



## Narrative Review

## There's nothing plain about projection radiography! A discussion paper

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## ABSTRACT

**Objectives:** Unlike the technological advances in cross-sectional imaging, the adoption of CR and DR has been relatively overlooked in terms of the additional radiographer skills and competences required for optimal practice. Furthermore, projection radiography is often referred to as basic, plain or other words suggesting simplicity or entry-level skill requirements. Radiographers' professional identity is connected with the discourse expressed via the language used in daily practice and consequently, if the perception of projection radiography is regarded as simple practice not requiring much reflection or complex decision-making, apathy and carelessness may arise. The purpose of this narrative review was to raise projection radiography from its longstanding lowly place and re-position it as a specialist imaging field. **Key findings:** Danish pre-registration radiography curricula contain little mention of projection radiography and a low proportion (n = 17/144; 11.8%) of Danish radiography students chose to focus on projection radiography within publicly available BSc. theses between 2016 and 2020 as compared to topics related to CT and MRI (n = 60/144; 41.7%).

**Conclusion:** By changing how we as the profession perceive the role and position of projection radiography, we can start to rebuild its lost prestige and demand a greater, more detailed and clinically relevant educational offering from academic partners. For this to commence, the language and terminology we use to describe ourselves and tasks undertaken must reflect the complexity of the profession.

**Implications for practice:** Regardless of imaging modality, every patient should be assured that a radiographer with expertise in acquiring images of diagnostic quality undertakes their examination. Reclaiming the prestige of projection radiography may lead students and radiographers to recognize projection radiography as a demanding specialist field for the benefit of the patients.

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Projection radiography remains the backbone of medical imaging services globally despite the increasing demand for cross sectional imaging (e.g. Computed Tomography (CT), Magnetic Resonance Imaging (MRI) and ultrasound (US)). Data from the England Diagnostic Imaging Data Set (2019/20)<sup>1</sup> identified that 44.9 million imaging tests were undertaken during the year and 23.2 million (51.7%) of those were projection radiography examinations, referred to in the report as 'plain radiography (X-ray)'. So what is wrong with this term?

The term plane, from planar reflecting the acquisition of images in differing anatomical planes, was established as a term from the early introduction of radiographic practice, emphasizing the different image orientations or image perspectives. With the advancement of radiographic practice to include examinations involving the introduction of contrast agents, the term planar evolved into the term plain, supposedly reflecting non-contrast radiographic examinations, although the phase and time of transition in terminology is not clear. However, with the advancement

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in imaging technologies and global adoption of CT, MRI, ultrasound, nuclear medicine and interventional radiography to expand the service offering of medical imaging departments, the term 'plain radiography' has increasingly become synonymous with perceptions of being 'basic' or 'low level' in terms of technology, competencies and skills, whereas other modalities are often described as 'advanced'. This perhaps reflects diagnostic radiographer threshold competencies on qualification relating predominantly to projection radiography with expectations of capabilities to assist in other modalities.<sup>2</sup> This might also explain the growth in assistant practitioners working with increasing independence and autonomy within projection radiography (and mammography as a subset of this).<sup>3</sup> As a result, with the exception of mammography which has become a specialist area of practice within the context of breast imaging, general projection radiography has been apparently demoted as an area of practice not worthy of specialization or higher level learning and nowhere is this more evident than within career advancement choices and pre- and post-registration education programmes.

In the UK, pre-registration diagnostic radiography programmes typically focus student learning of projection radiography image acquisition practice in the first 2 years of study, leaving later year(s) for education related to cross-sectional modalities, image evaluation and research (among other topics). However, programmes may also revisit and revise aspects of projection radiography in terms of critical reflection, image evaluation and contribution of imaging to patient pathways during all stages of study. This style of delivery and increasing emphasis on cross-sectional modality competence reflects the views of UK service managers and future workforce developments as suggested by Sloane and Miller (2017).<sup>4</sup> Very few Universities offer postgraduate education focusing on projection radiography unless this is incorporated within a radiographer reporting program. In contrast, a large number of post-education opportunities exist focusing on cross-sectional technologies and practice suggesting that Higher Education Institutions and academic radiographers do not value or recognize the need and opportunities for advanced or higher level knowledge and skills within general projection radiography.

In Denmark, pre-registration radiography curricula contain little mention of projection radiography image acquisition practices generally and patient positioning particularly. While the absence of such topics in pre-registration curricula does not necessarily translate into differences in the threshold skills of newly qualified radiographer practitioners,<sup>5</sup> it does emphasize to students the perceived 'low level' status of this area of radiographic practice, all be it subconsciously and perhaps unintentionally. This may also explain the relatively low proportion ( $n = 17/144$ ; 11.8%) of Danish students graduating from three Danish University Colleges who chose to focus on projection radiography within publicly available Bachelor Degree theses over the five years 2016–2020 (Table 1) as compared to topics related to CT and MRI ( $n = 60/144$ ; 41.7%).

So why is it time to raise projection radiography from its longstanding lowly place and re-position it as a specialist imaging field, deserving of recognition as such?

Like all other imaging modalities, the technology supporting projection radiography has experienced a digital revolution. While 'film-screen' technology may exist in some regions of the world, the last 20 years has generally seen a rapid evolution from film based systems through Computed Radiography (CR) to Direct Digital Radiography (DR) with increasing integration of image acquisition parameter automation within these advances. However, unlike the technological advances in cross-sectional imaging, the adoption of CR and DR has been relatively overlooked in terms of the additional radiographer skills and competencies required for optimal practice. As a result, techniques, exposure factor selection

**Table 1**

Distribution of topics in publicly available Danish Bachelor's theses (2016–2020).

BSc. Topic	N (%)
CT	37 (25.69)
CT/MR	2 (1.39)
Digital Radiography (Chest)	9 (6.25)
Digital Radiography (MSK)	8 (5.56)
Ergonomics	1 (0.69)
Intervention	1 (0.69)
Mammography	10 (6.94)
MR	21 (14.58)
Nuclear Medicine	11 (7.64)
Radiation Therapy	17 (11.81)
Ultrasound	2 (1.39)
Qualitative	25 (17.36)
Total	144 (100)

and modes of operation often reflect and perpetuate film-screen operation thereby failing to fully optimize the capabilities and opportunities for improvements presented by computerization. Further, the faster image acquisition processes, greater patient throughput and overall efficiency savings possible through the adoption of digital technologies, without sufficient consideration of patient care experience or radiographer role satisfaction or morale, has placed radiographers at risk of fulfilling the oft time derogatory persona of 'button pusher'.<sup>6</sup> This deprecating label is found both in the general public perception of radiographers<sup>7</sup> and, at least in the past, among radiographers themselves<sup>8</sup> who have expressed concerns about the increasing technological dominance and automation of radiography and the drive towards 'pushing the button'.<sup>9,10</sup> As it has been suggested that a radiographers' professional identity is connected with the discourse expressed via the language used in daily practice,<sup>12</sup> it is easy to understand how words may easily become fact. Consequently, if the perception of projection radiography is reduced to 'pushing a button' and regarded as simple practice not requiring much attention, reflection or complex decision making, apathy and carelessness may arise<sup>9</sup> and, one might assume, a reduction in image quality and diagnostic outcome.

The simple "push of a button" may initiate the radiation required to produce a radiographic image, but there are a large number of significant decisions required before a radiographer gets to that stage.<sup>14,13</sup> Radiographers have to consider: the appropriateness of referral and justification of examination before exposing the patient to radiation using optimized parameters based on detailed technological knowledge of diagnostic dose indices<sup>14</sup>; the clinical history, reason for the imaging and likely image appearances to allow for decision on diagnostic quality to be made; the presenting condition of patient and decisions around changing, approach to patient positioning, modification of image acquisition techniques, communication, and involvement of attendant or carer in the examination among other patient care factors; and all of these decisions are made before the radiographic examination itself commences. It is true that these same decisions, or similar, might apply to other imaging modalities and the purpose of this paper is not to downplay the role of other modalities but to raise up the continued importance of high quality projection radiography and those radiographers who choose to focus their practice or specialize in this modality. Nowhere is this better illustrated than consideration of musculoskeletal projection radiography

Radiography of the musculoskeletal (MSK) system is often undertaken when the patient has experienced trauma or reports pain and morbidity due to degenerative or pathological changes. In most of these situations, patients present with pain, deformity

and/or associated physical and psychological morbidities that impact the examination. In addition to the decision-making previously identified, radiographers need to consider patient orientation, bone anatomy, biomechanics and any movement restrictions and identify the appropriate image acquisition planes as part of examination planning, moving the patient and/or equipment accordingly to achieve a high quality image. Many MSK examinations may also be performed using manual exposure settings. This allows exposure factors to be personalized to the individual patient rather than relying solely on preset exposures to warrant sufficient technical image quality<sup>15</sup> and which, as a consequence of unclear visual measures of image degradation, previously inconsistent Exposure Indices scales and gradual 'bumping up' of exposure factors, has reportedly contributed towards 'dose creep'.<sup>16,17</sup> The consequence of poor image acquisition practice, such as the acceptance of rotated or otherwise improperly positioned extremity radiographs, can result in the obscuration or misdiagnosis of fractures or pathology and may even misguide clinicians in their treatment decisions.<sup>18–21</sup> This in some ways aligns projection radiography with ultrasound as the quality of the resultant image is operator and patient dependent, unlike CT or MRI where volume data acquisitions to some extent allow for image reformatting in the correct plane. However, unlike projection radiography, ultrasound and sonographers have achieved a higher status in the imaging hierarchy. Perhaps this is as a result of additional postgraduate education often required to practice independently. But this is not the case for CT, MRI or interventional radiography so once again, the reasons for the status of projection radiography being overlooked are inconsistent. However, this 'prestige gap' is likely responsible for the low volume of projection radiography research to date although the recent work of Snaithe et al. is, at least in the UK, beginning to address this.<sup>13</sup> The above discussion reflects the system of European education and practice but this is not consistent with other global regions.

In North America and some Arabic countries, the threshold qualification from Higher Education Institutions qualifies the graduate as eligible to take the National Examination of the Regulatory Body to establish threshold competence in projection radiography and practice as radiographer (Medical Imaging Technologist). To work in cross sectional modalities, additional education and certification is often required in these countries signaling not an advancement in the technology, but advancing (or extending) competence of the radiographer across a wider range of technologies building on the essential learning of the qualifying award. In this way, the workforce becomes more flexible and promotion results from this flexibility rather than the supposed 'advanced' nature of the technology itself. In the UK, this additional education for promotion and advancement is not required by the regulator and therefore variation exists in post qualification knowledge and skills. This is further exacerbated by the historical workforce and pay banding structure which may be perceived to promote the location or modality of practice over practitioner knowledge and skills. As a result, radiographers are reported to quickly leave projection radiography for higher paid roles in cross-sectional modalities.<sup>4</sup>

Regardless of regulatory approach and threshold qualification, all patients exposed to ionizing radiation for diagnostic purposes should be confident that the radiographer operating the technology has sufficient understanding to ensure optimal images, capable of directing a diagnosis and justifying the radiation exposure, are acquired. As such, projection radiography, and one could argue particularly MSK radiography, should be recognized as a specialty in its' own right and deserving of education beyond threshold capabilities. In-depth knowledge of particularly anatomy and pathology as well as image optimization techniques will enable

radiographers to practice patient-centered, individualized radiography; a concept where the radiographic procedure is based not only on the clinical question but also matched to the individual patient's anatomy and physiology. The appetite for such learning is evident within the community of radiographers in the UK and also Denmark with study days and courses focused on projection radiography quickly reaching capacity. However, as with many other programs of study, the impact of education on actual practice improvement is rarely effectively measured and so it remains uncertain whether interest translates into practice improvement. This is an area for further research and evaluation across the imaging modalities where radiographers could build the evidence base around education informed practice and improve the prestige of profession as a whole

In conclusion, projection radiography may be historically viewed as the 'bread and butter' of the radiography profession, but that should not suggest it is simple, unworthy of expertise and excellence, or the starting location of a career. It should represent the public face of radiography and every patient referred for projection radiography should be assured that their examination will be undertaken by a radiographer with expertise in acquiring images of diagnostic quality. By changing how we, as the profession, perceive the role and position of projection radiography, we can start to rebuild its lost prestige and demand a greater, more detailed and clinically relevant educational offering from academic partners. After all, while it is acceptable to be a novice at the start of your career, it is not acceptable to stay a novice several years in and post-qualification education opportunities must be provided, supported and embraced if we are to change perceptions. And the first step towards this? Let us as a professional group change the language and terminology we use to describe ourselves and tasks undertaken. Let us exchange words like 'basic' and 'plain' for words that more accurately reflect the complexity of the professional responsibilities of the radiographer working in the projection radiography environment, or at the very least, use language that does not semantically reduce the perception of the radiographer to that of the 'button-pusher'. By taking this small step in valuing ourselves, then further steps towards changing perceptions and improving the standing of radiographers working across modalities, but in particular specializing in projection radiography, will be easier to take.

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