audit and performance review, personal development review and clinical supervision as a minimum. Advanced Practitioner sonographers must also undertake regular continuing professional development (CPD) related to their clinical role.[33, 36, 37]

7.4 Transition from Career Level 7 Advanced Practitioner to Career Level 8 Consultant Practitioner

The role of a consultant sonographer "demands the ability to innovate, motivate and influence local and national agendas."[39] The consultant sonographer should "develop and share these traits and to evolve best practice, develop strategies, promote innovations and overcome barriers through discussion and shared knowledge."[39] Consultant sonographers must hold a relevant MSc and ideally hold (or be working towards) a Doctoral level qualification (e.g. PhD).[30,40]

“Fundamental to the consultant sonographer are the four elements of the consultant role:

- Expert clinical practice;
- Professional leadership & consultancy;
- Education training & development and practice & service development;
- Research & evaluation”.[39]

“Research is of paramount importance to consultant sonographers who are actively involved in developing practice and promoting research across the profession”.[39] NHS England incorporates consultancy across all of the four domains.[41] Health Education and Improvement Wales include an additional pillar for “strategy”.[42]

8. Conclusion

This document has highlighted the various drivers for change and contextualised the salient issues relating to ultrasound education and training. To assist in the development of a career structure and new models of education, such as an apprenticeship, to increase the future sonographic workforce, this document should be used to guide education providers, clinical managers and practitioners. It will also be used to inform and advise programmes applying for CASE accreditation, to ensure a minimum standard is achieved. Academic Level 6, 7 and 8 learning outcomes have been proposed, along with suggestions on how to support transition from a career Level 5 practitioner through to career Level 8 consultant practitioner. The importance of preceptorship, educational support and continuing professional development have been highlighted throughout, to ensure the proposed profession meets the needs of service users and provides safe, effective and progressive ultrasound practice.

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10. Appendices

10.1 Appendix 1: Standard of Proficiency for a Sonographer

These standards are based on the HCPC standards of proficiency for a Radiographer[21]. Some aspects have been amended to relate to ultrasound practice, where relevant.

Mapping to these Standards should be completed for any programme offering direct entry ultrasound education, which enables non-registered health care professionals to enter the sonography workforce.

Standard of proficiency	**Mapping to programme and module aims and learning outcomes**
Sonographers must:	
1. be able to practise safely and effectively within their scope of practice	
1.1 identify the limits of their practice and when to seek advice or refer to another professional or service	
1.2 recognise the need to manage their own workload and resources safely and effectively, including managing the emotional burden that comes with working in a pressured environment	
1.3 keep their skills and knowledge up to date and understand the importance of continuing professional development throughout their career	
2. practise within the legal and ethical boundaries of their profession	
2.1 maintain high standards of personal and professional conduct	
2.2 promote and protect the service user's interests at all times	
2.3 understand the importance of safeguarding by actively looking for signs of abuse, demonstrating understanding of relevant safeguarding processes, and engaging in these processes where necessary	
2.4 understand what is required of them by the Health and Care Professions Council, including but not limited to the Standards of conduct, performance and ethics	
2.5 respect and uphold the rights, dignity, values, and autonomy of service users, including their role in the assessment, diagnostic and / or therapeutic process	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
2.6 recognise that relationships with service users, carers and others should be based on mutual respect and trust, maintaining high standards of care in all circumstances	
2.7 understand the importance of and be able to obtain valid consent, which is voluntary and informed, has due regard to capacity, is proportionate to the circumstances and is appropriately documented	
2.8 understand the importance of capacity in the context of delivering care and treatment	
2.9 understand the scope of a professional duty of care, and exercise that duty	
2.10 understand and apply legislation, policies and guidance relevant to their profession and scope of practice	
2.11 recognise the power imbalance which comes with being a health care professional, and ensure they do not abuse this for personal gain	
2.12 understand the legislative, policy, ethical and research frameworks that underpin, inform and influence the practice of radiography	
3. look after their health and wellbeing, seeking appropriate support where necessary	
3.1 identify anxiety and stress in themselves and recognise the potential impact on their practice	
3.2 understand the importance of their own mental and physical health and wellbeing strategies in maintaining fitness to practise	
3.3 understand how to take appropriate action if their health may affect their ability to practise safely and effectively, including seeking help and support when necessary	
3.4 develop and adopt clear strategies for physical and mental self-care and self-awareness, to maintain a high standard of professional effectiveness and a safe working environment	
4. practise as an autonomous professional, exercising their own professional judgement	
4.1 recognise that they are personally responsible for and must be able to justify their decisions and actions	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
4.2 use their skills, knowledge and experience, and the information available to them, to make informed decisions and / or take action where necessary	
4.3 make reasoned decisions to initiate, continue, modify or cease treatment or the use of techniques or procedures, and record the decisions and reasoning appropriately	
4.4 make and receive appropriate referrals, where necessary	
4.5 exercise personal initiative	
4.6 demonstrate a logical and systematic approach to problem solving	
4.7 use research, reasoning and problem-solving skills when determining appropriate actions	
4.8 understand the need for active participation in training, supervision and mentoring in supporting high standards of practice, and personal and professional conduct, and the importance of demonstrating this in practice	
5. recognise the impact of culture, equality and diversity on practice and practise in a non-discriminatory and inclusive manner	
5.1 respond appropriately to the needs of all different groups and individuals in practice, recognising this can be affected by difference of any kind including, but not limited to, protected characteristics,[1] intersectional experiences and cultural differences	
5.2 understand equality legislation and apply it to their practice	
5.3 recognise the potential impact of their own values, beliefs and personal biases (which may be unconscious) on practice and take personal action to ensure all service users and carers are treated appropriately with respect and dignity	
5.4 understand the duty to make reasonable adjustments in practice and be able to make and support reasonable adjustments in theirs and others' practice	
5.5 recognise the characteristics and consequences of barriers to inclusion, including for socially isolated groups	
5.6 actively challenge these barriers, supporting the implementation of change wherever possible	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
5.7 recognise that regard to equality, diversity and inclusion needs to be embedded across all areas of the standards and practice	
5.8 understand the emotions, behaviours and psychosocial needs of people undergoing diagnostic ultrasound imaging, as well as that of their families and carers	
6. understand the importance of and be able to maintain confidentiality	
6.1 adhere to the professional duty of confidentiality and understand when disclosure may be required	
6.2 understand the principles of information governance and be aware of the safe and effective use of health and social care information	
6.3 recognise and respond in a timely manner to situations where it is necessary to share information to safeguard service users, carers and / or the wider public	
6.4 understand the need to ensure confidentiality is maintained in all situations in which service users rely on additional communication support (such as interpreters or translators)	
6.5 recognise that the concepts of confidentiality and informed consent extend to all mediums, including illustrative clinical records such as photography, video and audio recordings and digital platforms	
7. communicate effectively	
7.1 use effective and appropriate verbal and non-verbal skills to communicate with service users, carers, colleagues and others	
7.2 communicate in English to the required standard for their profession (equivalent to level 7 of the International English Language Testing System, with no element below 6.5[2])	
7.3 understand the characteristics and consequences of verbal and non-verbal communication and recognise how these can be affected by difference of any kind including, but not limited to, protected characteristics,[1] , intersectional experiences and cultural differences	

Standard of proficiency	**Mapping to programme and module aims and learning outcomes**
7.4 work with service users and / or their carers to facilitate the service user's preferred role in decision-making, and provide service users and carers with the information they may need where appropriate	
7.5 modify their own means of communication to address the individual communication needs and preferences of service users and carers, and remove any barriers to communication where possible	
7.6 understand the need to support the communication needs of service users and carers, such as through the use of an appropriate interpreter	
7.7 use information, communication and digital technologies appropriate to their practice	
7.8 understand the need to provide service users or people acting on their behalf with the information necessary in accessible formats to enable them to make informed decisions	
7.9 formulate and provide information and support for service users about their treatment and / or imaging process and procedures, with regular reappraisal of their information needs as appropriate	
7.10 advise other healthcare professionals about the relevance and application of imaging modalities to the service user's needs	
7.11 provide appropriate information and support for service users throughout their diagnostic imaging examinations	
8. work appropriately with others	
8.1 work in partnership with service users, carers, colleagues and others	
8.2 recognise the principles and practices of other health and care professionals and systems and how they interact with their profession	
8.3 understand the need to build and sustain professional relationships as both an autonomous practitioner and collaboratively as a member of a team	
8.4 contribute effectively to work undertaken as part of a multi-disciplinary team	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
8.5 identify anxiety and stress in service users, carers and colleagues, adapting their practice and providing support where appropriate	
8.6 understand the qualities, behaviours and benefits of leadership	
8.7 recognise that leadership is a skill all professionals can demonstrate	
8.8 identify their own leadership qualities, behaviours and approaches, taking into account the importance of equality, diversity and inclusion	
8.9 demonstrate leadership behaviours appropriate to their practice	
8.10 act as a role model for others	
8.11 promote and engage in the learning of others	
8.12 demonstrate awareness of the need to empower service users to participate in the decision-making processes related to their profession	
8.13 demonstrate awareness of the need to encourage, support and mentor staff at all practitioner levels	
8.14 demonstrate awareness of roles and responsibilities where work is delegated and demonstrate understanding of how this applies in practice	
8.15 understand, interpret and act upon information from other healthcare professionals and service users, in order to maximise health gain whilst minimising risks to the service user (such as from ultrasound insonation)	
8.16 understand the need to involve service users in service design, service delivery, education and research	
8.17 understand the need to engage service users and carers in planning and evaluating their diagnostic imaging and interventional procedures	
9. maintain records appropriately	
9.1 keep full, clear and accurate records in accordance with applicable legislation, protocols and guidelines	

Standard of proficiency	**Mapping to programme and module aims and learning outcomes**
9.2 manage records and all other information in accordance with applicable legislation, protocols and guidelines	
9.3 use digital record keeping tools, where required	
10. reflect on and review practice	
10.1 understand the value of reflective practice and the need to record the outcome of such reflection to support continuous improvement	
10.2 recognise the value of multi-disciplinary reviews, case conferences and other methods of review	

Standard of proficiency	**Mapping to programme and module aims and learning outcomes**
11. assure the quality of their practice	
11.1 engage in evidence-based practice and relevant audit procedures	
11.2 gather and use feedback and information, including qualitative and quantitative data, to evaluate the response of service users to their care	
11.3 monitor and systematically evaluate the quality of practice, and maintain an effective quality management and quality assurance process working towards continual improvement	
11.4 participate in quality management, including quality control, quality assurance, clinical governance and the use of appropriate outcome measures	
11.5 evaluate intervention plans using recognised and appropriate outcome measures, in conjunction with the service user where possible, and revise the plans as necessary	
11.6 recognise the value of gathering and using data for quality assurance and improvement programmes	
11.7 understand the principles and regulatory requirements for quality control and quality assurance as they apply to their profession	
11.8 understand the quality improvement processes in place relevant to their profession	
12. understand and apply the key concepts of the knowledge base relevant to their profession	
12.1 understand the structure and function of the human body, together with knowledge of physical and mental health, disease, disorder and dysfunction relevant to their profession	
12.2 demonstrate awareness of the principles and applications of scientific enquiry, including the evaluation of treatment efficacy and the research process	
12.3 recognise the role(s) of other professions and services in health and social care and understand how they may relate to the role of radiographer	
12.4 understand the structure and function of health and social care systems and services in the UK	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
12.5 demonstrate awareness of the philosophy and the development of the profession of sonography to inform understanding of current practice	
12.6 understand the role of the sonographer and other operators in the promotion of health and health education in relation to public health, healthy living and health screening for disease detection	
12.7 understand the harms and benefits of population and targeted health screening	
12.8 understand the physical principles on which the practice of sonography is based	
12.9 understand the concept of risk vs benefit with regards to ionising radiation and non-ionising radiation, acknowledging this will differ depending on modality, and communicate this with service users, taking into consideration service user judgement	
12.10 understand the philosophy and principles involved in the practice of their profession	
12.11 understand and apply the principles of ultrasound production, interaction with matter	
12.12 know the physical and scientific principles on which image formation using ultrasound is based	
12.13 understand ultrasound safety including the principles of safety indices and how to meet national and international safety guidelines	
12.14 understand the theoretical basis underpinning service user assessment prior to and during their procedure	
12.15 understand the capability, applications and range of equipment used in their profession	
12.16 distinguish between normal and abnormal appearances in real-time and on images	
12.17 know the concepts and principles involved in the practice of their profession and how these inform and direct clinical judgement and decision making	
12.18 know the pharmacology of drugs used in their profession	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
12.19 understand the legislation, principles and methods for the safe and effective administration of drugs used in their profession	
12.20 understand the mechanisms for the administration of drugs, including intravenous contrast agents	
12.21 recognise and respond to adverse or abnormal reactions to medications used in relation to their profession	
12.22 understand the principles of the safe storage, transportation and disposal of medicinal products used in relation their profession	
12.23 demonstrate awareness of the current developments and trends in the science and practice of sonography	
12.24 understand the different communication needs, anatomy and disease processes and their manifestation in children	
12.25 demonstrate awareness of the principles of Artificial Intelligence (AI) and deep learning technology, and its application to practice	
12.26 understand the signs and symptoms of disease and trauma that result in referral for diagnostic imaging procedures and their image appearances	
12.27 understand the structure and function of the human body in health, disease and trauma, as well as common pathologies and mechanisms of disease and trauma, relating to area(s) within the individual scope of clinical practice e.g. obstetric, gynaecological, general medical, vascular, musculoskeletal ultrasound	
13. draw on appropriate knowledge and skills to inform practice	
13.1 change their practice as needed to take account of new developments, technologies and changing contexts	
13.2 gather appropriate information	
13.3 analyse and critically evaluate the information collected to be able to assess, monitor and care for the service user before, during and after ultrasound procedures	
13.4 select and use appropriate assessment techniques and equipment and be able to use independent methods to establish and confirm service user identity prior to undertaking ultrasound procedures	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
13.5 undertake and record a thorough, sensitive and detailed assessment	
13.6 undertake or arrange investigations as appropriate	
13.7 conduct appropriate assessment or monitoring procedures, treatment, therapy or other actions safely and effectively	
13.8 recognise a range of research methodologies relevant to their role	
13.9 recognise the value of research to the critical evaluation of practice	
13.10 critically evaluate research and other evidence to inform their own practice	
13.11 engage service users in research as appropriate	
13.12 formulate specific and appropriate management plans including the setting of timescales	
13.13 assess, monitor and care for the service user across the pathway of care relevant to their profession	
13.14 undertake and record a thorough, sensitive and detailed clinical assessment, selecting and using appropriate techniques and equipment	
13.15 use physical, graphical, verbal and electronic methods to collect and analyse information from a range of relevant sources including service user's clinical history, diagnostic images and reports, pathological tests and results, dose recording and treatment verification systems	
13.16 interrogate and process data and information gathered accurately in order to conduct the procedures most appropriate to the service user's needs	
13.17 appraise image information for clinical manifestations and technical accuracy, and take further action as required	
13.18 manage complex and unpredictable situations including the ability to adapt planned procedures	
13.19 operate ultrasound imaging equipment safely and accurately relevant to their profession	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
13.20 check that equipment is functioning accurately and within the specifications, and to take appropriate action in the case of faulty functioning and operation	
13.21 select and explain the rationale for radiographic techniques and immobilisation procedures appropriate to the service user's physical and disease management requirements	
13.22 position service users correctly for safe and accurate procedures	
13.23 Authorise and plan appropriate ultrasound imaging examinations	
13.24 evaluate ultrasound on-screen safety indices (TI & MI) and their relevance in risk benefit decisions; understand and apply techniques to reduce insonation appropriately	
13.25 perform a broad range of ultrasound imaging techniques, relevant to scope of practice	
13.26 assist with more complex diagnostic ultrasound imaging techniques and interventional procedures providing support to the service user and other members of the multidisciplinary team, if within scope of practice	
13.27 critically analyse ultrasound images for technical quality and suggest improvement if required	
13.28 use to best effect the processing and related technology supporting imaging systems	
13.29 distinguish disease, trauma and urgent and unexpected findings as they manifest on diagnostic images and take direct and timely action to assist the referrer	
14. establish and maintain a safe practice environment	
14.1 understand the need to maintain the safety of themself and others, including service users, carers and colleagues	
14.2 demonstrate awareness of relevant health and safety legislation and comply with all local operational procedures and policies	
14.3 work safely, including being able to select appropriate hazard control and risk management, reduction or elimination techniques in a safe manner and in accordance with health and safety legislation	

Standard of proficiency	Mapping to programme and module aims and learning outcomes
14.4 select appropriate personal protective equipment and use it correctly	
14.5 establish safe environments for practice, which appropriately manage risk	
14.6 understand and apply appropriate moving and handling techniques	
14.7 ensure the physical safety of all individuals in the imaging work environment	
14.8 use basic life support techniques and be able to deal with clinical emergencies	
14.9 know the correct principles and applications of disinfectants, methods for sterilisation and decontamination, and for dealing with waste and spillages correctly	
15. promote health and prevent ill health	
15.1 understand the role of their profession in health promotion, health education and preventing ill health	
15.2 understand how social, economic and environmental factors (wider determinants of health) can influence a person's health and well-being	
15.3 empower and enable individuals (including service users and colleagues) to play a part in managing their own health	
15.4 engage in occupational health, including being aware of immunisation requirements	

Appendix 10.1 - References

1 The Equality Act 2010 defines the protected characteristics as age, disability, gender reassignment, race, religion or belief, sex, sexual orientation, marriage and civil partnership and pregnancy and maternity. Equivalent equality legislation in Northern Ireland protects age, disability, gender, race, religion or belief and sexual orientation.

2 The International English Language Testing System (IELTS) tests competence in the English language. Applicants who have qualified outside of the UK, whose first language is not English and who are not applying through the Swiss Mutual Recognition Route (SMR) must provide evidence that they have reached the necessary standard. More information available here: Statement on English language proficiency requirements for internationally trained health and care professionals | (hcpc-uk.org)

10.2 Appendix 2: QAA Level Descriptors.[24]

4.15 Descriptor for a higher education qualification at level 6 on the FHEQ: bachelor's degree with honours

The descriptor provided for this level of the FHEQ is for any bachelor's degree with honours which should meet the descriptor in full. This qualification descriptor should also be used as a reference point for other qualifications at level 6 of the FHEQ, including bachelor's degrees, and graduate diplomas.

Bachelor's degrees with honours are awarded to students who have demonstrated:

- a systematic understanding of key aspects of their field of study, including acquisition of coherent and detailed knowledge, at least some of which is at, or informed by, the forefront of defined aspects of a discipline
- an ability to deploy accurately established techniques of analysis and enquiry within a discipline
- conceptual understanding that enables the student:
  - to devise and sustain arguments, and/or to solve problems, using ideas and techniques, some of which are at the forefront of a discipline
  - to describe and comment upon particular aspects of current research, or equivalent advanced scholarship, in the discipline
- an appreciation of the uncertainty, ambiguity and limits of knowledge
- the ability to manage their own learning, and to make use of scholarly reviews and primary sources (for example, refereed research articles and/or original materials appropriate to the discipline).

Typically, holders of the qualification will be able to:

- apply the methods and techniques that they have learned to review, consolidate, extend and apply their knowledge and understanding, and to initiate and carry out projects
- critically evaluate arguments, assumptions, abstract concepts and data (that may be incomplete), to make judgements, and to frame appropriate questions to achieve a solution – or identify a range of solutions – to a problem
- communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

And holders will have:

- the qualities and transferable skills necessary for employment requiring:
  - the exercise of initiative and personal responsibility
  - decision-making in complex and unpredictable contexts
  - the learning ability needed to undertake appropriate further training of a professional or equivalent nature.

4.15.1 Holders of a bachelor's degree with honours will have developed an understanding of a complex body of knowledge, some of it at the current boundaries of an academic discipline. Through this, the holder will have developed analytical techniques and problem-solving skills that can be applied in many types of employment. The holder of such a qualification will be able to evaluate evidence, arguments and assumptions, to reach sound judgements and to communicate them effectively.

4.15.2 Holders of a bachelor's degree with honours should have the qualities needed for employment in situations requiring the exercise of personal responsibility, and decision-making in complex and unpredictable circumstances.

4.15.3 Bachelor's degrees with honours form the largest group of higher education qualifications. Typically, learning outcomes for these programmes would be expected to be achieved on the basis of study equivalent to three or four full-time academic years and lead to qualifications with titles such as Bachelor of Arts, BA (Hons) or Bachelor of Science, BSc (Hons). In addition to bachelor's degrees at this level are short courses and professional 'conversion' courses, based largely on undergraduate material, and taken usually by those who are already graduates in another discipline, leading to, for example, graduate certificates or graduate diplomas.

4.17 Descriptor for a higher education qualification at level 7 on the FHEQ and SCQF level 11 on the FQHEIS: master's degree

The descriptor provided for this level of the frameworks is for any master's degree which should meet the descriptor in full. This qualification descriptor should also be used as a reference point for other qualifications at level 7/ SCQF level 11 on the FQHEIS, including postgraduate certificates and postgraduate diplomas.

Master's degrees are awarded to students who have demonstrated:

- a systematic understanding of knowledge, and a critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of their academic discipline, field of study or area of professional practice
- a comprehensive understanding of techniques applicable to their own research or advanced scholarship
- originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline
- conceptual understanding that enables the student:
  - to evaluate critically current research and advanced scholarship in the discipline
  - to evaluate methodologies and develop critiques of them and, where appropriate, to propose new hypotheses.

Typically, holders of the qualification will be able to:

- deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences
- demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level
- continue to advance their knowledge and understanding, and to develop new skills to a high level.

And holders will have:

- the qualities and transferable skills necessary for employment requiring:
  - the exercise of initiative and personal responsibility
  - decision-making in complex and unpredictable situations
  - the independent learning ability required for continuing professional development.

4.17.1 Much of the study undertaken for master's degrees is at, or informed by, the forefront of an academic or professional discipline. Successful students show originality in the application of knowledge, and they understand how the boundaries of knowledge are advanced through research. They are able to deal with complex issues both systematically and creatively, and they show originality in tackling and solving problems. They have the qualities needed for employment in circumstances requiring sound judgement, personal responsibility and initiative in complex and unpredictable professional environments.

4.17.2 Master's degrees are awarded after completion of taught courses, programmes of research or a mixture of both. Longer, research-based programmes may lead to the degree of MPhil. The learning outcomes of most master's degree courses are achieved on the basis of study equivalent to at least one full-time calendar year and are taken by graduates with a bachelor's degree with honours (or equivalent achievement).

4.17.3 Master's degrees are often distinguished from other qualifications at this framework level (for example, advanced short courses, which often form parts of continuing professional development programmes and lead to postgraduate certificates and/or postgraduate diplomas) by an increased intensity, complexity and density of study. Master's degrees, in comparison to postgraduate certificates and postgraduate diplomas, typically include planned intellectual progression that often includes a synoptic/research or scholarly activity.

4.17.4 Some master's degrees, for example, in science, engineering and mathematics, comprise an integrated programme of study spanning several levels. Such programmes typically involve study equivalent to at least four full-time academic years in England, Wales and Northern Ireland and five in Scotland. Of this, study equivalent to at least one full-time academic year is at level 7 of the FHEQ/SCQF level 11 on the FQHEIS and the final outcomes of the qualifications themselves meet the expectations of the descriptor for a higher education qualification at level 7/level 11 in full. Study at bachelor's level is integrated with study at master's level and the programmes are designed to meet the qualification descriptors in full at level 6 of the FHEQ/SCQF level 10 on the FQHEIS as well as those at level 7 of the FHEQ/level 11 of the FQHEIS. Such qualifications are often termed 'integrated master's' as an acknowledgement of the prior period of study at lower levels (which typically meets the expectations of the descriptor for a higher education qualification at level 6/level 10).

4.17.5 First degrees in medicine, dentistry and veterinary science comprise an integrated programme of study and professional practice spanning several levels. While the final outcomes of the qualifications themselves typically meet the expectations of the descriptor for a higher education qualification at level 7/level 11, these qualifications may often retain, for historical reasons, titles of Bachelor of Medicine, and Bachelor of Surgery, Bachelor of Dental Surgery, Bachelor of Veterinary Medicine or Bachelor of Veterinary Science, and are abbreviated to MBChB or BM BS, BDS, BVetMed and BVSc respectively. The use of the title 'Dr' by medical doctors is a historical abbreviation for the profession; it does not indicate a qualification at doctoral level (level 8 on the FHEQ/SCQF level 12 on the FQHEIS).

4.17.6 In Scotland a small number of universities (Aberdeen, Glasgow, Edinburgh and St Andrews (the Scottish Ancients) have a long tradition of labelling certain undergraduate academic degrees as Master of Arts 'MA'. This title reflects historic Scottish custom and practice; there is no implication that the outcomes of the programmes are at SCQF level 11 on the FQHEIS. These programmes are at SCQF level 9 or 10 on the FQHEIS.

4.17.7 The Master of Arts (MA) awards granted by the University of Oxford and the University of Cambridge are not academic qualifications. The MA is normally granted, on application, to graduates of these universities with a bachelor's degree. No further study or assessment is required, but the recipient may be required to pay a fee. At the University of Oxford, the MA may be granted during or after the twenty-first term from matriculation, and at the University of Cambridge the MA may be granted six years after the end of the first term.

4.18 Descriptor for a higher education qualification at level 8 on the FHEQ and SCQF level 12 on the FQHEIS: doctoral degree

The descriptor provided for this level of the frameworks is for any doctoral degree which should meet the descriptor in full. This qualification descriptor should also be used as a reference point for other level 8/level 12 qualifications.

Doctoral degrees are awarded to students who have demonstrated:

- the creation and interpretation of new knowledge, through original research or other advanced scholarship, of a quality to satisfy peer review, extend the forefront of the discipline, and merit publication
- a systematic acquisition and understanding of a substantial body of knowledge which is at the forefront of an academic discipline or area of professional practice
- the general ability to conceptualise, design and implement a project for the generation of new knowledge, applications or understanding at the forefront of the discipline, and to adjust the project design in the light of unforeseen problems
- a detailed understanding of applicable techniques for research and advanced academic enquiry.

Typically, holders of the qualification will be able to:

- make informed judgements on complex issues in specialist fields, often in the absence of complete data, and be able to communicate their ideas and conclusions clearly and effectively to specialist and non-specialist audiences
- continue to undertake pure and/or applied research and development at an advanced level, contributing substantially to the development of new techniques, ideas or approaches.

And holders will have:

- the qualities and transferable skills necessary for employment requiring the exercise of personal responsibility and largely autonomous initiative in complex and unpredictable situations, in professional or equivalent environments.

4.18.1 Doctoral degrees are awarded for the creation and interpretation, construction and/or exposition of knowledge which extends the forefront of a discipline, usually through original research.

4.18.2 Holders of doctoral degrees are able to conceptualise, design and implement projects for the generation of significant new knowledge and/or understanding. Holders of doctoral degrees have the qualities needed for employment that require both the ability to make informed judgements on complex issues in specialist fields and an innovative approach to tackling and solving problems.

4.18.3 Doctoral programmes that may have a substantial taught element in addition to the research component (for example, professional doctorates), lead usually to awards which include the name of the discipline in their title (for example, EdD for Doctor of Education or DClinPsy for Doctor of Clinical Psychology). Professional doctorates aim to develop an individual's professional practice and to support them in producing a contribution to (professional) knowledge.

4.18.4 The titles PhD and DPhil are commonly used for doctoral degrees awarded on the basis of original research.

4.18.5 Achievement of outcomes consistent with the qualification descriptor for the doctoral degree normally requires study equivalent to three full-time calendar years.

4.18.6 Higher doctorates may be awarded in recognition of a substantial body of original research undertaken over the course of many years. Typically a portfolio of work that has been previously published in a peer-refereed context is submitted for assessment. Most degree awarding bodies restrict candidacy to graduates or their own academic staff of several years' standing.

10.3 Appendix 4: Module mapping to National Occupational Standards

10.3.1 Ultrasound Imaging CI.C.2019[1]

All focused course and programme accreditations need to include mapping of individual modules to the National Occupational Standards CI.C.2019[1], as these are the minimum standards of anyone performing ultrasound at all levels. If the programme or course includes interventional procedures the mapping for CI.I (see section 10.4.2) is also required.

A word template is available for the CI.C mapping. The module headings should be replaced with the programme module titles or the focused course title. If any aspects are not applicable to your programme/ focused course, justification should be provided.

CI.C.2019 - Perform, interpret and report on ultrasound examinations	**Module 1**	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**
Knowledge and Understanding						
1. legal, organisational and policy requirements relevant to your role, the role of others in your organisation and the activities being carried out						
2. the relevant national and local standards, guidelines, policies and procedures that are available and how and when they should be accessed						
3. the importance of respecting individuals' culture, privacy, dignity, wishes, beliefs and decisions and how to do so						
4. the limitations of your own knowledge and experience and the importance of operating within your scope of practice						

5. preparation of the environment and equipment for ultrasound examinations						
6. local policy and protocol for arranging and working with a chaperone						
7. the physical processes involved in the production of an ultrasound image						
8. the biological effects and potential risks associated with the use of ultrasound						
9. the principles and applied knowledge of the Doppler effect and its clinical application in imaging and diagnosis						
10. artefacts on images - their causes, value, limitations and minimisation strategies						
11. the effect of sound propagation through different tissues						
12. techniques to optimise the ultrasound image including position and preparation of the individual						
13. the safe operation of ultrasound equipment						
14. the potential for work-related disorders and how to minimise the risk						
15. the importance of timely equipment fault recognition and local procedures for reporting these						

16. image capture and recording devices						
17. equipment age and capabilities, limitations and routine maintenance, including the quality control processes required by the operator						
18. the function, specification and performance characteristics of ultrasound equipment and transducers						
19. the clinical conditions appropriate for ultrasound examinations and the implications of other disease processes relevant to the area of study						
20. the clinical justification of the examination request and an understanding of limitations						
21. the contraindications associated with each investigation and the implications of proceeding with due consideration of related risks						
22. the clinical implications of any allergy relevant to the examination						
23. the importance of obtaining valid consent in line with national and local guidelines						
24. methods of communicating difficult and complex information to individuals and key people						

25. the importance of providing individuals and key people with opportunities to ask questions and increase their understanding						
26. the information that should be given to individuals before, during and on completion of the examination						
27. how to adapt communication styles, ask questions, and listen carefully in ways which are appropriate for the needs of the individual						
28. normal anatomy and physiology, normal variants and anatomical relationships demonstrable by ultrasound including knowledge of normal measurements and predisposing factors of the individual						
29. how to acquire the best possible diagnostic images for a range of type and size of individual						
30. recognition of abnormal anatomy and physiology demonstrable by ultrasound and the significance of such abnormality						
31. the pathological processes and their appearance on ultrasound, relevant to the examination undertaken						
32. manifestations of an individual's physical and emotional status						

33. the impact of equipment controls on image quality and production, and safety indices						
34. local procedures pertaining to the examination report						
35. report writing techniques including medical terminology and standard abbreviations relevant to the examination						
36. alternative imaging examinations, diagnostic and interventional techniques, and other relevant investigations						
37. referral pathways, follow-up procedures and support resources for the individual						
38. procedures relating to recording, collating and preparing appropriate information, documentation and images for transfer or storage according to local protocols						
39. how to keep full, accurate and clear records in line with organisational procedures						
Performance criteria						
1. apply standard precautions for infection prevention and control, and other appropriate health and safety measures						
2. ensure all necessary preparations have been made by the individual						

and staff before starting the procedure						
3. check and prepare the equipment required for the examination						
4. ensure the environment is conducive to maintaining the privacy and dignity of the individual						
5. check the identification and clinical history details before commencing the procedure in accordance with local policies and procedures						
6. introduce yourself and other members of staff present during the examination						
7. review any previous relevant imaging where available						
8. enter the identification details of the individual into the ultrasound machine or, if previously entered, check for accuracy						
9. obtain valid consent for the procedure in accordance with national and local guidelines						
10. respect the individual's privacy, dignity, beliefs and decisions						

11. confirm the appropriateness of key people before the examination in accordance with local guidelines						
12. communicate with the individual / key people to facilitate their understanding of and co-operation with the examination						
13. establish the individual's capacity to understand the procedure with the help of key people if necessary						
14. clearly explain the procedure and possible outcomes, including risk, benefits and limitations						
15. check for any contraindications for the proposed procedure and take appropriate action in response to identified risks						
16. ensure the individual is in an appropriate and comfortable position for the examination, ensuring clothing is suitably adjusted to facilitate the examination						
17. select and prepare the appropriate imaging technique, transducer and initial scanning parameters for the individual and the site under examination						
18. apply sufficient acoustic coupling gel to the area to be examined to ensure optimal sound transmission						

19. make adjustments to the equipment controls to optimise the image quality and recognise the appearance of ultrasound artefacts						
20. ensure power levels and insonation time are kept to a minimum in accordance with national and international safety guidelines						
21. acquire and interpret appropriate ultrasound images and produce a report in accordance with your scope of practice and in-line with national and local guidelines and protocols						
22. observe and be aware of the individual's condition and well-being at all times and take appropriate action in response to any signs of discomfort and/or distress						
23. take appropriate steps to minimise the risk of work-related disorders						
24. maintain communication with the individual / key people throughout the procedure						
25. record images with appropriate annotation and measurements according to national and local guidelines and protocols						
26. extend the procedure as appropriate to confirm or supplement any initial findings						

27. seek advice from appropriate others where you observe unexpected appearances or unusual findings that are outside your area of personal competence						
28. provide the individual with information relating to the procedure and aftercare where necessary						
29. explain the process for obtaining results						
30. advise a referral to the appropriate person if an abnormality is observed which is likely to require further investigation or treatment, following national and local guidelines and protocols						
31. record, collate and prepare appropriate information, documentation and images for transfer or storage according to local protocols						
32. verify that the images have arrived/been stored according to local protocols						

10.3.2 Perform Image-Guided Procedures and/or Interventions CI.I.2019[2]

If the programme or course includes interventional procedures, then this mapping for CI.I is also required.

A word template is available for the CI.I mapping. The module headings should be replaced with the programme module titles or the focused course title. If any aspects are not applicable to your programme/ focused course, justification should be provided.

CI.I.2019 – Perform image guided procedures and/or interventions	**Module 1**	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**
Knowledge and Understanding						
1. legal, organisational and policy requirements relevant to your role, the role of others in your organisation and the activities being carried out						
2. the relevant national and local standards, guidelines, policies and procedures that are available and how and when they should be accessed						
3. the national and local guidelines for acceptance of requests for image guided interventional procedures in your area of practice						
4. the importance of obtaining valid consent in line with national and local guidelines						
5. the principles and role of image guidance in your area of practice						

6. the use of pre-intervention checklists and how they should be used according to local and national policies and procedures						
7. how to keep full, accurate and clear records in line with organisational procedures						
8. the limitations of your own knowledge and experience and the importance of operating within your scope of practice						
9. the benefits and limitations of image guided interventional procedures in your area of practice						
10. the role and importance of alternative, additional and complementary imaging techniques and investigations						
11. clinical appropriateness of the examination request and the action to take when the request is not appropriate						
12. how to undertake risk assessments for individuals prior to the procedure						

13. the contraindications associated with each investigation and the implications of proceeding with due consideration of related risks						
14. the preparation of the individual, environment and equipment for image guided interventional procedures in your area of practice						
15. the importance of respecting individuals' culture, privacy, dignity, wishes and beliefs and decisions and how to do so						
16. the roles and responsibilities of other team members						
17. how to adapt communication styles, ask questions, and listen carefully in ways which are appropriate for the needs of the individual						
18. methods of communicating difficult and complex information to individuals and key people						
19. the importance of providing individuals and key people with opportunities to ask questions and increase their understanding						

20. the information that should be given to individuals before, during and on completion of the examination						
21. debrief procedures and how these should be used to ensure that any problems encountered during the procedure are recorded to inform future interventions						
22. the anatomy, physiology and pathology of the anatomical structures under investigation						
23. the pathophysiology of relevant disease processes						
24. the clinical findings and imaging appearances associated with normal and abnormal anatomical structures						
25. the safe use of local anaesthesia and other medicines used during the procedure or intervention						
26. aseptic techniques and the potential consequences of poor practice						
27. the importance of minimising any unnecessary discomfort of individuals undergoing interventional procedures, and how to do so						

28. the management of emergency/acute complications that occur during the procedure						
29. the safe use and manipulation of non-imaging equipment used during the procedure						
30. the management, storage and transport of tissue samples where relevant						
31. local procedures for image acquisition, storage and retrieval						
32. the annotation and interpretation of relevant images and information to confirm the location of the region/structure(s) under investigation						
33. procedures relating to recording, collating and preparing appropriate documentation and images for transfer or storage according to local protocols						
34. how changes to image findings as a result of intervention may affect interpretation of future imaging procedures and decisions by others						
35. safe operation of imaging equipment in your area of practice						

36. the risks of work-related disorders and how to minimise the risks						
37. machine settings and methods available to optimise the image in your area of practice						
Performance criteria						
1. apply standard precautions for infection prevention and control, and other appropriate health and safety measures						
2. check and prepare the equipment required for the examination						
3. ensure all necessary preparations have been made by the individual and staff before starting the procedure						
4. ensure the environment is conducive to maintaining the privacy and dignity of the individual						
5. introduce yourself and other members of staff present during the examination						
6. check the identification details before commencing the interventional procedure in accordance with local policies and procedures						

7. obtain valid consent for the procedure in accordance with national and local guidelines						
8. communicate with the individual / key people to facilitate their understanding of and co-operation with the examination						
9. establish the individual's capacity to understand the procedure with the help of key people if necessary						
10. clearly explain the procedure and possible outcomes, including risk, benefits, limitations and alternatives						
11. respect the individual's privacy, dignity, beliefs and decisions						
12. review the clinical history for factors which might contraindicate the procedure						
13. assess the individual for contra-indications to any medicines to be used in the examination and for any relevant allergies, and take appropriate action						

14. ensure appropriate and recent imaging is available and assess relevant images and information prior to performing the procedure to confirm the location of the region/structure(s) of interest						
15. make an assessment of the individual's emotional needs and respond appropriately						
16. ensure that relevant checklists are completed prior to the procedure in line with local and national policies to highlight any potential problems before the procedure begins						
17. select the correct equipment for the procedure according to national and local guidelines and protocols						
18. take appropriate precautions to ensure a clean or aseptic technique as required						
19. ensure the individual is in an appropriate position and is as comfortable as possible for the procedure						
20. administer local anaesthetic if required according to local and national guidelines						

21. take appropriate steps to minimise the risk of work-related disorders						
22. ensure the procedure is carried out correctly and in accordance with local policies and procedures						
23. where required by the procedure, obtain any samples and label containers according to local guidelines and protocols						
24. ensure all images are acquired, stored and transferred in line with local guidelines and protocols						
25. ensure dressings are applied where appropriate after the procedure						
26. ensure immediate post-procedure observations are carried out according to national and local guidelines and protocols						
27. recognise and respond to a deterioration in the individual's clinical condition in line with relevant national and local guidelines and protocols						
28. provide the individual with information relating to the procedure and aftercare where necessary						

29. explain the process for obtaining results						
30. document the procedure according to national and local guidelines and protocols						

Appendix 10.3 - References

1. Skills for Health (2019) CI.C.2019 - Perform, interpret and report on ultrasound examinations. [Online]. Available: https://tools.skillsforhealth.org.uk/competence/show/html/id/4302/

2. Skills for Health (2019) CI.I.2019 - Perform image guided procedures and/or interventions [Online]. Available: https://tools.skillsforhealth.org.uk/competence/show/html/id/4307/

10.4 Appendix 5: Contributors and acknowledgements

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