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Challenges in mammography education and training today: The perspectives of radiography teachers/mentors and students in five European countries

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ABSTRACT

Introduction: This study aims to explore current challenges in mammography education from the perspectives of radiography teachers, mentors and students.
Methods: A qualitative study including two focus groups interviews, with radiography teachers/mentors (n = 5) and student radiographers (n = 5) exploring their perspectives on challenges in mammography education today. The content analysis methodology proposed by Graneheim and Lundman was applied to the interviews.
Results: Three main categories were identified, each with subcategories identified as: (1) Building Bridges; Applying Theoretical knowledge in Practice, Performing Mammograms, Communication and Quality Assessment (2) State of the Art in Mammography; Personal Attitudes and Skills, Quality Awareness and Patient Care (3) Exploring the Curriculum; Time Constraints, Capacity in Clinical Placement, Multidisciplinary Field and Elective Course.
Conclusion: The short study period allocated to this discipline and lack of material resources were considered the main limitations in mammography education, both impacting on the development of students' skills. Breast positioning, patient communication and quality control were considered key factors affecting mammography performance, patient experience and diagnostic outcome and should therefore be the core focus in mammography education.

Introduction

For women, breast cancer is the most common cause of death from cancer worldwide. It is the second leading cause of death from cancer for women in developed countries.[1] In Europe, 5-years survival rate range from 71% to 87% in women diagnosed with breast cancer.[2] Earlier detection and diagnosis of breast cancer are crucial to improve survival rates and reduce the need for aggressive treatment such as mastectomy.[3] There are several methods of detection. Aside from breast self-examination (BSE) and clinical breast examination (CBE), diagnostic (symptomatic patients) and screening (asymptomatic patients) mammography are the imaging procedures, mostly used to diagnose breast pathologies. The aim of screening mammography is to detect any breast pathology earlier than self-palpation or clinical breast examination.

This work is focused upon the degree pathway and therefore, whether in clinical or screening settings, mammography imaging procedures are performed by radiographers. The vast majority of European countries train the radiographers to level 6 in the European Qualifications Framework (EQF), which means the equivalent of a Bachelor of Science (BSc) degree. However, the level of emphasis on the acquisition of mammography knowledge, skills

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and competences in the BSc Radiography curriculum varies from country to country for both the theoretical component and practical training.[4] Moreover, in some countries, radiographers involved in national or local screening programmes are trained on the job, whilst in others, a specific official continuing professional development (CPD) certificate is required in order to work in a mammography screening programme.[5]

This paper aims to identify challenges in mammography education arising from the BSc Radiography degree curricula in Estonia, Finland, Norway, Portugal and Switzerland. In order to elucidate and understand the inherent challenges of the BSc degree curricula as well as the educational and training practices flowing from it in both higher education and clinical institutions, focus group discussions were carried out.

The research question: "What are the challenges of mammography and breast cancer education today within radiography degree programmes?" was followed up with complementary questions in order to capture details on optimised practice and improved diagnostic performance.

Method

Study design

This study aimed to explore challenges in mammography education from the perspectives of radiography teachers/mentors and students. A qualitative approach with focus group interviews was applied and recommended[6,7] given that the study is concerned with identifying common experiences and points of view.

Participants

Two focus group interviews were conducted, one with radiography teachers (n = 2)/mentors (n = 3) and one with radiography students (n = 5). Each focus group included one voluntary participant from each country taking part in the education and training in early detection of breast cancer for health care professionals (EBreast) project: Estonia, Finland, Norway, Portugal and Switzerland. Participating radiography teachers/mentors all had several years of experience as teachers in the field of mammography or as radiography students' mentors supervising the clinical placement in mammography. All the radiography students interviewed had completed the required theoretical and practical education components between their second and fourth years of education. An interest in mammography as a topic was required of all participants, as well as the ability to express themselves in English.

Focus group interviews

The focus group interviews were carried out in April and May 2016, and lasted 160 min for the radiography teachers and mentors, and 120 min for the student radiographers. The final sample size of student radiographers was four, as the student from Norway did not attend. Interviews were performed using web conferencing software and the audio was recorded. In order to minimize any potential language bias, two researchers conducted the interviews together with the support of one IT expert. The interview questions were derived from the results of a survey and an integrative review of this topic.[8] The semi-structured focus group interviews covered theoretical and practical challenges related to key components such as quality assurance, new technologies and patient care. In addition, administrative issues and suggestions for improvement were also topics.

Data analysis

The content analysis was carried out within the framework described by Graneheim and Lundman.[9] The first author transcribed the interviews. Each transcription was read several times to get an overall sense of the text to be analysed,[10] to anonymize and for corrections. During analysis, units of meaning were identified and abstracted, condensed from the contents area and coded using Graneheim and Lundman's[9] suggestions. For example, challenges relating to clinical placements were developed by asking: "What are your experiences with performing mammograms?" (Table 1). All related codes were sorted and categorized as recommended.[11] The final analysis identified eleven sub-categories and three main categories: Building Bridges, State of the Art in Mammography and Exploring the curriculum. The first author and one co-author analysed the material independently and subsequently reached a consensus on the emerging categories in order to ensure the trustworthiness of the results.[12,13]

Ethics

The participants gave their informed consent to take part in the study. Each institution allowed the respective participants time off to take part in the interview during their hours of work/study. No ethics or research committee permissions were required for this study.

Results

This study's main findings are grouped into the following three categories: (1) Building Bridges, (2) State of the Art in Mammography and (3) Exploring the Curriculum. Each category has 4-3-4 sub-categories, respectively, with their specific codes (Table 2).

Building bridges

Applying theoretical knowledge in practice

The students mentioned the challenges of applying all the theoretical knowledge in practice. They cited the need for basic knowledge of physics combined with technical knowledge relating to exposure parameters adapted to each clinical context and patient. Anatomy and pathology knowledge was also reported as necessary to assess the criteria for image quality and exposure

Table 1
Examples of meaning units, condensed meaning units and codes. Interview number, informants, text line (2, 4, 12).

Meaning unit	Condensed meaning unit	Code
For me I think it is the positioning which is the main challenge it is very hard (2,4,12)	Challenging and hard to position	Hard to position
The phantom is not enough to know the real challenges so we practice on our colleagues (2,3,33)	Phantom is not challenging enough therefore colleagues	Practice on colleagues
There is no phantom that are like a proper patient to position a mammogram (1,2,154)	No phantom like a patient	Positioning on the real patient
It takes a lot of time to practice and learn how to position the patient (1,3,73)	Takes time to learn positioning	Time consuming

Table 2
Three categories with 4-3-4 sub-categories, respectively, and 40 codes in total.

Mammography Education				
Category 1	**Building bridges**			
Sub-categories	*Applying theoretical knowledge in practice*	*Performing mammograms*	*Communication*	*Quality assessment*
Codes	Making connections	Time consuming	Challenges with real patients	Case study
	Need for hands-on	Hard to position	Role play	Image analysis
	Patient considerations	Positioning on real patient	Specific communication skills	Quality control courses
	New modalities	Practice on colleagues/students	Help from experts	Guidelines
	Active learning	Practice with experts		
Category 2	**State of the art in mammography**			
Sub-categories	*Personal attitudes and skills*	*Quality awareness*	*Patient care*	
Codes	Confidence	Detail-oriented	Pain	
	Authority	Outcome awareness	Anxieties	
	Empathic interacting skills	Constructive criticism	Intimacy	
	Hands-on skills	Self-correction awareness		
Category 3	**Exploring the curriculum**			
Sub-categories	*Time Constraints*	*Capacity in clinical placement*	*Multidisciplinary field*	*Elective courses*
Codes	Lack of lecture hours	Lack of clinical placement	Context of each profession	Optional specialization
	Limited internship hours	Limited learning period	Team work skills	Motivated students
			Shared knowledge and skills	

parameters. Theoretical explanations of newer technology and modalities used in mammography were presented as part of their education.

> "The theory part is sometimes too exhausting for me, it is better to see and then hear about the things (2,2,215)".

The students did not mention hands-on experience with different modalities such as tomosynthesis, magnetic resonance imaging (MRI) or 3D ultrasound. They were only observers. Contrast enhanced mammography (CEM) was not mentioned. Radiography teachers/mentors all expected students to have acquired theoretical knowledge about digital techniques, all the new equipment, radiation safety, anatomy and pathology, positioning and image criteria, as well as patient care when starting their clinical placement.

Performing mammograms

Positioning was one of the main challenges identified by the radiography students. All had attended lectures on positioning theory. At some educational institutions with mammography equipment, the students were also able to practice on their peers. When asked how they preferred to learn positioning, they all wanted more practical learning, first with a phantom, then with their peers and finally on real patients with an experienced radiographer guiding them.

> "First time in school but not on patient, because in the beginning it is difficult to positioning, but more you can do over and over again it is going to be easier on patient (2,2,120)".

Students had limited possibilities to perform mammograms in clinical placement due to the limited time for each patient. Also, it was experienced as a stressful situation for patients. All informants mentioned positioning as an important, but difficult skill to learn, which ought to be prioritised. Acquiring the technique takes time, both due to body habitus variations, requiring adaptations on positioning, and the different state of mind of each patient.

> "Positioning is creative and takes time to learn, they (students) cannot just learn it in five minutes, they must practice and have time to practice (1,4,86)".

It takes confidence to manage to be close to the patients/women, and performing the best exam of the breast takes effort. Mammography technique requires a different physical contact with patients when compared to other imaging modalities. It is more intimate.

Communication

The radiography students received general information about how to communicate with patients. They practiced using role-plays with actors and other students at the educational institution. Some received no specific instruction on how to communicate with mammography patients before clinical placement. When asked how they communicated with the patients/women at different stages of emotional anxiety, the students answered that experienced radiographers helped when problems arose.

> "There is always experienced radiographer to help if there are any problems (2,4,90)".

During clinical placements, students would like to have the mentor's help in specific situations in order to tackle the challenges of communicating with the patients/women, namely explaining what to say, where and when. Application of communication skills while performing mammograms and taking care of the patients/women at the same time was considered difficult and challenging by the students.

Quality assessment

Quality control and image quality assessment in mammography is critical due to the impact on breast pathology detection, and it was highlighted by both the educational institution and in clinical placement.

> "In mammography we do quality assurance all the time (1,3,341)".

Students receive theoretical lectures about quality control. Educational institutions with mammography equipment complement them with training opportunities, and allow students to practice the main tests. At educational institutions without mammography equipment, radiography students carried out the tests during the clinical placement under radiographers' supervision. Students learn to be aware of the pitfalls in mammography by studying clinical cases and analysing images.

> "We can see the picture and talk about it, what is good or what is wrong and how to fix it (2,1,149)".

When asked if the use of European Guidelines in mammography was a topic, the students said they did not remember. Radiography mentors in clinical placement encouraged student radiographers to read the respective National Recommendations based on the

European Guidelines. Out of those educational institutions that participated in this study, one had an entire module dedicated to quality control.

State of the art in mammography

Personal attitudes and skills

When asking radiography teachers/mentors about the characteristics of a radiographer who works in the field of mammography, they emphasized the need to be calm, confident, communicative and supportive, as well as paying attention to detail. To work well with patients/women means not to force, but guide, to talk, sometimes with authority, but always with empathy and understanding – those were the other characteristics emphasized. Psychological skills are needed to perform this type of hands-on exam.

> "You are the one who produces the images and not like a CT machine where you put the values and get the images you want (1,1,266)".

Quality awareness

All informants mentioned paying specific attention to image quality, when asked about differences between mammography and other modalities/specialities. Positioning is key to ensure that all the breast tissue with details is included in the exam, enabling the detection and diagnosis of breast cancer and other breast pathologies as early as possible. Quality control with high quality images were emphasized for mammography by the participants.

> *"Be aware of that everything you do has an effect on the outcome (1,3,268)".*

> *"The details are very important so we pay specific attentions to our pictures (2,1,286)".*

The participants highlighted that it is important to practice to become a better professional and accomplish self-correction, even to accept constructive criticism from other professions is crucial. How radiographers capture each image has a direct effect on the outcome in terms of patient experience and radiology performance.

Patient care

Students mentioned special patient awareness of intimacy while performing mammograms.

> "Patients feel more exposed and we need to touch and stay close (2,4,299)".

How to touch and to stay close to an anxious patient/woman, while being aware that some will feel pain during the examination was considered demanding and challenging by students. To take care of the patients/women at all stages of their emotional anxiety and perform a high quality image, is psychologically challenging.

Exploring the curriculum

Time constraints

When asked about the challenges in education today, the first answer from radiography teachers/mentors was insufficient time allocated to teach mammography considering all the new modalities and technological developments and updates. Only few hours are scheduled for theoretical lectures, and to practice with a phantom on mammography equipment. This was considered insufficient to prepare students, adequately before clinical placement.

> *"We have that limit of the time in theory so that happens that you mention things but they (students) do not learn it (1,1,63)".*

Capacity in clinical placement

All the students answered that they would like more time in clinical placement.

> "You can learn very well at the clinical placement and that is good even though it is very difficult (2,1,187)".

The capacity of clinical placement in mammography is insufficient, which means that not all the students get the opportunity of a clinical placement in mammography. Some students can only access this opportunity by request. There are also differences in the number of weeks allocated during the three or four years of radiography studies, as well as in the timing of clinical placement. For all these reasons, it is difficult for students to acquire the basic skills in mammography.

> " I think we do not have so much time as needed to teach the student (1,5,58)".

Multidisciplinary field

Breast cancer detection is a multidisciplinary field relying on the specific skills of each profession involved. It is crucial that everyone involved knows how to work together in a team so that all the different practitioners can make their contribution to the early detection of breast cancer. Knowledge about other professions' roles is therefore necessary.

> *"Important that we teach the students that every professional in the department has a specific role (1,2,430)".*

When asking the students about teamwork in mammography, they mentioned only radiologists, radiographers, nurses and doctors in general. They were satisfied with getting help when they asked for it, and they were aware of the specific knowledge that other professions could offer them.

> *"I did not see a lot of other professionals, only doctors and radiologists (2,2,327)".*

Elective courses

According to the participants, students should have the possibility to study a specific topic such as mammography. Such a strategy could help to identify who is really interested and motivated, allowing motivated students and professionals to work in this unique and challenging area.

> *"Have the opportunities to choose their specialties, the direction they want to work in* (1,3,489)".

Discussion

The purpose of this study was to explore current challenges in Mammography Education from the perspectives of radiography teachers/mentors and students from the five educational institutions in different countries involved in the Ebreast project.

Building bridges

The bridge between theory and practice is important[14] to build the necessary skills in several areas of breast imaging and mammography practice. Knowledge about instrumentation, techniques, as well as communication between radiographer and patient, are key areas. The participants in this study highlighted that this bridge was sometimes absent. The students mentioned being taught theoretical knowledge about all the modalities, but only practicing on full field digital mammography (FFDM) in screening

or diagnostics and assisting radiologists at ultrasound. Like many other areas in radiography, breast imaging has expanded as a field and is not just about full field digital mammography and ultrasound.[15,16] Early stage breast pathology detection necessitates a range of imaging modalities to ensure the best prognosis/outcomes. This has an impact on the theoretical and practical education and training of radiography students. The general challenges of narrowing the gap between theoretical and practical knowledge have already been described.[17] Ensuring a transition enabling students to build their necessary bridges in a busy real life setting is difficult – even when drawing on a variety of pedagogical approaches.[18,19] Theoretical knowledge about the new technology used in mammography to understand the optimal use of the equipment is not enough. How breast diagnosis centres are structured varies and this might affect the students' possibilities to learn hands-on with the new modalities in radiography.[20]

In spite of the growing number of breast imaging modalities available, students still find that the greatest challenges are positioning and capturing images using tomosynthesis and contrast enhanced digital mammography (CEDM), in addition to full field digital mammography. Performing mammograms require practice and performing high quality mammograms demand a lot of practice together with an experienced radiographer.[5,21] This is also the requirement in the curriculum for bachelor level student radiographers. Learning mammography imaging necessitates hands-on practice, including integrated use of one's own body in an intimate situation with women who may be at different stages of anxiety and pain. Some educational institutions use peer-to-peer support to prepare students,[22,23] but this might cause challenges in mammography training when there are mixed gender student groups. Nevertheless, mammography observation alone is not the preferred learning method, even for novices such as radiography students.[24,25]

Mentoring is recommended for students.[26,27] This study found that students had particularly high expectations of mentors related to communication while performing mammograms in intimate learning situations. To support the transition from general communication skills to mammography specific skills, pivotal communication mentoring is needed in the learning situations at the clinical placement. In addition, while positioning, mentors ought to emphasize the importance of image quality as crucial for the diagnosis. Performing images where the outcome has a direct impact on early detection of breast cancer is demanding, but is nevertheless the best way to learn and understand the awareness needed to perform mammograms according to the European Guidelines in Mammography.[20]

State of the art in mammography

In order to build the necessary bridges for students, it is critical to identify the distinct requirements of working as a radiographer in mammography. In this study, the specific personal attitudes, competences and skills mentioned by the radiographers are key to fostering quality awareness and psychological skills to take care of women coming for mammography. The hierarchical model by Thornbury and Fryback[28] defines the different levels of efficacy in diagnostic imaging and each profession contributes differently to the diagnostic outcome.[29] Where PGMI scoring is applied, constructive criticism given personally to each radiographer might have an influence on how to achieve high quality images.[30,31] To optimize the technique a combination of technical, psychological and communications skills is required.[32–34] In addition, attendance rates for mammography breast cancer screening programmes may be influenced by the work of the radiographer, who is often the only person who meets and communicates with the women.[35–37] Thus, since these skills have both a direct and indirect impact on the diagnostic outcome, they must clearly be taught and emphasised in order to assist students with learning and improving mammography practice.

Given the constantly evolving technologies and techniques, continuing professional development (CPD) is critical in breast imaging,[21] and it is crucial to highlight this to students during the early stages of their education and training. The European Guidelines recommend a minimum number of hours of mammography CPD to ensure the continuous high quality performance of all health professionals involved in breast cancer detection.[38,39]

Exploring the curriculum

In general, the technological development in the field of radiography will evolve continually. This is also the case in the specialized field of mammography.[16] The European Federation of Radiographer Societies (ERFS) sets out that bachelor level students shall acquire a broad knowledge base.[40] This study found a clear mismatch between the time allotted to teaching and the time actually needed, but students did not mention this as a challenge. Even though there were few informants, the fact is that there are a wide range of modalities in use for early detection of breast cancer and this ought to be reflected in the curriculum. Both students and radiographers mentioned the short period spent in mammography clinical placement. The duration of clinical placements influences whether they are periods of observation or active learning.[41] Observation alone does not suffice as a learning method to acquire basic mammography skills.

The majority of breast diagnostic centres today are structured as multidisciplinary services attending to women in the chain of early breast cancer detection.[20] Students were especially interested in the help they needed as novices in a multi professional team. In general, patients depend on health care professionals' abilities to work together.[42,43] If the best way to contribute to the mammography chain is to be fully aware of one's own and other professions' capacity and limitations, this has to be considered in the curriculum. Having said this, the curriculum should also reflect the fact that in order to provide the best service to women, knowledge about teamwork does not suffice without the relevant skills.

Offering mammography, which is a specialized and relatively narrow field in radiography, as a possible elective course may benefit the student radiographer. This may also have a positive impact on future recruitment into the mammography specialism.[44]

This study is part of a larger research project and presents the qualitative focus group findings.

Owing to the limited number of participants, the results have their limitations, and further research is therefore needed. Nevertheless, this study reveals certain inconsistencies and gaps between the perceptions of students and radiography teachers/mentors of several issues in mammography education.

Conclusion

Mammography education can be a challenge according to the participants. The short period allocated to this discipline and the lack of material resources were mentioned as the main limitations in mammography education impacting on the development of students' skills. Breast positioning, patient communication and quality control were considered the key factors that can affect mammography performance, patient experience and diagnostic outcome, they ought therefore to be emphasized more in mammography education.

Further research is needed to gain a more in-depth understanding of the challenges of workplace learning in breast imaging in order to promote detailed requirements for CPD, where

dedicated mammography screening postgraduate courses would be necessary. It is imperative that radiographers should be qualified to execute every step in performing breast imaging and that they are able to take care of women on the imaging site and in the follow-up process. Therefore, radiographers should be qualified team members reflecting their professionalism. This warrants increased focus on the inter-professional perspective.

Conflict of interest

None.

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