Radiography 30 (2024) 193–201

Contents lists available at ScienceDirect

Radiography

journal homepage: www.elsevier.com/locate/radi

Alumni, radiographers, clinical placement tutors and industry insights about current radiographers practice, competences and autonomy in western Switzerland

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ARTICLE INFO

Article history:
Received 11 August 2023
Received in revised form
2 October 2023
Accepted 8 November 2023

Keywords:
Radiologic technologist
Medical radiation sciences
Medical imaging
Diagnostic radiographer
Therapeutic radiographer
Nuclear medicine technologist

ABSTRACT

Introduction: Radiographers' profession is constantly evolving, which demands adaptation of education and training programs to build up medical imaging and radiation therapy professionals (MIRTPs) that provide healthcare to improve patient experience and outcomes. This study aimed to map radiographers' practices, competences, and autonomy level in Western Switzerland.
Methods: Data was collected by 2 cross-sectional online surveys targeting Alumni, radiographers, clinical placement tutors and medical imaging equipment specialists from industry, with opened and closed-end questions. Descriptive statistics and thematic analysis were used to analyse the data.
Results: 81 Alumni and 93 Chief-Radiographers, clinical tutors, practitioner-radiographers and industry answered the questionnaires. The competences considered as the most "acquired or completely acquired" by the Alumni were: adopt a reflective posture on practice (90.1 %; 73/81), adopt ethical behaviour (90.1 %; 73/81), carrying out and providing radiological services for diagnostic, therapeutic and preventive purposes (81.5 %; 68/81), adapting communication to the other surrounding persons (81.5 %; 66/81), and check compliance of procedures with standards (69.1 %; 56/81). Similar results were referred by Employers. The autonomy of the participant radiographers was considered as average, and it focuses only the preparation of the patient and the protocol optimisation. The development and integration of research is weak as well as the application of competences regarding professionalism.
Conclusions: A better link between educational institutions and clinical practice can help on the integration of research and evidence-based on practice, necessary to progress the radiographers' profession in Western Switzerland. The autonomy needs to be further developed and leadership courses must be integrated in the curricula to facilitate the implementation of new approaches to reinforce radiographer's profession.
Implications for practice: Practice must be revised to integrate evidence-based; to facilitate research development, the managers need to increase support.

Introduction

The role of medical imaging and radiation therapy professionals (MIRTPs) is expanding in a healthcare system that is constantly evolving and facing new challenges. New technology such as Artificial Intelligence (AI), new techniques, new requirements and guidelines, evidence-based practice implementation, responding to patients' demands/needs, and to an increasing workload are an

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https://doi.org/10.1016/j.radi.2023.11.007
1078-8174/

important part of MIRT professionals' challenges.[1–7] MIRTPs roles are constantly evolving and are not only focused on image production or treatment delivery, but are also englobing patient management, education, patient safety assurance, follow-up care, as well as advanced practices.[8–14] Advanced practice is considered a practice that involves an expert that is autonomous (authority to make decisions and the freedom to act in accordance with professional knowledge and competences),[15,16] while doing the work in their own field of expertise, to improve healthcare services. For MIRTP, this concerns mainly diverse roles within all imaging modalities, including clinical reporting and procedure-based practice.[8,17] At the same time, advanced practice helps to keep professionals motivated and engaged with lifelong learning, encouraging career progression.[8,17] The UK and USA are countries where advanced practice is well established. In the UK this evolution was promoted by the Radiography Skills Mix Project which aimed to improve healthcare services and patient-cantered care through a multiskilled healthcare team that is more motivated on patient needs instead of being oriented by professional restrictions.[17] However, advanced practice is not just about higher clinical expertise, skills, and competences, it requires research and innovation to make possible the implementation of improvements that are evidence/research-based for adequate patient care and better health outcomes.[17–19] The healthcare decisions must be supported by the most reliable, up-to-date, valid, and pertinent research evidence with the invaluable input of clinical expertise and patient values.[20,21] For these reasons, the link between clinical practice, research and academia must remain strong to ensure research addresses real clinical challenges and current clinical priorities. Education programmes need to be frequently adapted to respond to clinical practice needs and integrate new evidence-based, new pedagogical methods, new practice developments, and respond to students' requirements.[22–25] In Switzerland, Bachelor of Science (BSc) programmes in healthcare must follow the CanMEDS framework combined with a competence-based approach. CanMEDS framework presents the competences that healthcare professionals need to meet and provide healthcare services that answer to the people they serve.[26] A competence-based approach mobilises a combination of a variety of internal and external resources within a family of situations,[27] to transform the student into a reflective practitioner competent in concrete novel professional situations.[28–31] It encompasses three main principles: situation-based teaching, meaningful learning situations and teaching centred on the learner's areas of interest to transform the student into a reflective practitioner competent in concrete novel professional situations.[29,31]

For these reasons, understanding and mapping the healthcare system evolution requirements through surveys and inquiries of the main stakeholders is fundamental. This will allow undergraduate education programme trainings and continuous professional development (CPD) programmes to be updated, and for future competences development to close the gap between theory and practice.[32]

This study aimed to map radiographers' practices, competences and autonomy level in Western Switzerland to adapt and create opportunities for the future evolution of a new educational programme. The survey destinated to Alumni aimed to assess whether the programme's approaches adequately prepared graduates for clinical practice, by identifying the most developed competences and autonomy level. While the survey destinated to the group called “Employers” had the purpose of determine if newly qualified radiographers were sufficiently prepared for their work and ongoing development in clinical settings.

Methodology

Two cross-sectional online surveys were designed; one survey aimed to explore the insights from Alumni of classes from 2015 to 2021 in a Western Switzerland MIRT programme and the other was destinated to the non-Alumni designated as “Employers” from now on. The group called “Employers” included head radiographers, practitioner-radiographers, clinical placement tutors, and industry/medical imaging equipment specialists that have potential to hire/employ the newly graduated radiographers or to work with them closely and, at the same time, that are engaged with the University of Applied Sciences (UAS) where the MIRT Bachelor (BSc) programme takes place.

Ethics

The surveys were constructed using Microsoft Forms and were subjected to ethical considerations in line with Swiss Law. As the research involved non-health related data, personal or anonymous data, it did not require approval from federal or cantonal ethics committees. Nevertheless, the research adhered to data protection principles, and all information collected was securely stored on the institution's servers. Participants had the option to reach out via email to the main author for any queries.

Surveys design

The surveys were designed, tested and modified before dissemination. Four academics with backgrounds in medical radiation sciences and two practising radiographers reviewed the surveys to ensure content validity and clarity. Feedback from the piloting phase was incorporated to enhance the survey tools when appropriate. Both questionnaires primarily comprised closed-ended questions, while two open-ended questions allowed respondents to provide additional insights about clinical practice.

The Alumni survey aimed to collect perspectives on the MIRT programme in place in Western Switzerland between 2012 and 2021. Its purpose was to assess whether the programme's approaches adequately prepared graduates for clinical practice. On the other hand, the survey for Employers sought to obtain perspectives from the employers' standpoint. This survey aimed to determine if newly qualified radiographers were sufficiently prepared for their work and ongoing development in clinical settings.

The Alumni's survey consisted of eight sections. The initial part collected demographic data and hospital characteristics, including hospital type, participant roles, modalities of expertise, years of experience, and gender. Subsequent sections covered topics such as competencies acquired during education and training, autonomy levels in clinical and research practice, CPD opportunities and needs, application of CanMED Roles in clinical practice, and assessment of the MIRT programme's content, duration, clinical placements, strengths, and areas for improvement. The survey also explored the transition from school to practice and participants' observations during that period. Similarly, the survey aimed at “Employers” addressed the same domains but with different possibilities for the answers to have their perspectives on how newly graduated radiographers were prepared to enter in the profession.

Data collection and analysis

Data collection was facilitated through snowball sampling and distribution of surveys via the researchers' networks and the Swiss Association of Radiographers (ASTRM Romande).

For data analysis, both descriptive and inferential statistics were employed, utilizing Excel and using Stata 16.1 software (Stats Corp., Texas, USA, 2017). Additionally, the non-parametric Wilcoxon rank-sum test was conducted to extract meaningful insights between both groups (Alumni and Employers). For multivariable data, since stratified variables did not follow normal distribution, the non-parametric Kruskal–Wallis test was established, followed by a Wilcoxon rank-sum test between each group to determine which group showed statistical differences ($p < 0.05$).

Results

The questionnaires were answered by 81 (out of 261) Alumni and by 93 (out of an estimated population of 1000) "Employers".

Demographics and professional experience, major roles and domains of activity

Most of the Alumni participants were women (56.8 %; 46/81) with an age ranging between 20 and 29 years-old (75.3 %), while the "Employers" were mainly males (53.8 %) within the age range of 30–39 (46.2 %; 43/93).

Most Alumni (19.8 %) participating in the study had 3 years of professional experience, 18.5 % had 5 years, and 14.8 % had 4. The professional experience of "employers varied (Fig. 1).

The main responsibilities/roles of Alumni were practitioner radiographer (87.7 %) at university hospitals (25.9 %) and private clinics (18.5 %) (Fig. 2). The "Employers" had as main responsibility and functions: practitioner radiographer (50.5 %; 47/93), sometimes combining the role of clinical placement tutor (36/93), or head radiographer (27/93). This group worked mainly in state (25/93) or regional hospitals (20.4 %; 19/93) (Figs. 2 & 3b).

Most of Alumni (75 %) were diagnostic radiographers (RD), followed by nuclear medicine (NM) radiographers (12 %) and therapeutic radiographers (RT). Similar tendency was observed for the group designated as "Employers" with diagnostic radiography as the main domain of activity (67 %; 62/93). The diagnostic radiographers in both groups worked with several imaging modalities (Fig. 3). Those working in Nuclear Medicine (NM) ran radiopharmaceuticals preparation, positron-emission tomography (PET), PET/CT or single photon emission computed tomography (SPECT), and therapy. In Radiation Therapy (RT), the planning, preparation, and treatment application were the main areas of activity. The participants referred management, studies, research, and academic as other (O) activities performed in their work.

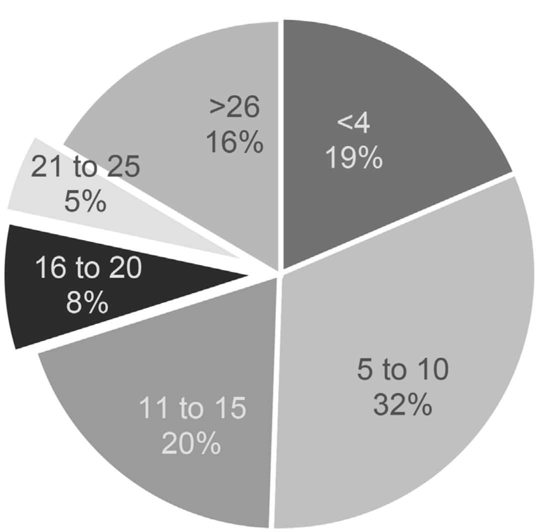

Figure 1. Professional experience of Employers (head-radiographers, radiographers-practitioners, clinical placement tutors, application specialists from the industry).

Development and application of competences in clinical practice

The perceived level of development of competences during the education and training programme by Alumni, ranging from "not acquired" to "completely acquired", was asked to both groups of participants.

Regarding the Alumni, the competences considered as the most "acquired or completely acquired" were: adopt a reflective posture on practice (90.1 %; 73/81) and adopt ethical behaviour (90.1 %; 73/81) (Fig. 4). While the less developed competences were working in partnership to drive technological innovation (91.4 %; 74/81), engaging in personal and professional development programmes to CPD, advising patients, their families, other healthcare professionals, and industry on MIRT issues (80.2 %; 65/81 for both), develop and produce applied research (61.7 %; 50/81).

The Employers perceptions about the acquisition of competences by the newly graduated radiographers arriving in their departments were similar to those of the Alumni but they also perceived as acquired the adaption of communication to the other surrounding persons (78.5 %; 73/93), manage and develop systems for data management (54.8 %; 51/93) (Fig. 5). Employers considered advising about radiation protection (54.8 %; 51/93), produce (83.9 %; 78/93) and integrate applied research in clinical practice (69.9 %; 65/93) as non-acquired, or at least, not completely acquired (Fig. 5).

According to the Alumni, the most solicited competence in clinical practice was the one related to the relationship with the patient and patient management throughout the examination (92.6 %; 75/81), followed by technical competences (75.3 %; 61/81), risk management (67.9 %; 55/81), and patient-centred care (59.3 %; 48/81 (Fig. 6). The less performed in their clinical practice was research, with 59.3 % (48/81) of responses corresponding to "never" or "rare". The set of competences labelled as professional competences (evidence-based practice (EBP), ethics, ergonomics, public health, Lifelong Learning, etc.) were identified by 23 out of 81 (28.4 %) of the participants as never or rarely applied in clinical practice (37 %; 30/81).

For the group of "Employers", research was highlighted as never carried out by 56.9 % of the participants and professional competences were never or rarely performed by 43 % (Fig. 7). Education and training competences such as supervision of trainees and new employees, ongoing personal training, etc. were highlighted as rarely developed by 47.3 % of the participants, as well as quality manager competences (checking and monitoring the quality of equipment and images, drawing up/updating procedures and protocols, proposing measures for improvement) (43 %). The most performed was the competence related to the relationship, with the relationship with the patient and patient management throughout the examination (84.9 %; 79/93), meaning welcoming, informing and ensuring patient comfort, providing high-quality care, etc. , and the group of competences related to technology (83.9 %; 78/93) (carrying out diagnostic or therapeutic procedures - acquiring the examination, manipulating parameters, administering treatment).

The results showed that according to Alumni, radiographers tend to use certain competences more often than according to Employers. Indeed, statistically significant differences were found

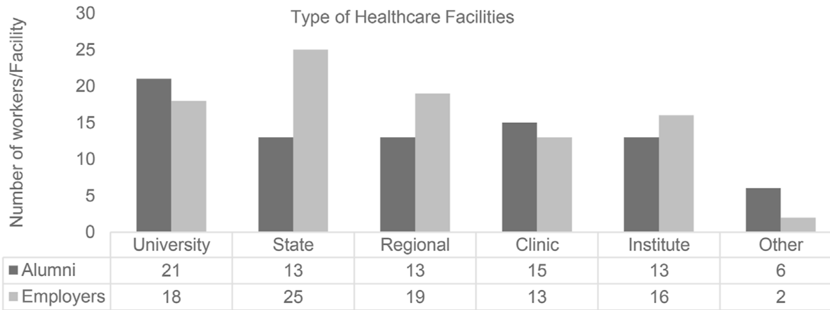

Figure 2. Types of healthcare facilities where Alumni and Employers (head-radiographers, radiographers-practitioners, clinical placement tutors, application specialists from the industry) were working at the time of the study.

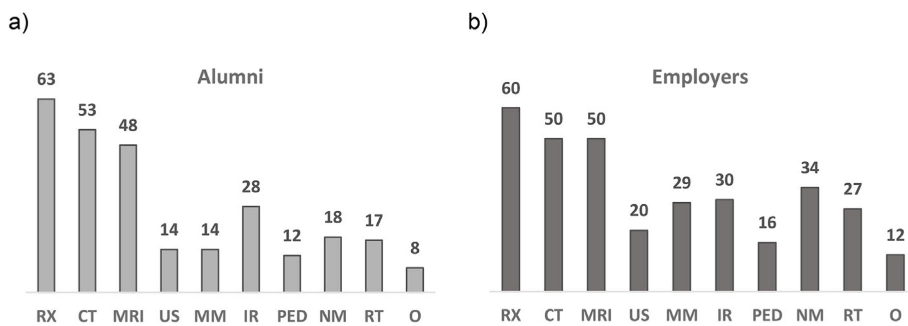

Figure 3. Main domains of Activity for (**a**) Alumni and for (**b**) Employers (head-radiographers, radiographers-practitioners, clinical placement tutors, application specialists from the industry). Note PED – Paediatrics; NM – Nuclear medicine including PET/SPECT/PET-CT & therapy; RT- Radiation therapy and includes planning, treatment.

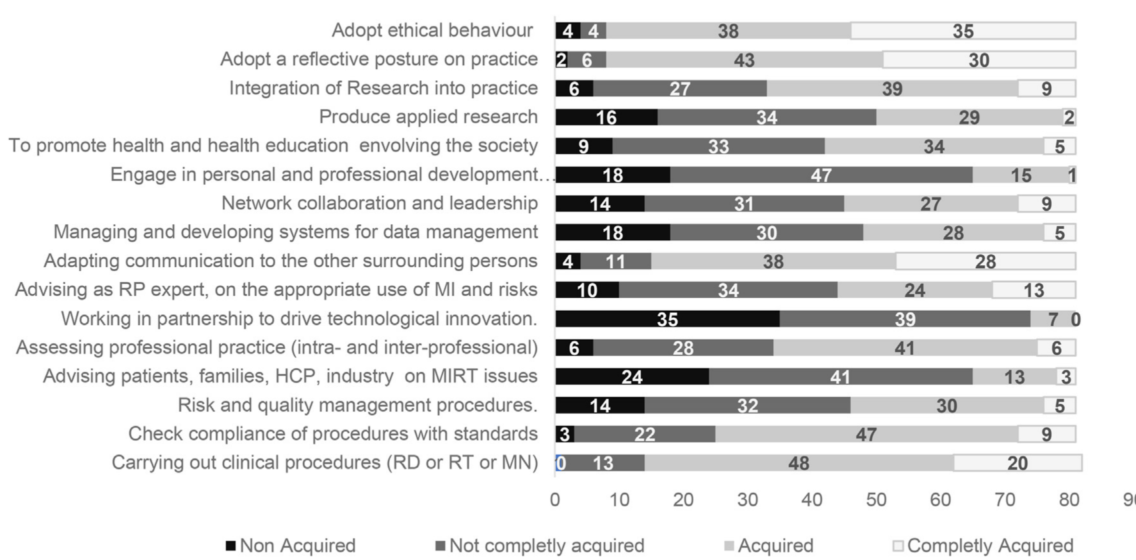

Figure 4. Alumni perspectives about the acquisition/development of competences during the BSc programme.

between Alumni and Employers for the following variables concerning radiographers' competences: work organization, data management and education & training ($p < 0.05$).

Radiographers' research in clinical practice

Only few Alumni (14.8 %; 12/81) and Employers (5.4 %; 5/93) referred to participate in research activities with an allocation of 20 % maximum of their work time. Only 9 radiographers for both groups had allocated 40 %–60 % of their time for research.

The main activities (Fig. 8) conducted by Alumni and Employers in the time for research were data collection and analysis, and methodology design.

The main areas of research identified by the participants were MRI, CT, XR, radiation protection, AI and contrast media (Fig. 9).

Statistical differences ($p < 0.05$) in research appeared when analysis between institution type was conducted. The tests showed significant differences, according to Alumni, for research between radiographers working in the university hospital and

Figure 5. Employers perspectives about the acquisition/development of competences by the newly graduated radiographers during the BSc programme at the arrival of their departments.

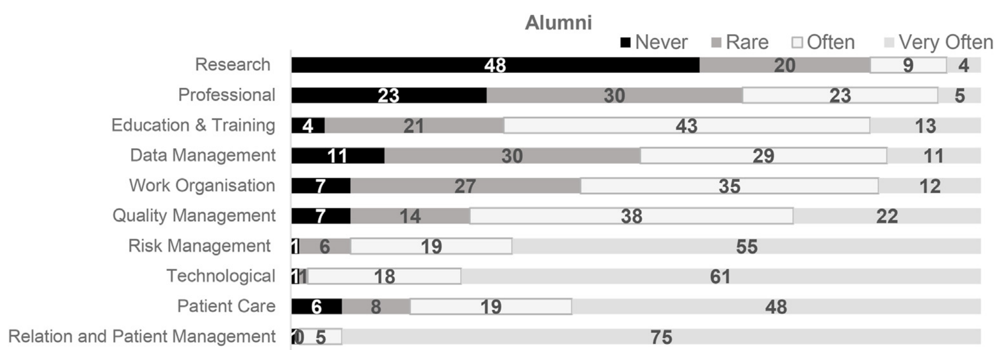

Figure 6. Frequency of application in clinical practice of each radiographer competence by Alumni.

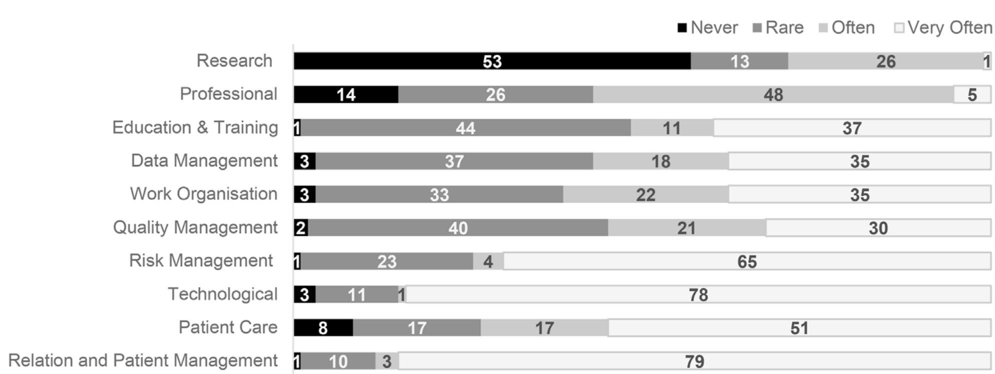

Figure 7. Frequency of application in clinical practice of each radiographer competence by chiefs-radiographers, radiographers-practitioners, clinical placement tutors, application specialists from the industry (employers' group).

those working in the regional hospital, the state hospital or in clinics ($p < 0.05$). The results suggest that radiographers working in university hospitals tend to be more involved in research than those who do not. However, no differences were found between radiographers working in the university hospital and private institutions or other organizations (such as industry and research institutions) according to this population ($p > 0.05$). Similar results were found when focusing on the Employers group with the exception that another significant difference was found between radiographers working in university hospitals and those working in private institutions. Once again, radiographers working at the university hospital tend to do more research.

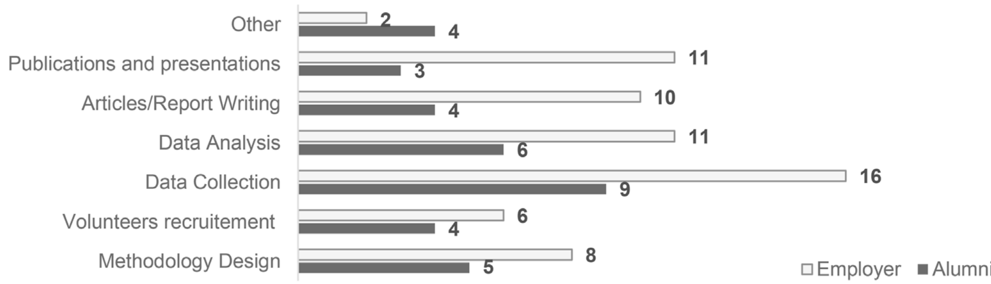

Figure 8. Research activities performed by Alumni and Employers.

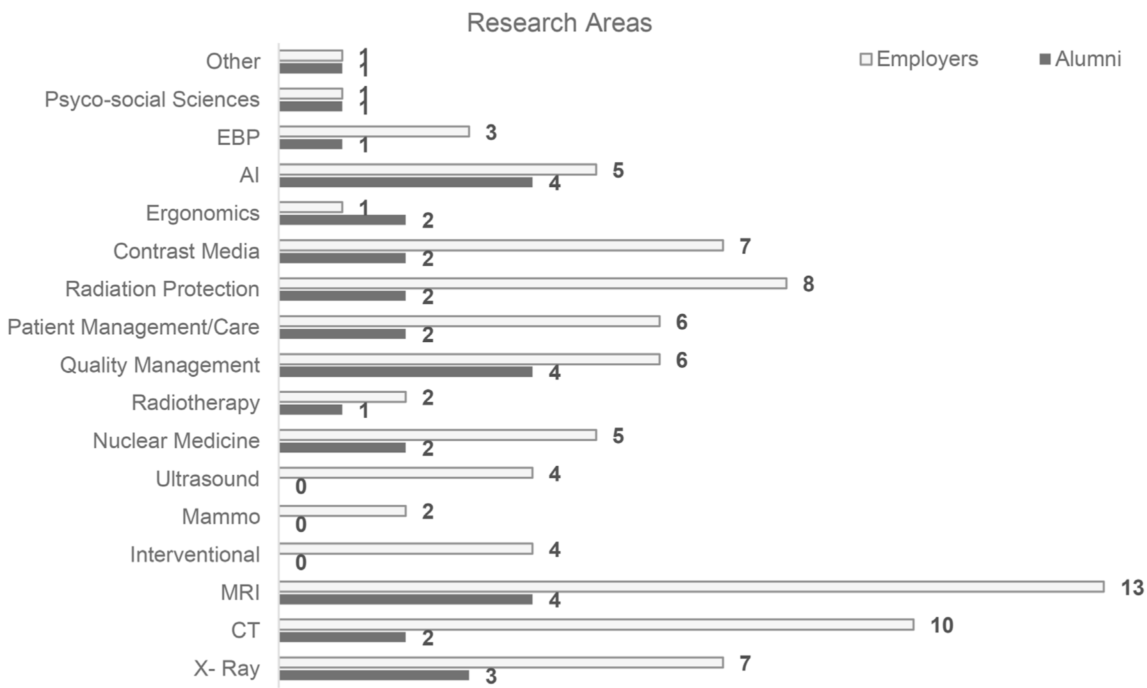

Figure 9. Research areas explored by Alumni and Employers.

Radiographers' autonomy levels in clinical practice

The participants were asked about autonomy, namely what was the meaning for them and what was their level of autonomy in their clinical work.

For 26 out of 81 Alumni, autonomy was defined as "Ability to design an action and manage its implementation within a structure that defines the overall constraints and provides assistance where necessary". While for others (17/81) was "The ability of someone not to be dependent on others" or (16/81) "The ability to set achievable goals for oneself and others, and to manage one's time and activities in line with these goals within a larger framework that determines what is possible and what is not". In clinical practice, the participant Alumni considered their level of autonomy as "average", feeling that "I have autonomy in patient care, but I do not decide on the technique" (34.6 %; 28/81) or "I decide on the protocol best suited to the patient, optimising parameters and/or treatment" (22.2 %; 18/81) (Fig. 10).

"Employers" group defined mainly autonomy as average regarding "I decide on the protocol best suited to the patient, optimising parameters and/or treatment" (31.2 %) and autonomy in patient care but not for the technique selection (23.7 %). Only few (3.2 %; 3/93) referred that radiographers were autonomous to justify the examinations (Fig. 10).

Discussion

This study combined the responses from Alumni of BSc MIRT programme held in Switzerland and "Employers" settled in the institutions that will hire/employ those Alumni after the graduation. The aim was to map radiographers' practices, competences and autonomy levels in Western Switzerland, regarding their level of development from both perspectives.

Major roles, domains of activity and competences

The results showed that most of the participants were practicing as radiographers in hospitals, private clinics, and institutes and performing mainly as diagnostic radiographers in conventional radiography, CT and MRI. The Swiss studies[33–35] about the use of medical imaging modalities revealed that the number of examinations executed in Switzerland increased, leading to a need of MIRT professionals. Radiography, CT, MRI and mammography were identified as the most common medical imaging examinations

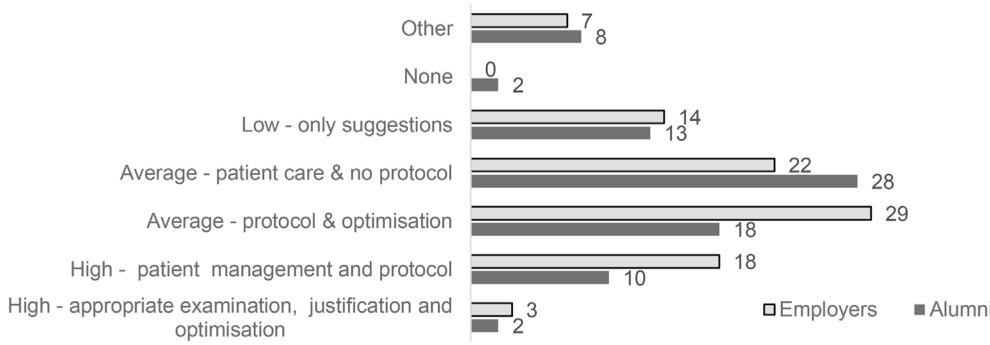

Figure 10. Levels of autonomy in clinical practice according to Alumni and Employers.

required in Switzerland. The Organization for Economic Co-operation and Development (OCDE) reports indicated as well that Switzerland is one of the countries with more of this equipment type installed,[36,37] especially CT and MRI. To perform those examinations, specific competences are required.[9,10,12,13,38,39]

According to the Alumni and "Employers" these competences were partially acquired or acquired when the newly formed radiographers (Alumni) entered the job market. On the contrary, capacity of interaction with industry and other stakeholders, advising about medical imaging/therapy, produce and integrate research in practice, were competences considered as non-acquired/developed during their education and training (Figs. 5 and 6). Regarding the frequency of its application in practice, the interaction with patients and the technical competences were the most emphasised for both, which encourages us as academics to continue in this direction.

The high frequency of technology-related competences suggests that radiographers are adopting modern tools and procedures to enhance diagnosis and therapy. Nevertheless, it seems to be different when it comes to the application of professional competences, and research development and integration, as it was highlighted as less developed and practised. The underutilisation of such professional competences, namely ethics, lifelong learning, and EBP, indicates a need for healthcare institutions and training programmes to emphasise the importance of these skills and better integrate them into practice. Professionalism started during undergraduate training, continues to be influenced by education, and incorporates a number of normative behaviours, values, positive attitudes, such as humanistic qualities, as altruism, empathy and ethical practice, and skills.[40,41] These competences are vital for maintaining high standards of care and ensuring the best possible patient outcomes and, ultimately, to reinforce radiography as a profession and as a science.[40] However, in many countries, Radiography/Medical Radiation Sciences is not yet recognised as a profession but as a semi-profession, since radiographers are seen as having poor autonomy, reduced input in clinical decision making and minimal responsibilities.[23]

Radiographers' autonomy levels in clinical practice

The lack of recognition carries significant implications for radiographers, influencing their roles in the various aspects of medical imaging examinations already presented regarding their career. This is visible in the results of this study since autonomy is mainly considered as average and not high (Fig. 10). Radiographers mainly focus on their interactions with the patient, to prepare them, and on performing the examination. Protocols and sometimes even optimisation techniques are often chosen by the medical doctors.

However, professional autonomy refers to the capacity of a skilled professional to exercise independent decision-making, drawing upon their expert judgment and expertise and acting in a self-directing role,[42,43] which is not frequently the case in the studied context. That is why research is critical to reinforce knowledge, skills, competences, and finally, recognition.[44]

Radiographers' research in clinical practice

The low integration of EBP and research in clinical practice is not new. Nixon[40] referred, a while ago, several barriers to its implementation, namely poor attitude towards research; lack of knowledge; insufficient time; lack of support from peers, managers and other health professionals; lack of resources as well as the resistance to change. This means that an investment in leadership education is required as a way of shaping future radiographers as leaders of their own practice, motivating them to enable an evolution of professional identity as contexts change. These abilities to adapt, to change and tackle uncertainty are essential in this new era for research, considering the continuous technological development that characterise the radiographer's work environment combined with the patient demands and needs.[45,46]

At this moment, the low frequency of research engagement raises concerns about the incorporation of evidence-based practices in clinical decision-making in Switzerland. Research is crucial for advancing knowledge and improving patient outcomes[47] and it is an integral part of the profession as robust evidence base is created by radiographers, for radiographers, seeking to optimise the medical imaging services as it is radiographer's responsibility.[48–51] Thus, promoting a research-oriented culture in clinical settings could lead to better patient care and a more efficient healthcare service.[49]

The findings from this study can be used to improve the curriculum and training programmes for radiographers to enhance competences related to research, professional skills, and education. Moreover, fostering partnerships between educational institutions and employers could further promote the development and application of desired competences in clinical practice. For the future education and training framework for radiographers, regular meetings and discussions for co-construction of the new programme are setup with "employers", as well as regular follow ups to identify the latest updates of radiographer's profession and clinical practice. Experts-panel in key medical imaging and radiotherapy areas are forming to enable structured data collection for creating practice-representative scenarios, projects, and problems for students to explore in a competence-based approach during their studies based in Swiss context and needs.[29,31] These groups have as objective to improve interactions between the UAS and the field.

Limitations

Limitations of this study include the restricted period of dissemination, as it coincided with the summertime when radiographers commonly take their main holidays, leading to potential impacts on the response rate. Additionally, the diversity in education and training levels for radiographers in Switzerland, along with the existence of four official languages in the country, posed challenges in ensuring comprehensive coverage of the entire context. As a result, a decision was made to focus solely on the French-speaking part of the country, where a Bachelor of Sciences programme is implemented. This approach may introduce bias, as it might not fully capture the needs of the German or Italian-speaking regions, limiting the applicability of the findings to newly qualified radiographers seeking jobs in other parts of the country.

Furthermore, the study's scope was limited to "Employers" who primarily collaborate with the UAS in western Switzerland, neglecting potential insights from other institutions within the geographical area. This could have implications for the generalisability of the study's conclusions beyond the specific collaboration network.

Conclusions

This study investigated the practices, competences, and autonomy levels of radiographers in Western Switzerland from two key perspectives: the Alumni of the BSc MIRT programme and the "Employers" representing institutions where these Alumni would be employed after graduation. The findings stressed a discrepancy between technical competences and professional competences, as well as research development and integration. While radiographers exhibited a high frequency of technology-related competences, they displayed limited utilisation of professional competences such as ethics, lifelong learning, and evidence-based practice (EBP). This discrepancy suggests the need for developing and nurturing a research-oriented culture in clinical settings to enhance patient care and optimizing medical imaging services. To address these limitations and promote professional growth, investment in leadership education is essential to empower radiographers as leaders in their practice, enabling them to adapt to evolving contexts and tackle uncertainties in this dynamic healthcare landscape.

Conflict of interest statement

None of the authors has a conflict of interest.
Cláudia Sá dos Reis (on behalf of all the authors).

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