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Evidence-based radiography: A new methodology or the systematisation of an old practice?☆

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ABSTRACT

Introduction: Evidence based radiography (EBR) is the logical development of evidence based practice applied to radiography. The aim of this study was to investigate the opinion of a cohort of Portuguese radiographers in Southern Portugal working in public hospitals regarding evidence based practice (EBP), namely about the levels of knowledge about EBR, how they access information and how they use it within daily practice.

Methods: A self-administered questionnaire was applied to a sample of 40 radiographers in the Portuguese region of Algarve. This questionnaire was validated for Portuguese speakers using the translation-retranslation method.

Results: The final response rate was 69% (40/58). Results suggest that most radiographers trained EBR during their undergraduate training. Although, no statistically significant correlations were found in the practice of EBR against participant gender, age, training, career level, reading papers and workplace. The most frequent reason to read papers is the "interest" to do so, and national professional journals are read more often. It was found that radiographers that read scientific papers more frequently know more about research ($p = 0.005$), understand the importance of research for the professional activity ($p = 0.023$), and know more on how to conduct research papers ($p = 0.034$).

Conclusion: EBR within radiography is not yet well established, and radiographers' have varying viewpoints. Radiographers that read scientific papers more frequently understand better the philosophy behind this concept but it is very important to deepen the knowledge on this area.

Implications for practice: When practicing radiography based on the best available scientific knowledge, professionals are ensuring the best for patients and for profession. To achieve this, and before taking any action, it is important to evaluate the current situation, and this research presents a way to do so.

Introduction

Evidence-based radiography (EBR) is defined as the decision that results from integrating the clinical history with the most appropriate imaging examination, based on the best available evidence, experience of the professional and to achieve optimal patient management. It is the logical development of evidence based practice applied to medicine and, specifically, to radiography and involves the following steps: formulation of a question; conduction of an efficient search of the literature and then critically evaluating it; applying results based on patient experience and values; and finally, evaluate the results obtained in practice.[1,2]

Over the years, radiographers have taken on more responsibility for their professional practice, making necessary that clinical performance is safe and effective and there is no reason to consider

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that the paradigm based on scientific evidence should not be integrated into the practice of medical image professionals.[3] As a result, there is a growing need for a debate about the implementation of EBR. In order to qualify a professional in EBR, it is necessary to assume skills in the critical evaluation, in literature searching, in identifying appropriate databases and other sources of online information. This practice makes professionals better prepared to select the best possible evidence.[4]

In radiography, the continuous development of technology, advances in diagnostic and therapeutic procedures and increasingly quality-conscious users make demands for effective high-quality radiography, and radiographers are expected to fulfil these challenges in providing healthcare services. In addition to aspects of professional development and service quality, EBR is also connected to legislative, ethical and economic issues concerning radiography[5] and much of the radiological literature mainly addresses technical concepts and technical capabilities for the first two levels of the imaging hierarchy.[6]

In fact, it is intended that principles of EBR help to promote the appropriate use of resources, decreasing the use of examinations that use ionizing radiation, including unjustified or unintended exposures, meeting the increasing demands of radioprotection issues in radiological thinking.[7]

The EFRS Evidence-Based Practice Statement (2015) emphasizes the importance of including research activities in radiography curricula, providing future professionals with tools for continuous professional development (CPD).[8] In accordance, the curriculum of radiography degrees should teach the fundamentals of EBP, in a way that the professional can select, apply and integrate new knowledge throughout their professional life.[8,9]

The EFRS also recommends three models to achieve these goals[10]: research-led teaching, by presenting scientific data directly to students during classes; research-oriented teaching, by guiding students through selection and reading of scientific papers; and finally research-tutored practices, by stimulating students to develop critical analysis of scientific papers. When taught appropriately at degree level, the use of evidence becomes part of professional role and it will surely develop the practice, the organization and the professional knowledge.[11]

This EBR framework was based on the principles of Evidence Based Medicine (EBM) which were originally defined as the integration of the best available evidence, along with clinical experience and patient values to achieve the best patient outcome.[12] The International Nursing Council, in 2012, described EBM as a nursing discipline that minimises the imbalance between nursing theory and practice.[13] It is common to hear references to EBM within clinical practice as a method to endorse the procedures that are used to manage patients.[12]

Thus, EBM typically involves the same five steps mentioned above, first developed at McMaster University, by David Sackette and Paul Glasziou.[14] EBM begins with the formulation of the question, followed by the identification of evidence in the literature to answer that question. In the third phase, the selected literature is evaluated and in the fourth phase there is a synthesis of the identified literature. In the last stage, the application of the evidence occurs, in which a summary of the results from the literature are applied to the initial question. In some occasions, the answer to an EBM question may be just a yes or no, sometimes it can also be expressed through specific measurements. However, it can also provide answer to questions that go beyond precision, and it is necessary to evaluate the answers using a hierarchical approach until the final answer is achieved.[5]

It should be well-known that "EBM is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of EBM means integrating individual clinical expertise with the best external clinical evidence from systematic research".[15,16]

EBR as a daily practice in imaging departments may allow that radiographers can continuously update and deepen their knowledge and how to use research data in clinical settings more effectively.[17] In addition, EBR is regarded as useful for developing evidence-based protocols and guidelines[18] and can easily be used by professionals to evaluate the effectiveness of their departments under normal working conditions.[19] So, by decreasing the variability between radiographers' practice and through the employment of evidence based imaging protocol application the diagnostic and therapeutic treatment, outcomes for patients should improve.

Since there is little information on how EBR is regarded and practiced by radiographers and whether barriers to optimal use may differ, this study aims to evaluate the knowledge of radiographers on EBR, how they search for information on a theme and how they apply this information in their daily practice. This may help to foster appropriate decisions regarding imaging procedures for improved patient outcomes.

The call to evidence-based quality improvement and health care transformation stresses the need to redesign care that is effective, safe and efficient. In line with multiple recommendations from national and international experts, healthcare professionals responded to the launch of initiatives that maximize the valuable contributions they make. Such initiatives include adoption of practices; models of curriculum realignment and education; development of models and theories; scientific involvement in the new fields of research and development of a research network for the study of improvement, incorporating the opportunities and challenges that this methodology poses/offers.[20]

When considering all concepts, the aim of this study was to investigate the opinion of a cohort of Portuguese radiographers in Southern Portugal working in public hospitals about EBP.

Materials and methods

The target population for this survey-based research study was radiographers who work in the two public hospitals in the Algarve, the southernmost region of Portugal. Participants were in permanent positions in their hospital and did not rotate between other institutions. If they accepted the invitation to participate in the study are, we asked to provide their consent. This research study was approved by the ethics committee of the hospitals involved.

The instrument used consisted of a paper-based questionnaire developed from the research by Ahonen and Liikanen which was originally carried out in Finland in 2010.[21] The authors of the instrument gave their permission for its use and it was subsequently translated into Portuguese using the translation-retranslation method and adapted to reflect the context of this study. This questionnaire was distributed directly by researchers in the radiography departments, from June to August 2018. Each questionnaire was coded with a sequential number that identifies it in the database, before delivery. Once completed, the respondent returned it to the researcher, which deposited it in a box, thereby ensuring confidentiality. At the end of data collection, the box was opened.

The questionnaire was formulated in order to obtain information about the sociodemographic characteristics of the respondents, their attitudes towards EBR and research, the resources and factors that promote or hinder participation in research activities, research evidence, the importance of the different sources of evidence and the perception of the respondents regarding their knowledge and self-confidence in this theme.[2] Thus, the questionnaire comprised of sociodemographic questions (n = 8), multiple choice questions (n = 11), filter questions (n = 1), closed

questions (n = 3), open questions (n = 2) on a Likert scale of five points (n = 46). For some of the multiple-choice questions, respondents were allowed to choose more than one option.

The questions presented to participants in the survey are summarized in Table 1.

The internal consistency of the questionnaire was evaluated using the Cronbach's alpha coefficient. The values obtained ranged from a maximum of 0.981 (excellent) in the orientation scale to a minimum of 0.730 (reasonable) in the support scale.

Participants were asked about their views on a number of statements. The possible responses included totally agree, partially agree, neither agree nor disagree, partially disagree and totally disagree. Responses were uploaded to IBM SPSS (IBM Inc, Armonk, NY) software platform Version 23 for analysis. Regarding the statistical treatment, descriptive statistics, based on frequencies and percentages, were used to characterize the study population. Regarding the items related to the conditions of the EBR for participants, descriptive statistics (means and standard deviation) were used, and the Student T-Test for comparing two groups. To test the formulated hypotheses, we used as a reference to accept or reject the null hypothesis a significance level (α) $\leq$ 0.05.

Results

The sample was composed of 40 participants that only work in the clinical field, from a population of 58 (69% of response rate).

Of the 40 participants, 25 (62.5%) were male and 15 (37.5%) female. Of these, 32 (80%) were aged 41 years or less and the remaining eight (20%) were over 41. Regarding the workplace, 28 (70%) participants worked in the Eastern Hospital and the remaining work in the Western Hospital. Regarding the level of training and according to the Portuguese framework, four (10%) of the participants had a Bachelor's degree, 21 (52.5%) had a Bachelor's with major in Radiography, nine (22.5%) had a specialized qualification and the remaining six (15%) had a Master's degree. The roles of the participants ranged from entry level to the most senior, 24 (60%) were at the entry level.

Of the 40 participants in this study, 33 (82.5%) had received training in EBP at the University/Polytechnic School, these being the majority, one (2.5%) reported receiving this training as part of post-graduate studies. Of the respondents, 29 (72.5%) participated in a research project only as students, although 24 (60.0%) fully agree that EBP is relevant to their work. A full description of the main results from this research study can be found in Table 2.

Only two participants did not agree with the statement: "If you consider that participation in research activities are not part of the work of the radiographer, please briefly explain why you think so". Most participants state that research activities were part of their role.

This research found that 37.5% of participants consider that scientific research projects should be carried out with other professionals in the clinical and/or medical area and only 2.5% claim that these should be performed by radiographers in individual participation. As for the factors that encourage participation in research activities, the question allowed for more than one answer. Interest in research activities was the area most emphasised by participants (9; 22.5%), followed by support from the unit/service director (3; 7.5%), as unique factors. The main factors that block participation in research activities are lack of time (6; 15.0%) and motivation (6; 15.0%).

With respect to the advantages obtained from participation in research activities across postgraduate courses, the most frequent answers focused mainly on the increase in knowledge, improvements in clinical practice for the benefit of the user, for improvements at the curricular level and continuous professional development.

Some of the respondents through the participation of the research activities expect to obtain recognition of their scientific capacities, to achieve career progression, to give more recognition to the profession and to identify areas of possible development.

The reasons for reading scientific publications were mainly "interest" (11; 27.5%) and "easy access to publications" (4; 10%). Regarding the factors blocking the reading of scientific publications, they can be consulted in Table 3.

Analysing the participation of the respondents in a scientific research project and referring to the tasks performed by them, it was verified that not all participants had experience as lead researchers. Ten (25%) respondents stated that they performed all of the tasks that make up a research project, two (5.0%) did not answer the question, two (5.0%) said they have not participated in a scientific research project, and 26 (65.0%) developed only some of the tasks.

When asked about the reading habits of professional/scientific journals, data shows that international professional journals are more appealing to respondents (Table 4). Reasons given for the reading of professional and scientific journals is mainly for personal development (n = 17; 42.5% vs n = 16; 40.0%), followed by the reason "to keep up to date on new practices" (n = 15; 37.5% vs. n = 14; 35.0%).

The age and academic grade of participants were not statistically significant factors in relation to EBR practice, however, slightly higher response values were found when the academic degree was higher in reference to accessing research work. Gender did not present any statistically significant differences (P > 0.05). As example, "knowledge about research", p = 0.505; "importance of research on professional activity", p = 0.290; "way to guide research", p = 0.279.

There were no statistically significant differences from those who frequently read scientific journals and the practice of EBR. Using *t-student* test, with regard to "Knowledge of research" there were statistically significant differences (T-student = 3.586; p = 0.005), and participants who read scientific journals more frequently obtain significantly higher values in this dimension (3.71 vs. 2.35). About the "importance of research on professional activity" there were statistically significant differences (T-student = 1.072; p = 0.023), and participants who perform research on professional activity obtain significantly higher values in this dimension (4.03 vs. 3.55). At last, for the variable "How research projects are conducted" there were statistically significant differences (T-student = 1.099; p = 0.034) and it is also shown that participants who read more scientific journals obtain significantly higher values in this dimension (4.15 vs 3.69) (Table 5).

Table 1
Summary of questions in the survey.

A number of statements were presented and the level of concordance with which one of them was asked, from the relevance of EBP to time available scientific research
Open comments from participants were registered and then grouped by theme, allowing a frequency analyses of factors that contribute to scientific paper reading
Frequency of reading and the origin (National and international professional journals and general scientific journals) of scientific papers selected to read
Influence of frequency reading of scientific papers on EBP, namely research knowledge, how to conduct a research and the importance to professional activity

Table 2
Level of concordance with statements regarding evidence-based practice (EBP).

	Totally Agree		Partially Agree		Do not agree or disagree		Partially Disagree		Totally Disagree	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Evidence-based practice is relevant for radiographers	24	60	14	35	1	2.5	1	2.5	–	–
Evidence based practice is part of my job	15	37.5	16	40	6	15	3	7.5	–	–
In my job, it is useful to use data based on evidence to support my practice	14	35	20	50	5	12.5	1	2.5	–	–
Evidence-based actions are useful to develop/improve my skills	13	32.5	19	47.5	7	17.5	1	2.5	–	–
Scientific research provides information about radiographer's practice	16	40	19	47,5	4	10	1	2,5	–	–
Participation in research activities are part of my professional activities	13	32,5	13	32.5	13	32.5	1	2.5	–	–
Participation in research activities increase my chances of promotion/career progress	6	15	9	22,5	10	25	9	22,5	6	15
Participation in research activities are part of my responsibilities as a teacher/student tutor	20	50	13	32.5	6	15	–	–	1	2.5
Participation in research activities helps my professional and personal development in my workplace	14	35	19	47.5	6	15	1	2.5	–	–
I am available to participate in scientific activities	13	32.5	15	37.5	8	20	4	10	–	–
I should develop research projects in my radiography department	13	32.5	17	42.5	9	22.5	1	2.5	–	–
My core knowledge provides enough knowledge to work as a radiographer	1	2.5	12	30	10	25	11	27.5	6	15
The radiographer's job is based on practical/technical skill, therefore there's no need of research inputs/contribution	–	–	2	5	–	–	19	47.5	–	47.5
Scientific data research takes too much time from the radiographer's major responsibilities	3	7.5	8	20	7	17.5	13	32.5	–	22.5

Table 3
A summary of open comments regarding the factors contributing to reading a research paper.

	n	%
Interest in reading research papers	11	27.5
Sufficient knowledge and interest in reading research papers and easy access to research papers	5	12.5
Easy access to research papers	4	10.0
Sufficient knowledge and interest in reading research papers	3	7.5
Interest in reading research papers and I talk to colleagues at work about research	3	7.5
Easy access to research papers and talking to colleagues about them	2	5.0
The fact that I talk to colleagues at work about research papers, easy access and interest	2	5.0
The fact that I talk with colleagues at work about research papers	1	2.5
Interest in reading research papers and sufficient linguistic knowledge	1	2.5
Easy access to research papers and sufficient linguistic knowledge	1	2.5
The fact that I talk to colleagues at work about research papers and other factors	1	2.5
Interest in reading research papers, easy access and free time	1	2.5
Reserved time for reading research papers, sufficient linguistic knowledge and talking to colleagues about them	1	2.5
Sufficient knowledge, interest in reading research papers and sufficient linguistic knowledge	1	2.5
Easy access to research papers, sufficient linguistic knowledge and talking to colleagues about them	1	2.5
Linguistic knowledge, talking to colleagues about research papers and free time to read them	1	2.5
Interest in reading research papers, sufficient knowledge to read them, easy access to publications and talking to my colleagues about them	1	2.5
Total	40	100

Table 4
A summary of participant responses' regarding scientific publication preferences.

	Every Week		Once a month		A few times per year		Once a year		Do not read	
	n	%	*n*	%	*N*	%	*n*	%	*n*	%
National Professional Journals	–	–	20	50.0	4	10.0	11	27.5	5	12.5
International Professional Journals	1	2.5	4	10.0	20	50.0	6	15.0	9	22.5
Scientific Journals	–	–	8	20.0	20	50.0	6	15.0	6	15.0

Table 5
Frequency of reading research papers significantly influences EBP in radiography.

	Knowledge of research	Importance of research on professional activity	How research projects are conducted
Reading of scientific papers			
p value	0.005	0.023	0.034
Most frequent			
Average	3.71	4.03	4.15
Standard deviation	0.58	0.58	0.42
Less frequent			
Average	2.35	3.55	3.69
Standard deviation	0.73	0.59	0.62

Discussion

Study data indicates that the majority of respondents participated in research activities during their studies (29, 72.5%). Research activities were considered beneficial, since they increase the knowledge in the area, value the curriculum, increase the critical capacity of the professional and improve the quality of the services to benefit the patient.

According to some respondents, research activities should be performed by radiographers in conjunction with clinical and/or medical professionals (15, 37.5%) or in collaboration with external organizations (14, 35.0%) and only a small percentage (1, 2.5%) believe that research activities should be conducted individually by radiographers. Regarding this type of activity, participants state that the factors that may encourage their participation are their "interest in the research activity" and the "support of the management/service unit". Opposing factors were cited as a lack of time and motivation and were similar to those stated in the report by Ahonen and Liikanen.[21]

Data revealed that participants considered that participation in research activities were part of their professional activities, which helps in professional and personal development and the development of research projects, at postgraduate level. Scientific research was also considered a form of self-development and promotion of teamwork within the radiology departments.

However, some participants pointed out that participation in research activities should be optional for stakeholders rather than a common duty for all. Such tasks should be carried out by external professional researchers. EBR is when health professionals who perform functions in a given area of care are able to formulate a research question, evaluate the literature and then apply the best current evidence in a specific clinical case. There is great interest in the field of evidence-based radiography.[1,22] EBR can be an important tool in the determination of patients who should be referred for examinations that use medical imaging techniques and which type of imaging technique should be applied. Thus, EBR includes the formulation of clinically relevant issues, using the medical literature, analysing data accurately, summarizing the evidence and applying it in clinical practice.[22]

In this research study, it was verified that most professionals do not allocate much importance to the literature due to lack of time, motivation and difficulties in obtaining publications. Many stated that they only read professional and scientific journals a few times per year. This research concludes that the frequency of reading influences the preconditions for the EBR, meaning that respondents do not regularly read scientific articles or journals, which negatively influences research and EBP culture.[4]

The research identified males at the entry level of their career to have a better knowledge of how to research than females of similar experience and high also for radiographers aged over 41 years and with a higher academic level (Master's degree).

As for the place where they perform their functions, there were no differences between hospitals. Regarding the support, the highest values were found in female participants older than 41 years, who have a higher academic level, who are based in superior positions. Considering the previous condition "importance of research in the professional activity" and "the form of orientation of research in the work" it was observed that the scores were higher for males, professionals with older age (>41 years) with the Bachelors and perform their duties in primary care centres. In contrast, young participants, at a higher career level and with a higher academic degree, obtain higher scores and could be the promoters of EBR and change the attitude within the profession.[21]

The results of the present research show that EBR is not widely implemented in the institutions where the study was performed, although some play a more active role in this area than others. The results from this small cohort of participants indicate further efforts are required to increase EBR activity. As Medina (2011) also mentions when discussing evidence-based nursing, it has a complex structure that requires training to be adequately implemented.[23]

Some indicators of EBP existed, as an old practice, even before the EBP concept appearance, but as stated in 1999, that was not part of the normal functioning of institutions and the understanding of the concept itself is still limited[22] and we can see that this persisted until today. The philosophy underlying this concept is favourable and the introduction of this practice does not seem to be problematic, as in the present research, since most respondents said they are available to participate in research activities.[21] Reporting to Schafranski's view (2012) EBM as it is practiced today needs to radically rearrange to at least postulate a place within the confines of science.[19]

The need to use good evidence in clinical practice is dominant for the continuity of scientific development and, especially, to increase the quality of patient care, considering their circumstances and desires, professional experience of the clinician and the best evidence available at the time.[8,9,12]

The main limitation of this research was the number of participants. This happened because in the Algarve region, there are few radiographers (target population of 58 working in the public hospitals with a response rate of 69%). Despite the findings were reasonably positive, from this small cohort and within the cohort several early stage radiographers are involved in research, the outcomes cannot be applied across a population of all Portuguese radiographers or further afield

Conclusion

With the completion of this research it was concluded that the majority of the radiographers only participated in research activities during their academic studies and according to their opinion, further research is warranted by the radiographers together with other professionals in the clinical area and in collaboration with external organisations. Participants considered that the factors that can foment their participation in these type of activities are the interest for the investigation activity and the support of the

direction/unit of service, the impeding factors are the lack of time and motivation.

Respondents do not devote much time to scientific reading due to lack of time, motivation and difficulties in obtaining publications, in which the majority only read this type of literature (professional and scientific journals) a few times a year, thus influencing the utilisation of EBR.

It has been found that the philosophy underlying the implementation of the EBR concept is favourable and the introduction of this practice does not seem to be problematic, since most participants would like to have more time available for research activities.

However, we conclude that this concept is not altogether used in the places where this research was carried out. Some participants assume a more active role in this area, others demonstrate that they need to deepen their knowledge about this subject, concluding that radiography need to embrace the concepts of evidence based practice. The scientific area will greatly benefit from visible results in improving clinical practice, which will result in a more rigorous approach in all aspects of the work. Thus, EBR is the use of the best evidence available, in the pursuit of the best radiological-based health care appropriate to each patient.

Conflict of interest statement

None.

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References

1. Abrantes A. *Determinantes Organizacionais na Qualidade em Tecnologias da Saúde. O caso particular dos Serviços de Radiologia do Sector Público da Região de Saúde do Algarve*. Universidade de Évora; 2012.
2. Villar C. Radiología basada en la evidencia en el diagnóstico por imagen: ¿qué es y cómo se practica? *J Invertebr Pathol* 2011:326–34.
3. Smith T. Evidence based medical imaging (EBMI). *Radiol Technol* 2009;**3**(80):270–5.
4. Ugwu AC, Benjamin EU, Jennifer MI, Felix EO. Evidence based medical imaging practice in Nigeria: A paradigm or a placebo? *Eur J Radiogr* 2010;**1**(4):169–72.
5. Hafslund B, Clare J, Graverholt B, Wammen Nortvedt M. Evidence-based radiography. *Radiography Elsevier* 2008 Nov 1;**14**(4):343–8.
6. Sardanelli F, Bashir H, Berzaczy D, Cannella G, Espeland A, Flor N, et al. The role of imaging specialists as authors of systematic reviews on diagnostic and interventional imaging and its impact on scientific quality: report from the EuroAIM evidence-based radiology working group. *Radiology* 2014 Apr 14;**272**(2):533–40. Radiological Society of North America.
7. García Villar C. Evidence-based radiology for diagnostic imaging: what it is and how to practice it. *Radiol (English Ed)* 2011;**53**(4):326–34.
8. European Federation of Radiographer Societies. The implementation of evidence based practice in undergraduate radiography curricula. *EFRS* 2015:6–9.
9. European Federation of Radiographer Societies. EFRS Statement on Radiography Research In Europe Strengthening evidence-based practice within the profession. *EFRS* 2016:1–5.
10. European Federation, of Radiographer Societies. EFRS statement on radiography education. *EFRS* 2019;(January):1–9.
11. Metsälä E, Strøm B, Juha K, Line W, Marjukka P, Hafslund B. Evidence-based radiography in education. *J Clin Radiogr Radiother* 2012;**6**(1):4–11.
12. El Dib R. Como praticar a medicina baseada em evidências. *J Vasc Bras* 2007 Mar 1;**6**(1):1–4.
13. The Evidence-Based Radiology Working Group T. Evidence-based radiology: a new approach to the practice of radiology. *Radiology* 2001 Sep 1;**220**(3):566–75. Radiological Society of North America.
14. Sheehan JJ, Ridge CA, Ward EVM, Duffy GJ, Collins CD, Skehan SJ, et al. The process of evidence-based practice in radiology: an introduction. *Acad Radiol* 2007;**14**(4):385–8.
15. Sackett DL, Rosenberg WMC, Gray JAM, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ* 1996 Jan 13;**312**(7023):71–2.
16. Evidence-based imaging: optimizing imaging in patient careColey BD, Medina LS, Blackmore CC, editors. *Pediatr Radiol* 2007;**37**(5):507–8.
17. Erturk SM, Ondategui-Parra S, Otero H, Ros PR. Evidence-based radiology. *J Am Coll Radiol* 2006;**3**(7):513–9.
18. Tong A, Mahady SE, Craig JC, Lau G, Peduto AJ, Loy C. Radiologists' perspectives about evidence-based medicine and their clinical practice: a semistructured interview study. *BMJ Open* 2014 Dec 1;**4**(12):e006199.
19. Schafranski MD. Medicina baseada em evidências – novo paradigma ou pseudociência? *Rev Bras Cir Cardiovasc* 2012;**27**(2):334–7.
20. Stevens K. The impact of evidence-based practice in nursing and the next big ideas. *Online J Issues Nurs* 2013;**18**(2):4.
21. Ahonen S-M, Liikanen E. Radiographers' preconditions for evidence-based radiography. *Radiogr (London 1995)* 2010;**16**(3):217–22. United Kingdom.
22. Upton D. Clinical effectiveness: how much do radiographers know about it and what do they think of the concept? *Radiography* 1999;**5**(2):79–87.
23. Medina EU, Riveros ER, Pailaquilén RMB. Ensayo clinico para la enfermeria basada en evidencia: un desafio alcanzable. *Acta Paul Enferm* 2011 Jan 1;**24**(3):419–25.