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REVIEW ARTICLE

## **Evidence-based radiography**

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## **Abstract**

Evidence-based practice (EBP) offers the integration of the best research evidence with clinical knowledge and expertise and patient values. EBP is a well known term in health care. This paper discusses the implementation of EBP into radiography and introduces the term evidence-based radiography. Evidence-based radiography is radiography informed and based on the combination of clinical expertise and the best available research-based evidence, patient preferences and resources available.

In Norway, EBP in radiography is being debated and radiographers are discussing the challenges of implementing EBP in both academic and clinical practice. This discussion paper explains why EBP needs to be a basis for a radiography curriculum and a part of radiographers' practice. We argue that Norwegian radiographers must increase participation in research and developing practice within their specific radiographic domain.

### **KEYWORDS**

Evidence-based practice; Radiography; Systematic; Method; Implementing; Research

## **Introduction**

Radiographers are taking on greater responsibilities and today perform work that only a few years ago was exclusively the radiologist's. Radiographers need to be able to deal with advanced technical equipment and be responsive to the continuous technological development within their field.<sup>1</sup> In daily work radiographers in Norway have to care for patients during more and more time consuming and advanced diagnostic examinations, therapeutic interventions or in radiation treatment. Radiography requires practitioners who possess both specialist and generalist knowledge and skills.<sup>1-3</sup> Furthermore, Norwegian society expects health care personnel to meet the challenges they may face at any time in the various aspects of providing health services.<sup>2</sup> To fulfil these demands, in an effective and safe delivery of practice, there is a need for a debate on the implementation of evidence-based practice (EBP) in radiography.

The aim of this paper is to discuss the use of EBP in professional radiography focussing on students' learning and on clinical practice. The paper explores evidence-based radiography in practice, in curriculum framework, and several aspects and challenges linked to its implementation. The paper will also challenge radiographers to become an active research-based profession, to develop the practice of radiography, and discuss how evidence-based radiography can encourage them to engage in research, and support the research of others, to develop "best" practice.

Evidence-based radiography should become a term familiar to the profession and the health care system. In this discussion paper, the argument for evidence-based radiography is based on articles, books and web pages by authors within evidence-based medicine, evidence-based practice, evidence-based nursing, evidence-based physiotherapy, evidence-based radiology, and radiography.

## **Evidence-based radiography**

In health care, decisions rely on the clinical problem at hand, research-based and experience-based knowledge, the clinical context and available resources. The definition of evidence-

based medicine grasps this situation and was first introduced in 1992 by Sackett: “*Evidence-based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual expertise with the best available external evidence from systematic research*”.<sup>4</sup> This definition is becoming established and is quoted by others.<sup>5-6</sup>

Sackett’s definition has also been amended for the health sciences and allied professions. Evidence-based practice is used to describe all aspects of the discipline. The “*Sicily statement on evidence-based practice*”,<sup>7</sup> includes all health care professionals. Allied professions such as nursing and physiotherapy have developed evidence-based nursing and evidence-based physiotherapy and databases exist within their professional fields.<sup>8,9</sup> A web address for evidence-based radiology is also available.<sup>10</sup>

EBP is used in clinical practice in relation to, and together with, the fields of the various professions. A model of EBP described by *the Norwegian Knowledge Centre*,<sup>11</sup> by Ciliska,<sup>12</sup> and by Melnyk<sup>13</sup> is shown in Fig.1. The figure illustrates clinical practice based on evidence from research, but also the knowledge from professional and client sources as described in EBP.

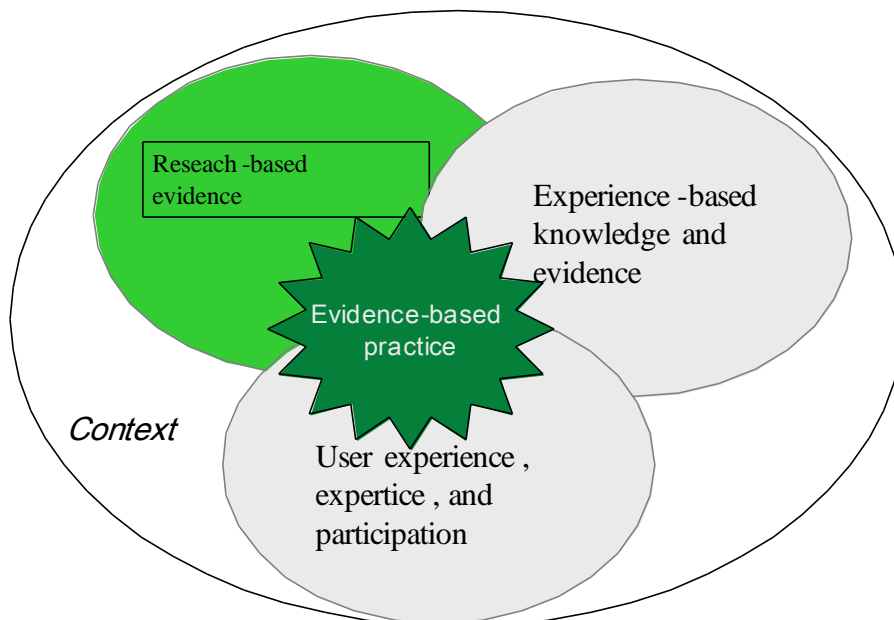


Fig.1 Sources of knowledge in EBP<sup>11-13</sup>

When this knowledge of EBP is translated for radiography, a definition of evidence-based radiography should be: *Evidence-based radiography is radiography informed and based on the combination of clinical expertise and the best available research-based evidence, patient preferences and available resources.* This statement links EBP into the professional domain of radiography.

However, searches in our first-choice databases such as Cinahl and Medline illustrated that evidence-based radiography is not yet a universally established term used as key words and headings in the literature. Searching in Cinahl for ‘radiography’ (profession) and ‘evidence-based practice’ gave few hits<sup>14-20</sup>, but there were no hits in Medline.

## **Evidence-based radiography in practice**

Radiographers most certainly generate and subsequently use evidence in day to day service delivery, but most radiographers are not routinely using EBP. Traditionally, as a discipline, radiography has not been perceived by its practitioners to require investigation. A reliance on tradition and subjective experience has often been the norm for the profession.<sup>21-25</sup> This is also a finding among other health professions.<sup>26,27</sup> Health service research findings document a gap between best practice and actual clinical care.<sup>28-30</sup> The use of research-based evidence and knowledge based on critically assessed evidence is lacking.<sup>31-33</sup>

Today health care professionals, including radiographers in Norway must fulfil requirements related to effectiveness, efficiency, cost-effectiveness and practical skills in assessment, compassion and care. There are increasing demands to document the quality of treatment and to continuously improve accessibility, organization, and the quality of health services as experienced by users.<sup>2</sup> In radiography this means actively seeking new evidence within the fields to remain professionally up to date and to be able to provide high quality services for health care users. On average it takes years to translate research findings into clinical practice.<sup>34</sup> A strategy to reach these requirements in care provision is to increase the use of EBP,<sup>7,35</sup> and this is one of the driving forces behind its development.<sup>7</sup>

Competency in the critical assessment of research articles or other literature such as regulations, use of peer reviewed databases and sources available on the Internet, is required to become a practitioner skilled in evidence-based radiography. It includes competency in implementing research findings into practice and requires both commitment and a sense of the value of evidence-based radiographic practice. This practice shows the way to becoming better prepared for changing procedures and how to prioritise different tasks and choose the best available evidence in decision making.<sup>28,13,36</sup>

## A systematic method of evidence-based radiography

Evidence-based radiography requires a systematic method for practice. For example, Fig. 2 outlines a six-step procedure for EBP:

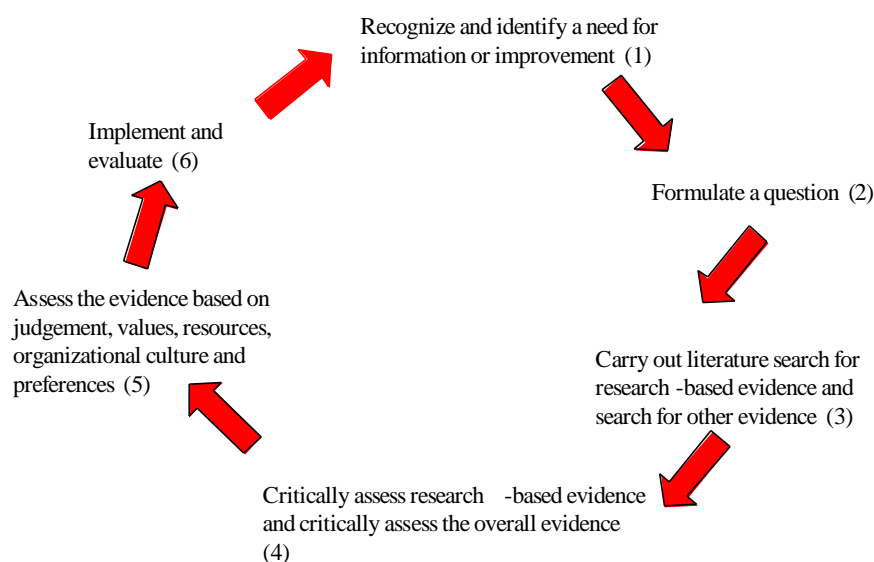


Fig.2A structured method to evidence-based practice<sup>11-13</sup>

Each of the steps requires a balance of skills to take a student, or a practitioner, from accepting a lack of information through to application.<sup>7</sup> The first steps are recognizing a need for information and making a researchable clinical question. To ask a clinical question in the EBP process has been said to be the most important and the most challenging one<sup>4</sup> and this will be further outlined. It might be useful to consider the research questions as being related to “background” or “foreground” knowledge.<sup>4</sup> As Straus<sup>4</sup> explains, background questions ask for general knowledge about a condition or thing and foreground questions ask for specific knowledge to inform clinical decisions or actions. This is well illustrated through the normal development of students. Initially their primary interest is to understand normal human physiology and pathophysiology or the technical factors within imaging techniques and treatment. As they progress in their education, a shift in their focus will occur involving the individual problems of a patient or group of patients, or the examination needed to produce optimum images given the patient’s condition.

A commonly used framework for asking well constructed and clinically relevant questions is “PICO”. PICO is a mnemonic for covering the relevant aspects of such questions, namely Population of interest (P), the Intervention of interest (I), sometimes a Comparison of the intervention (C), and the Outcome relevant to you (O). An example of a PICO question is: “*In women with BRAC1 gene (P) how can we, by mammography (I) or magnetic resonance (C), best determine breast cancer (O)*”? The PICO-question indicates which study design would be most appropriate and what kind of evidence to search for answering the question. Without formulating a searchable and answerable question, the entire EBP process is off to a faulty start.<sup>36</sup> A PICO question that is searchable and answerable requires answers from completed research, clinical judgment, and patient preferences and the focus is on generating knowledge that will guide practice.

Further steps are searching for literature and critically assessing the literature that is essential to maintaining high quality in EBP. The evidence-base should be assessed on scientific and clinical judgement, values, resources, organizational culture and preferences. The last step is implementing the end result in clinical practice. The implementation of new knowledge or new procedures should always be followed by evaluation.<sup>37</sup> When evaluating the outcomes of an evidence implementation it is important to realize that EBP fosters common goals such as improving patient care and best practice through interdisciplinary collaboration.<sup>36</sup>

## Evidence-based radiography integrated in the curriculum

Students, as well as radiographers, have to take into consideration the duty of being lifelong learners.<sup>38,39,3</sup> It is well known that interactive and clinically integrated teaching activities in health care education have produced documentary evidence of better learning outcomes than standalone didactic teaching.<sup>40,41</sup> Teaching methods such as *Problem-Based Learning* and *Evidence-Based Practice* support lifelong learning.<sup>40-42</sup> Specific learning outcomes within knowledge, practical skills, attitudes, and behaviour will increase when using the EBP methodology to classify and solve clinical questions.<sup>40,42,43</sup>

Implementing EBP has changed the way students use information compared to ordinary teaching and learning strategies. The students use information in a more systematic manner. EBP has also been shown to change the way students shift their role from passive acceptance towards active searching and analysis of available information.<sup>7,43</sup> In evidence-based radiography we incorporate evidence with other knowledge into real-time clinical decisions, whether for individual or groups of patients. Students learn specifically how to access research in academic clinical practice and integrate evidence from clinical care research with knowledge from other sources. They come to see the use of evidence as part of good clinical learning.<sup>4</sup> When implementing EBP in an academic environment the librarians, who are expert at literature searches, should be actively involved. Electronic resources should be readily accessible for students, academics and radiographers.<sup>44</sup>

EBP needs to be grounded in best evidence and this requires a synthesis of best evidence. Haynes<sup>45</sup> outlines the hierarchy of the “5S” model which explains five levels of organisation of evidence in health care research; studies, synthesis, synopsis, summaries and systems. The lowest level is studies as for example original journal articles. The next one is synthesis which is a systematic review, and then the level of synopsis. This is a brief description of original articles and then reviews such as those that appear in the evidence-based journals. Next to the top level are summaries which integrate best available evidence from the lower levels. This might be evidence-based textbooks. Finally at the top of this hierarchy are systems such as decision-making support services that match information from individual patients with the best evidence from research and clinical judgement. This hierarchy is for mainly quantitative



research from a medical environment, but qualitative evidence is equally useful particularly when radiographers want evidence of how users are experiencing phenomena. The strongest level of qualitative evidence is that which comes from systematic reviews of descriptive and qualitative studies.<sup>36</sup> When research has not been conducted, guidelines for practice may be drafted from opinion leaders, authorities, or reports from expert committees.<sup>36</sup>

Students familiar with EBP will have the knowledge to ask clinically relevant questions, to know where to search for knowledge, to recognize where and how to search for evidence and to assess critically what is found.<sup>4</sup> They learn the purpose of critical appraisal and use appraisal instruments to determine the value of the research to practice, and they view the research for the contribution it can make to practice.<sup>36</sup> These students will, more than ever before, claim their rightful place in a multidisciplinary team where EBP is the norm.<sup>42,46</sup> In radiography, at least in Norway, these students will become a “new generation” of clinical radiographic practitioners.

## **Barriers and strategies in implementing evidence-based radiography**

Accepting and implementing evidence-based practice in any organization will usually be a challenge. All health care professionals within the organization need to understand the principles of EBP, recognise EBP in action, implement current policies, and have a critical attitude to their own practice and to evidence. Without these skills, professionals will find it difficult to provide “best practice”<sup>7</sup> and to implement evidence-based practice in radiography. There are different strategies available to assist in accepting the implementation of evidence-based practice.

Some researchers have focused on barriers to accepting the implementation of EBP.<sup>37,47</sup> The lack of basic skills in critical appraisal and the time factor involved in such are two of the hindrances identified in the literature. Being unskilled can be hidden behind an outspoken scepticism towards EBP.<sup>37,7,48</sup> Although these findings are from other disciplines, similar barriers might be recognised among radiographers working in similar clinical settings. Radiographers may more easily adopt evidence-based radiography when they are able to link the new knowledge with their own previous knowledge. They then have the ability to identify,

capture, interpret, share, reframe and re-codify new knowledge with their existing knowledge base for appropriate use.<sup>47</sup>

Other barriers for implementing EBP are unwritten rules, assumptions and expectations within the organisation. Where and when decision making is expected to be based on the best available evidence, key players within the organisation, particularly the leaders, must create an evidence-based culture.<sup>47,13</sup> An important strategy is to convince key players of the benefit of skills in EBP.<sup>36</sup>

Radiographers in practice, who are not educated in using evidence-based radiography, need an introduction to and basic knowledge of the systematic methodology and curriculum framework of EBP. Academics should be persuaded and use EBP in their teaching and research.<sup>36</sup> It requires educated and skilled staff as well as continuing education to facilitate the use of EBP when incorporating it into a curriculum.<sup>36,49</sup> In clinical or academic practice advanced EBP users are role models. They are knowledge oriented and use research both as a product and a process for teaching and managing practice.<sup>36</sup>

## **Radiographers and research**

An evidence-based clinical practice does not imply that radiographers need to be able to conduct research, but their key activities will be appraisal of research and the translation of research into practice.<sup>50</sup> EBP focuses on outcomes evaluation either for an application of research to practice or for an ongoing evaluation of practice parameters.<sup>36</sup> EBP principles should be handled as tools with which radiographers might improve practice and determine best practice within a complex health care system. EBP should be most useful within professional practice in the medical radiation sciences as listed in ISRRT.<sup>1</sup>

Advancing best practice in radiography requires accelerating clinical research to generate evidence in practice.<sup>36</sup> Radiographers are responsible for developing practice within their profession and should have an obligation for doing research in their specific radiographic domain. Today more and more radiographers in Norway are joining postgraduate and master studies, with a Master of EBP starting in Norway in 2008. The radiographic domain is wide

open for radiography researchers to explore areas within the different fields and paradigms of sciences. The areas for research are identified in Norway and elsewhere with priority given to aspects of optimization of diagnostic imaging quality and the radiation dose. Other important areas are related to the extended role of radiographer, human resource issues, introduction of new imaging techniques, the aspects of technological innovation, investigations and treatment, and effectiveness of different diagnostic procedures.<sup>51,3,25</sup> Radiographers may also play an active and important role in developing information material relating to radiological procedures.<sup>52</sup>

The radiographic knowledge base has for many years been built on research carried out by radiologists and physicists.<sup>53</sup> Radiography research is growing in Norway and elsewhere,<sup>54,55,24,25</sup> but there is still a need for more specific professional evidence being presented by radiographers.<sup>14</sup> Implementing evidence-based radiography in the curriculum and in clinical practice may advance systematic work (drawing on existing knowledge gained from research and practical experience<sup>56</sup>). It will also increase the research knowledge and expand practice and research activity among radiographers.<sup>57</sup>

All health care professions must join together with the goal of advancing EBP in their practice and science.<sup>36</sup> Joining the research milieu of radiologists, physicists and nurses as part of the multidisciplinary team<sup>8,10,58</sup> will encourage radiographers to initiate research projects. Being a team-worker will give greater insight into the complexity of health care provision and radiographers' place within the system. In certain circumstances, where radiographic knowledge is limited, the radiography professions will need to create new knowledge by conducting their own research.<sup>49</sup> Radiographers have a great deal of expertise to offer.<sup>59</sup> Our challenge is to carry out research relevant to health care needs in the 21st century.

## **Conclusion**

Health care service providers and consumers demand high quality achieved by including evidence-based practice in both the educational curriculum and in practice. Evidence-based radiography may ease the process of justifying clinical issues in a structured manner and sustain practice with research-based evidence. Implementing evidence-based radiography in

the curriculum and in daily professional practice should offer a contribution to the rapid development of radiography as a discipline. Evidence-based radiography will aid the building of radiographers' own research knowledge base, in Norway and in other countries with similar health care systems. To achieve this, practical experience and the radiography research base needs to expand, especially if evaluation of the procedures used is based on best available and research-based knowledge. Academics, who become experts in teaching from an evidence-based radiography approach, and radiographers in clinical practice implementing evidence-based radiography, will surely increase the knowledge of evidence-based radiography. By this means they will be at the critical cutting edge of the discipline and professional development.

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