Artificial Intelligence in Radiology, Nuclear Medicine and Radiotherapy: Perceptions, Experiences and Expectations from the Medical Radiation Technologists and Radiographers in Latin-America

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Abstract (300)

Objectives: The aim of this research was to understand the impact of the artificial intelligence on the medical radiation technologists and radiographers, as well as the varying perceptions that professionals in this domain have regarding its implementation.

Methods: An online survey was conducted among Latin American professionals. This survey enabled the collection of qualitative data concerning the primary perceptions of radiographers regarding the implementation of AI.

Results: A total of 398 valid responses were obtained, and it was determined that 98.5% (n=392) of the respondents expressed agreement with the implementation of AI in clinical practice. The primary contributions of AI that were identified were the optimization of processes, greater diagnostic accuracy, and the possibility of job expansion. On the other hand, concerns were raised regarding the quickness of training opportunities and limited avenues for learning in this domain.

Discussion:

Conclusion:

Keywords: Artificial Intelligence, perception, radiography, health personnel.

Introduction

The utilization of AI has become pervasive in clinical routine activities, especially in imaging departments. However, its application has evolved to encompass sophisticated tasks, with the objective of enhancing the processes of image acquisition, processing, and interpretation.[1] The field of radiology offers a conducive environment for the assessment of AI implementation in clinical settings, owing to the digital and standardized nature of the data.[2] Notwithstanding the evident benefits of AI in enhancing diagnostic precision, challenges persist in fully integrating the clinical context of the user, underscoring the ongoing evolution of AI[3], demonstrating the need to implement training programs for future healthcare professionals.[4] These programs are designed to equip the professionals with the skills to utilize technological tools in a responsible and effective manner within their clinical practice.[5]

The integration of AI in the field of radiology has enabled the utilization of advanced technologies, thereby precipitating exponential growth in various domains of the discipline.[6] In the domain of general radiology, AI has facilitated enhanced detection of anomalies in chest X-rays,[7] expedited the diagnosis of pulmonary embolisms in CT pulmonary angiography,[8] and to make better the performance of radiologists in interpreting breast cancer.[9] In Nuclear Medicine, the efficacy of AI has been demonstrated in the segmentation of pan-cancerous lesions in PET/CT with 18F-FDG,[10] in attenuation correction for PET/CT images,[11] and in the creation of models with high predictive accuracy for malignancy and adverse pathological characteristics in prostate cancer.[12] In the field of radiotherapy, the utilization of AI has been predominantly focused on the optimization of treatments.[13–15]

The adequate implementation of AI faces challenges regarding the regulatory frameworks of each country and the validation of their models,[16] as well as their respective acceptance by professionals. It is crucial to acknowledge that a considerable proportion of radiographers operates in low-income settings, predominantly utilizing analog methods due to their familiarity.[17] Additionally, there is a prevailing lack of understanding and training among professionals regarding the application of AI in clinical practice,[18] which has led some radiographers to express concerns about their future relevance due to their perceived lack of the necessary training to meet current technological demands.[19,20]

Awere of these points, it is imperative to comprehend the perspectives that professionals hold regarding the integration of AI in their daily practice. To this end, several regional[21–23] and global[24] surveys have been conducted to collect information on this topic. However, the proportion of respondents in Latin America has been extremely low, which makes it difficult to have representative data from this region to establish the real perspective of Latin American professionals regarding the integration of AI in their clinical practices.

Therefore, the objective of this research is to demonstrate the experience, perception and expectations of Latin American professionals in relation to AI, so that the results obtained will allow for the identification of the necessary requirements to gradually implement AI in the field of radiology, nuclear medicine and radiotherapy.

Methods

Research design and representation

This study employed an exploratory cross-sectional design with a survey approach. The present research project (424-C4-281) was reviewed and exempt from ethical revision by the Local Research Ethics Committee (CEC-632-2024).

Instrument

For data collection, an online survey was developed using Microsoft Forms (Microsoft Corporation, Redmond). This survey was developed based on a previous global study[24], with active collaboration from regional experts to adapt the collection instrument to the specific needs of the Latin American context. To encourage participation, the survey was made available for completion at the participant's discretion following receipt of the invitation. The survey was available in Spanish and Portuguese. The survey was designed to require about 15 minutes to be completed.

The survey comprised both closed and open-ended questions, which were methodically grouped into five sections according to subject matter: demographics, experience with AI, impact of AI on the profession, perception of AI, and opinion about AI. The survey's structure was designed to facilitate the quick identification of eligible participants and ensure a seamless integration of the study's themes with the participants' backgrounds. This approach was implemented to ensure a smooth progression through the survey, leading from closed-ended questions to open-ended inquiries.

Participants

In order to delimit the sample to the desired objectives of the study, the following inclusion criteria were taken in account: respondents who provided informed consent, health professionals who were working in clinical practice in radiology, nuclear medicine, or radiotherapy, with an academic degree related to a Bachelor's degree in Bioimaging Production, a Bachelor's degree in Imaging, a Higher Degree in Medical Technology with a specialization in Radiology, a Radiology Technologist, a Higher Technician in Medical Imaging, a University Radiologist Technician, or a similar degree, and who were working in any Latin American country.

The following criteria were deemed ineligible for inclusion: instances of noncompliance with the stipulated informed consent protocol, respondents lacking the requisite professional standing, and professionals whose practice locations lie outside the geographical confines of Latin America. This exclusion criteria encompasses individuals who, while having undergone academic training in Latin America, subsequently engage in professional practice in other regions.

Data collection

The survey responses were collected during one month between and September and October 2024. The survey was distributed online and through different personal messaging platforms to all professionals with experience related to the field of Radiology, Nuclear Medicine and Radiotherapy that work, study or were living in any Latin American country, thereby employing a non-probabilistic sampling strategy.

Data analysis

The data obtained for each of the responses were documented. The frequencies of responses were analyzed using descriptive statistical techniques in Microsoft Excel (Microsoft Corporation, Redmond). The synthesis of the primary findings was facilitated through the utilization of graphics and tables. A descriptive analysis of the absolute and relative frequencies of distribution of each of the variables of interest was used for their elaboration, and values represented as percentages were used.

On the other hand, the qualitative data were loaded into ATLAS.ti 25 (ATLAS.ti Scientific Software Development GmbH, Denver) for the purpose of qualitative analysis of the responses to the open-ended questions. Initially, an automated concept analysis was performed to identify keywords and

manually define codes related to each concept. Subsequently, the software was used to generate preliminary descriptions for each identified code. These descriptions were then manually refined by reviewing relevant observations and textual quotations extracted from the read responses. This methodological approach facilitated systematic coding and thorough interpretation of the qualitative data, ensuring consistency and depth in the analysis. Obtained results from Spanish and Portuguese were later translated to English for publication purposes.

Results

A total of 631 surveys were completed and recollected, but only 398 valid responses were obtained after the application of the inclusion and exclusion criteria (Figure 1). Respondents were distributed in sixteen Latin American countries, with varied amount of participation by country depicted in Figure 2.

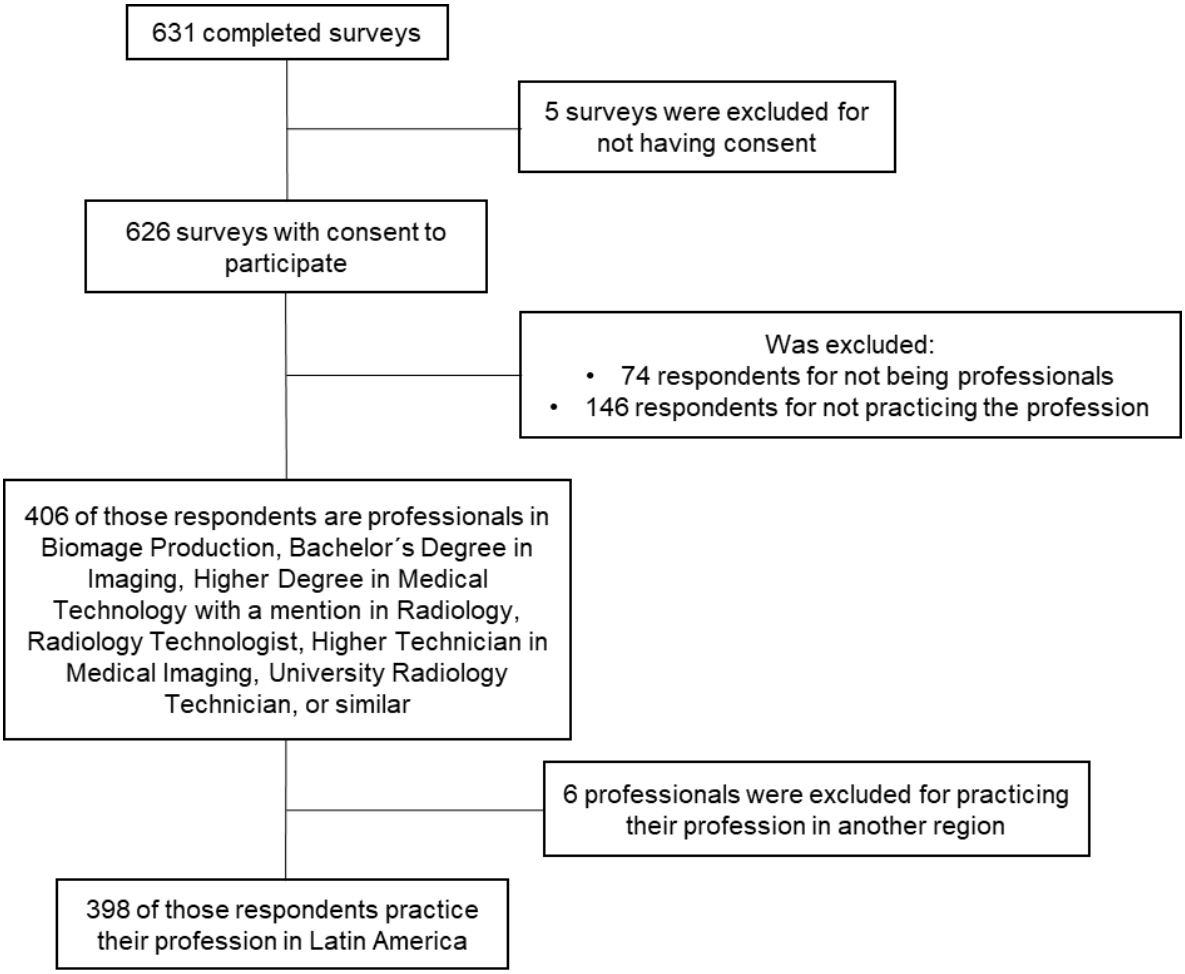

Figure 1. Flow chart of the sample selection process

Demographics

Table 1 details the main demographics of the participants. Of the respondents, the majority 20.4% (n=81) were from Argentina and 44.7% (n=178) have a degree or graduate degree. Most of the respondents (55.2%, n=220) were male and were in the 30-39 age range (32.2%, n=128). The participants primarily practice their profession in private hospitals or clinics (44.0%, n= 175), and the majority have between one to nine years of work experience.

Table 1

Distribution of demographic data by variable

Variables	Groups	Frequency (n)	Percentage (%)
Gender	Female	177	44.5
	Male	220	55.2
	I´d rather not say	1	0.3
Age	20 – 29 years	87	21.9
	30 – 39 years	128	32.2
	40 – 49 years	105	26.4
	50 – 59 years	67	16.8
	60 – 64 years	8	2.0
	> 65 years	3	0.7
Academic training	Diploma / Higher technician /	132	33.2
	Radiology technologist	17	4.3
	Bachelor's Degree	178	44.7
	Degree	67	16.8
	Master / Postgraduate / PhD.	4	1.0
Field in which the professional practice is developed	Public hospital / Public clinic	158	39.7
	Private hospital / Private clinic	175	44.0
	Academic Institution	57	14.3
	Public and private sector	8	2.0
Work experience	1 – 9 years	163	41.0
	10 – 19 years	122	30.7
	20 – 29 years	83	20.8
	30 – 39 years	24	6.0
	> 40 years	6	1.5

*The respondents belong to the area of Radiology, Nuclear Medicine and Radiotherapy.

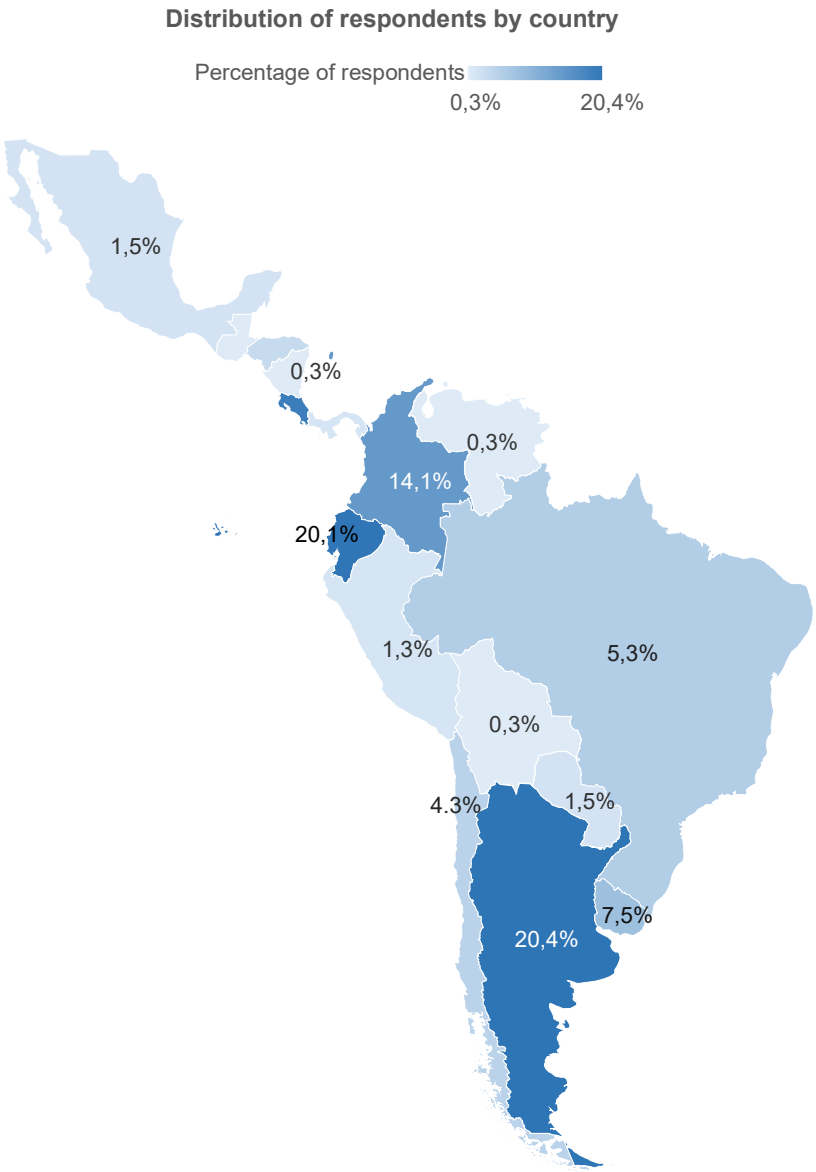

Figure 2. Geographic distribution of respondents

As depicted in Figure 2, the highest number of responses were obtained from Argentina (20.4%, n=81) and Ecuador (20.1%, n=80). Conversely, the countries with the fewest respondents were Bolivia, Nicaragua, Venezuela and Guatemala with 0.3% (n=1) each. On the other hand, 2.5% (n=2) of the professionals who pursued their studies in Argentina now practice in Uruguay and 1.2% (n=1) works in Brazil. In Ecuador, a professional trained in Colombia (1.2%, n=1) is currently employed in the field. The remaining respondents are employed within their country of study. (Figure 3).

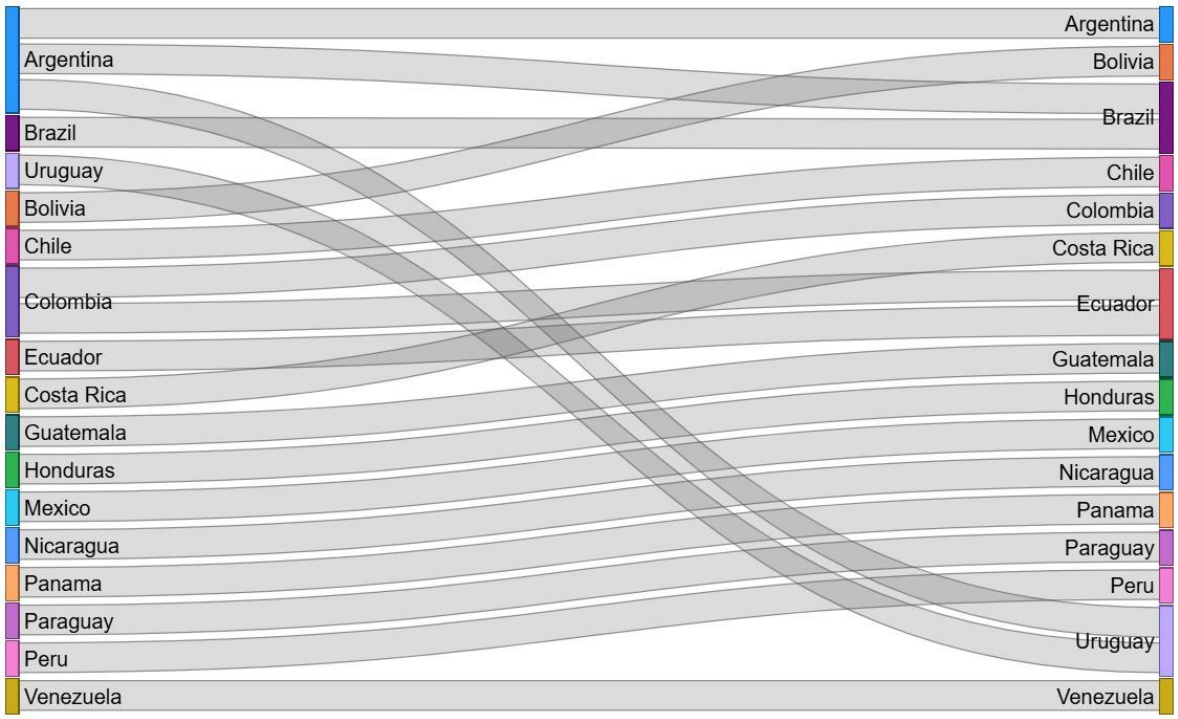

Figure 3. Sankey diagram on the country of academic training compared to the country of work

Experience with AI

Most respondents (85.9%, n=342) indicated that they primarily utilize clinical digital images for the acquisition of radiology studies, tomography, resonance, and other applications. A mere 5% (n=20) reported employing them in processing tasks, such as: segmentation, contouring, thresholding, dosimetry in radiotherapy. Meanwhile, 8.3% (n=33) indicated that they use the images for research, teaching or report creation. Only 0.8% (n=3) of the respondents reported not utilizing digital imaging in their daily practice.

A significant proportion, 14.6% (n=58) of respondents acknowledge the utility of AI in radiology and have engaged in experimentation with specific programs to fulfill their professional obligations. Conversely, 40.7% (n=162) of respondents acknowledged AI as an emerging and evolving technology in radiology, expressing a desire to acquire knowledge and experiment on this topic. On the other hand, 6.8% (n=27) are aware of the existence of research applications of AI in radiology yet expressed skepticism about its imminent integration into clinical practice. In contrast, 14.8% (n=59) concurred with the belief that AI will become a valuable instrument, however, not in the foreseeable future. The remaining respondents (21.1%, n=84) have been exposed to the concept of AI, but did not know of its applications in radiology. A small percentage (2%, n=8) indicated a state of complete ignorance about AI.

Regarding the integration of AI within clinical practice, a significant proportion of respondents expressed a favorable stance towards the incorporation of novel technological advancements in the clinical domain. Specifically, 98.5% (n=392) of respondents indicated their willingness to adopt these technological advances, with 15.6% (n=62) expressing a strong preference for their implementation irrespective of its publication source or vendor, while the remaining 82.9% (n=330) underscored the importance of legal approval, scientific evidence, and distribution by established brands as

prerequisites for AI integration. In contrast, only 1.5% (n=6) expressed a lack of willingness to adopt novel clinical advances that were not part of their university training.

Impact of AI on the profession

Most respondents (46.7%, n = 186) anticipate that AI will play a significant role in patient management, identification confirmation, appointment verification and requests. The 31.7% (n = 126) believe that the specific application of AI will be in quality assurance, image quality review, and positioning and dose planning. A significant proportion, 19.6% (n=78), anticipate a substantial influence on the prioritization of studies and their respective reconstructions and reports. A mere 2% (n=8) expressed uncertainty regarding the specific domain in which AI will exert its greatest impact.

In general, respondents concur that AI will have some involvement in each of the profession's specialties. The respondents identified the following specialties as the most promising for AI integration: general radiology (77%, n=306), MRI (12.9%, n=51), nuclear medicine (5.8%, n=24), and radiotherapy (3.5%, n=14). Notably, 0.8% (n=3) of respondents did not specify any specialty.

Furthermore, 41.2% (n=164) of respondents expressed a positive outlook on the incorporation of AI technology into radiological analysis or medical imaging, perceiving it as a significant advancement for the field. In addition, 37.4% (n=149) acknowledged the potential benefits of AI in radiology as an opportunity, emphasizing the importance of being prepared to embrace these advancements with confidence. A segment of 17.6% (n=70) of respondents expressed a neutral stance regarding the incorporation of AI technology, while 3.5% (n=14) conveyed skepticism, noting a lack of confidence. Notably, 0.3% (n=1) of respondents firmly opposed the integration of AI in radiology, labeling it as a misguided endeavor.

Regarding the degree of concern about the impact that AI would have on the role of professionals, 7.8% (n=31), think that there will be a massive increase in hiring, and 46.2% (n=184) believe that it will improve the job market but only for those who are better prepared in the subject of AI. Some 24.4% (n=97) are concerned that their current roles will have to change and feel less prepared for its application, and only 8.3% (n=33) believe that jobs will be lost. The remaining respondents (13.3%, n=53) do not believe that AI will have any impact.

A substantial majority, 82.4% (n=328) of respondents agree that there should be synergy between the AI and the practitioner in image interpretation. Additionally, 8.8% (n=35) of respondents indicated that both AI and human practitioners could contribute to the process. Conversely, 8.0% (n=32) of respondents expressed a preference for human practitioners to exclusively perform image interpretation, while 0.8% (n=3) indicated a willingness to entrust the responsibility entirely to the AI.

In scope of concern about AI diagnostic errors, 22.9% (n=91) expressed the belief that the utilization of AI would result in a reduction of errors, while 41.0% (n=163) indicated that they did not harbor any concerns regarding this matter if it is demonstrated to function similarly to a specialized human. However, 36.2% (n=144) believe that AI will make mistakes more frequently due to the intricate nature of medical images (e.g., the presence of artifacts). In the event of an error by the AI, 48.0% (n=191) assert that the onus falls upon the professional to make the final decision, thereby assuming legal responsibility, while 9.5% (n=38) advocate for the AI manufacturer to be held legally liable. However, 42.5% (n=169) contend that both parties should be held accountable.

Perception of AI

Most respondents expressed strong agreement (38.2%, n=152) or partial agreement (46.7%, n=186) that AI will transform clinical practice in imaging. However, only 30.2% (n=121) of practitioners reported feeling fully prepared to incorporate AI into their daily practice. Notably, only 5.6% (n=23) strongly agreed that there is sufficient training available on AI. Consequently, 36.4% (n=145) of respondents expressed disagreement with the perception of sufficient AI training, while 65.8% (n=262) strongly endorsed the incorporation of AI technology education into the imaging curriculum (Figure 4).

With respect to the utilization of AI in clinical practice, 18.1% (n=72) of respondents expressed their belief that patients will readily accept the integration of AI in their care, while 31.9% (n=127) neither agreed nor disagreed. Within this theme, 32.4% (n=129) of the professionals expressed strong agreement, along with 43.5% (n=173) who partially agreed that AI will be able to ensure more consistent patient safety standards for Imaging. Furthermore, 44.0% (n=175) of respondents assert that the implementation of AI will enhance the consistency of image quality in imaging.

Conversely, nearly half of the professionals (45.7%, n=128) neither concurred nor disagreed about the acceptance of their coworkers regarding the implementation of AI in clinical practice. A significant proportion, 34.9% (n=139), expressed disagreement with the assertion that AI poses a threat to the profession, while a smaller but notable segment, 19.6% (n=78), concurred with the view that it does. Furthermore, a substantial percentage, 38.2% (n=152) partially agreed that AI would contribute to a reduction in workload, and an even more pronounced majority, 43.5% (n=173), expressed strong conviction that AI would play an instrumental role in the clinical practice of Radiology, Nuclear Medicine, and Radiotherapy.

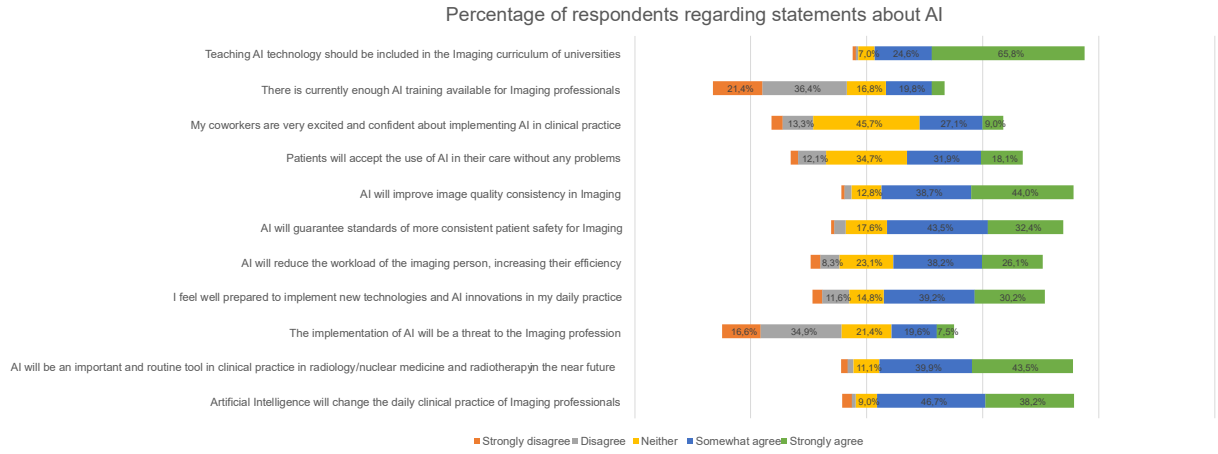

Figure 4. Percentage of respondents on the perception statement of AI

Qualitative data

For the question about if AI represents an opportunity or a threat for the development and progress of medical imaging careers, most of the participants considered AI as an opportunity, identifying the following codes: “opportunity to optimize and improve the quality of the imaging procedures” and “opportunity of professional expansion”. In the first code, AI is seen as an opportunity to improve the quality and efficiency of radiology. The participants highlighted the importance of supervising its implementation to benefit from this technology without neglecting professional responsibility. For the second code, AI in medical imaging represents an opportunity to generate advancement in the

profession, opening new fields for professional performance and remarking on the role of universities and other educational institutions in terms of generating curriculum updates and training current professionals. A few participants described AI as a threat or perceived its implementation skeptically, expressing concerns about the possibility of being displaced in their job positions and generating extreme technology dependence. Some representative responses for each code are shown in Table 2.

Table 2

Representative responses by code for the first open question

Code	Representative responses
Opportunity to optimize and improve the quality of the imaging procedures	*(...) opportunity by developing new ways of both image acquisition and diagnosis. Opportunity. Because quality control and dose reduction would be better.* *It is an excellent opportunity to optimize care processes, resources and patient care.* *It represents one more opportunity for the development of medicine field, it should be used as one more tool to work and improve the health of the population.*
Opportunity of professional expansion	*For me it represents a great opportunity for advancement in the imaging career, being a support for the professional.* *It is a very convenient opportunity for the growth and development of the Imaging Career for both professionals and students.* *I think it can be an opportunity to expand work expectations but as long as AI is not the main source of participation in the activity to be performed. As well as developing the necessary training in universities to cope with this technological advance.*
Threat and skepticism	*I think it is a development opportunity that at the same time threatens the progression because with AI we see that more and more images are offered that can be acquired by less prepared people, you have to have an eye and innovate in the curricula of each university to adapt to changes.* *A threat because jobs can be lost, and I have not yet seen many opportunities on this update.*

* The original language of the representative responses is Spanish, so these are the translations

For the question “In your opinion, what will change in the medical imaging profession with the growth and implementation of AI in clinical practice in the medium-long term?”, more concepts emerged. The codes identified, from most to low frequency, were: (a) “*changes in diagnostic precision*”, in which participants express that AI will allow them to identify pathologies faster and with more precision, facilitating radiologists in complex issues and improving diagnostic quality; (b) “*changes in optimization of attention process*”, in which the AI is described as a tool that can improve diagnostic

and attention processes, impacting patients' experiences regarding their attention and improving waiting times; (c) "*changes in technical aspects for imaging acquisition and postprocessing*", were participants declared that AI will help to improve image quality, reduce acquisition times and optimize processes. This advance will benefit patients and clinical staff; and (d) "*changes viewed with skepticism, distrust or as threatening*" in which it was described that AI generates concerns about job losses and loss of humanization in health care. Participants declare that a balance is necessary between technology and human role in medicine to warrant quality in healthcare. Some representative responses for each code are shown in Table 3.

Table 3

Representative responses by code for the second open question

Code	Representative responses
Changes in diagnostic precision	*I think that more than anything else, it will change for physicians and not for technicians and graduates. The way of performing the study will not change, but the interpretation will.* *It can help to make a more accurate diagnosis on some occasions* It will probably even help to visualize lesions that would not be seen with the naked eye by a less experienced person.
Changes in optimization of attention process	*It will change the distribution of time in the professional's work, mainly in task management and work efficiency.* *(...) In which the processes can be faster, more timely attention can be provided, and the quality of the images can be improved.* *It would streamline and organize processes that take a long time with unnecessary paperwork*
Changes in technical aspects for imaging acquisition and postprocessing	*(will improve) the quality of images, speed in acquisitions* *Faster execution of studies and better quality due to equipment with faster data processing, correction of artifacts, reduction of hardware due to software efficiency* *Exploration times can be optimized, image quality and diagnostic results improved.*
Changes viewed with skepticism, distrust or threatening	*Unfortunately for health professionals in the field of diagnostic imaging, the most important decisions in medical institutions are made by people who do not empathize with the employees, so that, despite the incorporation of these tools, they are not well implemented and detract and harm the daily work, mainly due to the lack of knowledge of the authorities in the logistics of our work performance.*

	(It will change) productivity, productivity demand, decrease in quality of care and cognitive activity of the staff due to automation. There will be no major changes in the work room (...) care will be less humanized due to mercantilism
	The professional interacting with AI will no longer be upgraded. I believe that jobs will be reduced

* The original language of the representative responses is Spanish, so these are a translation

Discussion

The results of this research are of great importance when investigating the perceptions of radiographers who develop their clinical practice in Latin America, since the antecedents on this subject have focused mainly on other regions of the world. It is a matter of interest to determine whether the trends in the responses could be influenced by characteristics specific to each geographic area.

The study revealed a high level of acceptance of AI, with 98.5% of respondents expressing their willingness to incorporate it into the clinical field across various disciplines. Most respondents expressed a positive outlook on AI's potential to facilitate professional growth and enhance the quality and efficiency of imaging processes. Conversely, a smaller proportion of respondents perceive the implementation of AI as a threat or remain skeptical, believing that they could be displaced from their jobs. The reasons for this are varied, but it is important to emphasize the concern of this group to maintain a balanced synergy between technology and human action. In relation to the findings of the global study,[25] it was revealed that professionals surveyed expressed comparable concerns. Additionally, a fear of losing personnel qualifications was identified, although this was not directly evidenced in the present research.

Most respondents recognize that AI will engender numerous advantages, and a paradigm shift in the profession; however, only 14.6% have employed specific AI programs to accomplish these tasks. These data demonstrate a retained integration of AI into clinical practice in Latin America. Furthermore, over half of the respondents consider that the implementation of AI will bring improvements in the labor market, but that adequate preparation is essential to face the evolution of the profile with respect to the skills needed to adequately practice the profession. The preponderance of studies undertaken in this field indicates that AI will confer numerous advantages, yet it is imperative to acknowledge the constraints imposed by training.

It is noteworthy that the implementation of AI in Latin America has been comparatively protracted in comparison to other regions of the world. Indeed, a study conducted in 2024, considering that it is an economic power, showed that 55.4% of its respondents considered that one of the main limitations surrounding AI is that it is very expensive to acquire.[26] This could be attributed to the fact that economic resources play a pivotal role in the adoption of these emerging technologies in the region, potentially resulting in a delayed uptake of novel techniques. While the moderate progress of AI does allow for more precise integration due to existing familiarity with its use, it also creates opportunities for the creation and promotion of training programs for both radiographers and future professionals, as evidenced by the fact that training is identified as a significant barrier to the adoption of AI.[26]

It is a fact that the implementation of AI in the field of imaging will inevitably lead to a paradigm shift in clinical practice. This assertion is further substantiated by the findings of other studies in this domain. However, a mere 30.2% of radiographers expressed a sense of assurance regarding their preparedness for this transition. This figure is even higher than that obtained by Pedersen et al. who

found that only 11.1% of professionals were very confident about working with AI systems.[26] Moreover, a consensus among respondents highlights a paucity of training opportunities in AI. This finding underscores the prevailing challenge of a shortage of education on the subject, registered in the medical curricula worldwide and the strong desire for AI education.[27] Considering these findings, it is imperative to implement career-specific courses and continuing education programs that focus on this subject.

It is noteworthy that a mere 18.1% of survey respondents anticipate complete acceptance of AI by patients. This is particularly salient given that the lack of education on this topic can engender mistrust in the efficacy of these technologies, particularly among those who are less familiar with the subject. In this context, Busch et al. conducted a global study to ascertain patients' perspectives on the implementation of AI in healthcare, which revealed a positive attitude in 57.6% of the patients.[28] However, in other study, patients exhibited a more neutral stance on the matter of entrusting AI with diagnostic interpretation tasks.[29]

In addition, respondents recognize that AI will streamline the IT processes present at each stage of the acquisition of a study, thereby reducing the workload and the time required for each person. It could be hypothesized that this increased efficiency would result in a more individualized and personalized approach to each user. However, given the saturation of health systems in several countries in the region, it is probable that the streamlining of processes will lead to an increase in the number of people attended per day. Consequently, patients' distrust of AI may be attributed to their apprehension of a dehumanization of the care process. The present study is consistent with this hypothesis, as the data obtained demonstrate a clear preference for care provided by a human professional.[29]

In relation to the mentioned points, the data demonstrated that professionals have a high level of confidence in the ability of AI to enhance the quality of imaging, and that it will be capable of ensuring patient safety standards are met. However, should there be any opposition to AI from users, the process of integrating these technologies will be rendered more complex. This underscores the necessity for professional training in this domain, complemented by the imperative to enlighten users on the merits of these novel technologies in the realm of radiology. Consequently, a phased implementation of AI within the clinical field is advocated, a process that should be guided by extant guidelines and training materials derived from prior research.[30]

Conclusion

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