

Bridging the AI-literacy gap in healthcare: a qualitative analysis of the Flanders case-study

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Abstract

Background: The integration of Artificial Intelligence (AI) in healthcare is advancing rapidly, promising to enhance clinical decision-making, streamline administrative tasks, and personalize patient care. However, many healthcare professionals report a lack of confidence in understanding, critically evaluating, and ethically applying AI technologies. In regions like Flanders, Belgium—recognized for innovation yet facing moderate lifelong learning participation—these challenges are pronounced, especially amid an aging healthcare workforce and resource disparities between professions.

Objective: This study aimed to explore the requirements, obstacles, and prospects of AI adoption among healthcare professionals, and to identify the specific training priorities needed to bridge the AI-literacy gap in clinical practice in the Flanders region.

Methods: A multi-stage qualitative methodology was employed. First, 15 semi-structured interviews with key informants were conducted to inform the survey design. Then, a survey was distributed to healthcare professionals across Flanders, gathering 134 valid responses. Finally, three focus groups involving 39 participants were conducted to co-interpret the survey findings. Thematic analysis and descriptive statistics were used to synthesize insights across stages.

Results: Healthcare professionals recognized AI's potential to reduce administrative burdens and enhance clinical care but reported low self-perceived AI literacy, especially among older and non-physician staff. Interest in AI training was high, particularly for practical applications and basic AI knowledge, rather than technical coding or standalone ethics courses. Differences emerged based on occupation, age, and perceived job security. Nurses and younger professionals were especially concerned about the risks and opportunities of AI adoption. A lack of legally approved AI tools and practical hands-on training were identified as major barriers. Focus group discussions highlighted disparities in access to AI training between doctors and nurses, skepticism about private-sector-led courses, and the need for hospital management support in facilitating AI education.

Conclusions: A one-size-fits-all approach to AI training in healthcare is inadequate. Training programs must be stratified by occupation, age, and resource availability, emphasizing immediate practical applications while embedding ethical considerations within broader curricula. Addressing barriers to training accessibility and clarifying regulatory frameworks will be crucial to scaling AI integration in healthcare systems, starting in Flanders and potentially informing broader European initiatives under frameworks like the EU AI Act.

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Abstract

Background

The integration of Artificial Intelligence (AI) in healthcare is advancing rapidly, promising to enhance clinical decision-making, streamline administrative tasks, and personalize patient care. However, many healthcare professionals report a lack of confidence in understanding, critically evaluating, and ethically applying AI technologies. In regions like Flanders, Belgium—recognized for innovation yet facing moderate lifelong learning participation—these challenges are pronounced, especially amid an aging healthcare workforce and resource disparities between professions.

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This study aimed to explore the requirements, obstacles, and prospects of AI adoption among healthcare professionals, and to identify the specific training priorities needed to bridge the AI-literacy gap in clinical practice in the Flanders region.

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Results

Healthcare professionals recognized AI's potential to reduce administrative burdens and enhance clinical care but reported low self-perceived AI literacy, especially among older and non-physician staff. Interest in AI training was high, particularly for practical applications and basic AI knowledge, rather than technical coding or standalone ethics courses. Differences emerged based on occupation, age, and perceived job security. Nurses and younger professionals were especially concerned about the risks and opportunities of AI adoption. A lack of legally approved AI tools and practical hands-on training were identified as major barriers. Focus group discussions highlighted disparities in access to AI training between doctors and nurses, skepticism about private-sector-led courses, and the need for hospital management support in facilitating AI education.

Conclusions

A one-size-fits-all approach to AI training in healthcare is inadequate. Training programs must be stratified by occupation, age, and resource availability, emphasizing immediate practical applications while embedding ethical considerations within broader curricula. Addressing barriers to training accessibility and clarifying regulatory frameworks will be crucial to scaling AI integration in healthcare systems, starting in Flanders and potentially informing broader European initiatives under frameworks like the EU AI Act.

Keywords: AI integration, Cross-disciplinary collaboration, AI literacy, Healthcare workforce, Occupational divides, Structural inequalities, Tailored training, lifelong learning, upskilling

Introduction

The Information Age has spurred healthcare innovation by providing extensive data access and technology during the last 40 years, empowering the workforce to revolutionize healthcare. The

emergence of Artificial Intelligence (AI) stands out as one of the most transformative elements of this era. Amid present conditions, AI technologies are increasingly becoming prominent in the analysis of diverse health data [CITATION Wan19 \l 1033]. They are accelerating the processes of diagnosis and therapy, enhancing imaging techniques, providing guidance for surgical procedures, and streamlining drug research, thereby enabling the development of more personalized therapies [CITATION Mat19 \l 1033]. Topol's words, i.e. "*Nearly every clinician in the future; from specialist physicians to paramedics, will be using artificial intelligence technology and especially deep learning*", underline the expanding field of use of AI in medicine [CITATION Top19 \l 1033]. One increasingly acknowledged, yet still under-researched, area where AI could provide significant support is the reduction of administrative burden in healthcare. Studies suggest that clinicians spend up to half of their working hours on documentation, scheduling, and other non-clinical tasks, leading to burnout and reduced time with patients [CITATION Adl20 \l 1033]. AI-driven solutions—such as automated note-taking, intelligent triage systems, and smart scheduling assistants—hold promise in alleviating this load. However, while the literature often emphasizes diagnostic and clinical decision-making applications of AI, the administrative potential of AI remains relatively underexplored in both academic and policy discussions. This gap limits the development of training programs and tools that target what may be among the most immediate and practical benefits of AI for the existing workforce.

Although the utilization of AI tools in clinical practice is on the rise, there exists a self-reported deficiency in the ability to comprehend, critically evaluate, and ethically utilize these tools in everyday clinical settings [CITATION Has23 \l 1033]. As a result, there is still an apparent reluctance by the medical workforce to utilise AI clinically [CITATION Doh24 \l 1033]. Given these contexts, an increasing number of researchers and organizations underscore the importance of integrating AI into medical education, residency training, and continuous education programs for medical staff. This integration is crucial for raising awareness about the appropriate utilization of AI in healthcare settings and accelerate its everyday clinical care adoption.

The successful integration of AI into healthcare systems faces fundamental challenges, including user acceptance, consistent utilization in day-to-day operations, and seamless integration into the broader clinical workspace [CITATION Des24 \l 1033]. Overcoming these hurdles is essential to ensure that AI technologies become an integral and widely accepted part of routine medical practice. As in other non-medical professions, guidelines emphasize that training related to AI is crucial for its effective integration into everyday practice [CITATION Mal21 \l 1033], not only within pre-registration healthcare programs but also as a means of continuously developing the skill set of the existing workforce. At the same time, by incorporating AI responsibly, healthcare systems not only enhance their operational efficiency [CITATION AIS24 \l 1033] but also foster a sense of co-ownership among individuals and communities, within the sector. While a growing volume of literature advocates for the inclusion of AI-related content in medical curricula [CITATION Mas19 \l 1033] [CITATION Meh21 \l 1033], the studies examining the training needs of the medical workforce in relation to AI are relatively scarce. [CITATION Doh24 \l 1033].

In line with these considerations, the current article explores the following research questions: *What are the requirements, obstacles, and prospects for medical staff in integrating AI into their daily tasks? What are their key priorities and needs for AI training in these areas?* To address these questions, the study conducts a thorough needs assessment of the overall medical workforce (doctors and nurse practitioners among others) [CITATION Hea19 \l 1033]. The articles that have explored the training of the medical workforce in AI, have mostly concentrated on specific specializations such as clinical imaging [CITATION Doh24 \l 1033], or electrocardiogram interpretation [CITATION Tah23 \l 1033]. Few holistic approaches that explore the wide-scale AI deployment in

healthcare practices call for investments in human capital, clear regulations, and enhanced AI literacy [CITATION Esm24 \l 1033].

The current study leverages existing literature to implement multi-stage, qualitative research focusing on the healthcare professionals in the Flemish region of Belgium, i.e. a region that is characterized as an innovation leader - reflected in a comprehensive AI policy plan [CITATION Fle \l 1033]- but only moderate achievements in lifelong learning [CITATION Com24 \l 1033]. Accordingly, this focused investigation holds promise for enriching existing literature. The rest of the article is structured as follows. Section 2 delves into the relevant literature for the adoption of AI into Flanders and integration of AI training in the healthcare systems. Section 3 presents the design and methodology of the current study. Section 4 illuminates the results from our research, while Section 5 draws insights from the results and discusses limitations and pathways for future research.

Learning needs for AI in healthcare

AI is rapidly transforming healthcare and education, offering unprecedented opportunities for innovation. Yet, integrating AI into these fields presents significant challenges, especially in ensuring that clinicians and educators are adequately trained to harness its full potential. In healthcare, AI has already shown remarkable promise, from analyzing chest X-rays and skin lesions (Keane and Topol, 2021) to increasing understanding of individual treatment response for COPD [CITATION Hut24 \l 1033] and significantly decreasing the time needed to review seizure events [CITATION Bha23 \l 1033] [CITATION Cha22 \l 1033]. Despite these advancements, scaling AI faces hurdles such as technical limitations, trust deficits, privacy concerns, algorithmic biases, and systemic issues like misaligned incentives, fragmented workflows [CITATION Esm24 \l 1033], or even lack of more general, basic AI literacy among healthcare professionals. Addressing these challenges requires a strategic approach that emphasizes investments in human capital, clear regulatory frameworks, and improved AI literacy. To overcome these barriers, a human-centered design approach and revised frameworks tailored to healthcare-specific challenges are essential [CITATION Hua24 \l 1033].

Despite these advancements, clinician education has not kept pace. A survey found that only 13.8% of clinicians believed their training programs adequately prepared them for integrating AI into their practice [CITATION Kea21 \l 1033]. However, another survey [CITATION Sch21 \l 1033] shows that 71% of clinicians in ophthalmology, radiology, and dermatology reported optimism about AI improving their fields, particularly in disease screening and reducing monotonous tasks. This indicates that expectations for AI solutions are high among healthcare professionals. However, 80.9% had never used AI in practice, and only 5.5% rated their knowledge as "excellent". Interestingly, ophthalmologists reported the highest usage of AI (15.7%), compared to radiologists (6.1%) and dermatologists (5.2%), highlighting disparities in AI adoption between occupations that reflect differences in exposure and training [CITATION Sch21 \l 1033]. Significant divergences are also identifiable between different generations: clinicians with less than five years of experience were twice as likely to perceive AI's impact as profound compared to those with over 30 years of practice. This generational divide underscores the need for tailored strategies to foster acceptance and implementation.

Beyond clinical environments, AI is significantly reshaping the landscape of medical and dental education. Virtual simulations provide students with the opportunity to practice complex procedures on digital patients, helping to mitigate the risks associated with live, real-world practice. In addition, AI-driven tools enhance students' diagnostic and treatment planning abilities by improving their pattern recognition and decision-making skills [CITATION Dav23 \l 1033]. The receptiveness of medical and dental students to AI applications is particularly indicative of how AI can be integrated into graduate training, preparing the next generation of healthcare professionals for a future deeply intertwined with technological advancements. An international survey [CITATION Bus24 \l 1033] of 4,596 medical, dentistry, and veterinary students from 48 countries found that 67.6% have positive

attitudes toward AI in healthcare, and 76.1% desire more AI education in their curricula. Despite this interest, 75.3% reported limited general knowledge of AI, and indicated the absence of AI-related courses in their programs. Additionally, the majority of respondents felt unprepared to use AI in their future careers, underscoring the necessity for curriculum enhancements to include AI competencies. Cross-sectional studies, involving 3,018 medical students across Turkey, further emphasized concerns about potential job reductions due to AI (44.9%), and the fear of AI devaluing the medical profession (58.6%). Along these lines, notably, only 6% of the respondents felt competent to inform patients about AI's features and risks, highlighting a significant literacy gap. In this vein, the majority expressed a need for training in AI applications, error reduction, and ethical problem-solving related to AI use [CITATION Civ221 \l 1033].

Similar studies - with smaller samples - confirm these findings and further underscore the necessity of incorporating practical and ethical AI training into medical education to prepare students for the realities of AI-supported healthcare [CITATION Wei241 \t \l 1033], Furthermore, experts emphasized the importance of integrating ethical considerations into AI education for medical students [CITATION Wei23 \t \l 1033]. In this regard, they advocated for a curriculum that balances technical AI skills with discussions on ethical implications, ensuring that future physicians can navigate the complexities of AI applications responsibly. This approach aims to foster a generation of healthcare professionals who are not only proficient in AI technologies but also mindful of their ethical responsibilities.

To address the aforementioned challenges, medical schools and training programs must integrate AI-related competencies into their curricula. [CITATION Kea21 \l 1033] advocate for the inclusion of AI ethics, practical applications, and critical appraisal skills in medical education. Refined curricula should also take into account inconsistencies in AI training across institutions, highlighting the challenges of standardizing education systems globally [CITATION Ice22 \l 1033]. However, concerns about over-reliance on AI persist in healthcare, with educators warning of potential undermining of critical thinking skills [CITATION Kea21 \l 1033] [CITATION Dav23 \l 1033].

All the above indicate a pressing need to update medical education curricula to include comprehensive AI training. Such training should cover practical AI applications, ethical considerations, and strategies to mitigate potential negative impacts on the medical profession. By addressing these educational gaps, future healthcare professionals can be better equipped to integrate AI into their practice, ultimately enhancing patient care and maintaining the integrity of the profession. Moreover, medical education serves as the essential foundation for the entire continuum of healthcare workers' training. The competencies acquired during undergraduate studies serve as the bedrock of a clinician's professional development, not only establishing their initial skill set but also shaping the trajectory of postgraduate and continuous professional development programs. Drawing on these findings, our study brings the training of clinicians into sharper focus.

Research Design and Methodology

Contextualizing the study: an outline of Flanders' healthcare system

The current study explores the integration of AI in healthcare training in Flanders, a region of Belgium, (NUTS1 statistical region), which consists of five NUTS2 subregions, i.e. Antwerp (BE21), Limburg (BE22), East-Flanders (BE23), Flemish-Brabant (BE24) and West-Flanders (BE25) [CITATION Eur \l 1033]. The healthcare system in Flanders is technologically advanced and operates under a mixed public-private model, offering universal coverage to residents. A network of hospitals, general practitioners, and specialists provide the care, which is mostly funded by social security payments. Primary care and preventative health services are highly valued in Flanders, with an emphasis on patient choice and accessibility. As of the latest available data, Flanders has a relatively high availability of hospital beds compared to European standards. The bed density is around 560 per hundred thousand people. More analytically, regional data on available beds in

hospitals¹ per hundred thousand inhabitants [CITATION EUR24 \l 1033] indicate that while Belgium is slightly above the EU-27 average in hospital bed capacity, the NUTS2 regions show significant variation. Subregion of West-Flanders has the highest capacity, whereas Flemish Brabant has the lowest. All regions are aligned with the broader trend observed across Belgium and the EU-27, which shows a steady decline in the number of available hospital beds over the long term, reflecting shifts towards outpatient care, efficiency measures, and a focus on preventive healthcare (see Figure 1).

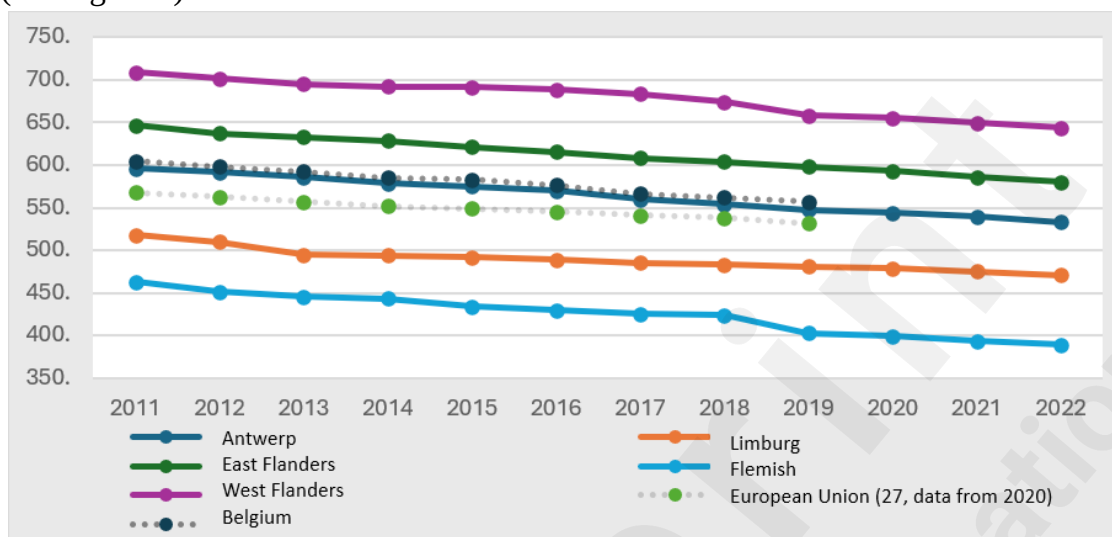


Figure 1. Available beds in hospitals per hundred thousand inhabitants. Source: Eurostat

In the meantime, Flanders boasts a well-trained healthcare workforce, with a mix of general practitioners (GPs), specialists, nurses, and other health professionals. There are approximately 320 doctors per hundred thousand inhabitants, which is close to the European average of 350. However, four out of five regions in Flanders have practitioner numbers below the national average (see Figure 2). Flanders' healthcare system, although resource-rich and technologically advanced, is facing challenges due to an ageing workforce that extends throughout the Belgian healthcare system. More analytically, Belgium's healthcare workforce is aging more rapidly compared to the EU average: the percentage of practicing physicians in Belgium that were aged 55 or older were 24,1% in 2000 and this percentage increased rapidly to 44,9% in 2016 surpassing the EU-12 average of 34,5% for the same year. Most recent data indicate that this trend continues, since in 2020 the percentage of Belgian physicians aged 55 and over was 43.3%, surpassing the EU-14 average of 35.1% and the EU-27 average of 37.4%. Against this background, several key specialties see an even higher proportion of aging practitioners, such as rheumatologists (46.1%), general practitioners (44.6%), and radiologists (41%). This aging workforce exacerbates existing shortages, straining the system's ability to meet the growing healthcare demands of an aging population. Despite efforts to address the issue, the percentage of older physicians in Belgium remains significantly higher than the EU-27 averages, posing a long-term challenge for healthcare sustainability [CITATION Hea24 \l 1033].

¹ Hospital beds regularly maintained and staffed and immediately available for the care of admitted patients.

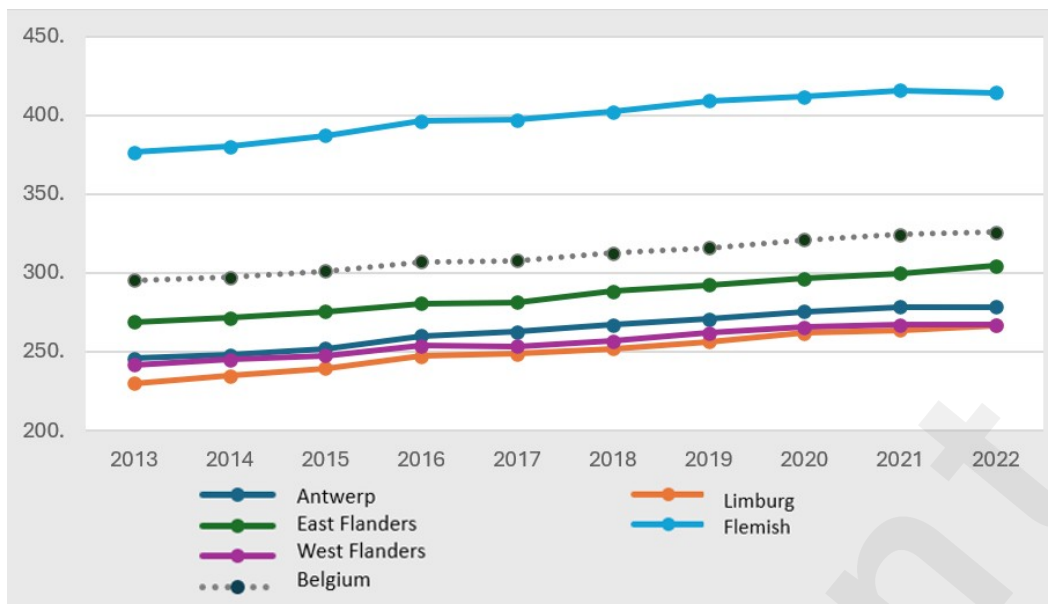


Figure 2 . Physicians by NUTS 2 region per hundred thousand inhabitants. Source: Eurostat

Indeed, while AI is rapidly being adopted across the global economy, Flanders remains behind in this transformative shift. As of early 2024, an impressive 72% of companies worldwide reported using AI in at least one aspect of their operations[CITATION Sin24 \l 1033]. However, a more recent 2023 study from Flanders, indicates that only 32.1% of companies have embraced AI within their business processes[CITATION Sta24 \l 1033]. This difference underscores a need for greater awareness and integration of AI technologies in the region. One of the key challenges in Flanders is a lack of perceived necessity. A substantial 65.5% of Flemish companies believe that AI offers no significant benefits to their business. Compounding this issue, 64.5% admit to lacking the requisite knowledge, skills, and experience to effectively implement AI solutions. These barriers highlight an urgent need for targeted education and skill-building initiatives to bridge the gap between potential and practice. Although Flanders is recognized as a European innovation leader, it achieves only the European average when it comes to lifelong learning participation[CITATION Com24 \l 1033]. This was further confirmed by the Monitoring Report from the Flemish Department of Work and Social Economy [CITATION Ger24 \l 1033]. As the workplace continues to evolve, 95% of employers anticipate that the skills required of professionals will change significantly in the coming years. However, this shift is met with resistance: 40.7% of adults in Flanders currently do not participate in any form of training and express no interest in doing so, as they see no need for learning.

When asked about lifelong learning specifically related to AI, 44% of European respondents expressed skepticism, stating it is unlikely that their employer would provide AI-related training[CITATION Pou24 \l 1032]. This hesitancy creates a mismatch between the growing relevance of AI and the readiness of the workforce to engage with it. The European AI Act's Article 4 on "AI Literacy" could act as a catalyst for change [CITATION Eur24 \l 1033]. Starting from February 2, 2025, this directive requires "providers and deployers of AI systems to take measures to ensure, to the best extent possible, a sufficient level of AI literacy among their staff and other persons involved in the operation and use of AI systems." This legislative push will likely increase the demand for AI-focused training and education in Flanders, creating a significant opportunity for initiatives to close the AI literacy gap and foster a workforce that is ready to thrive in an AI-driven economy.

Research methodology

The current study investigated the requirements, obstacles, prospects and needs for AI training for the healthcare workforce, by following an exploratory three-stage research design (see Initially, preliminary semi-structured interviews (Stage 1) were conducted to gather qualitative insights that informed the development of a subsequent survey (Stage 2). In the third stage, focus groups were employed to co-interpret the survey results and extract deeper insights. This multi-stage approach ensured that the study addressed relevant, context-specific topics and was grounded in real-world perspectives.). Initially, preliminary semi-structured interviews (Stage 1) were conducted to gather qualitative insights that informed the development of a subsequent survey (Stage 2). In the third stage, focus groups were employed to co-interpret the survey results and extract deeper insights. This multi-stage approach ensured that the study addressed relevant, context-specific topics and was grounded in real-world perspectives.

Table 1 Research Design

Research Stage	Stage 1	Stage 2	Stage 3
Research Objective(s)	Gaining insights for the use of AI in healthcare	Knowledge, skills and training needs on AI in healthcare	Data integration & interpretation
Research Tool	Semi-structured interviews	Quantitative survey	Three focus groups
Research subjects/objects	Key informants and representatives of medical staff	Medical staff across Flanders	Medical staff across Flanders

More analytically, in the first stage of the study, fifteen (15) semi-structured interviews were conducted with key informants from the healthcare sector selected to represent diverse levels of AI expertise (see Error: Reference source not found). A strategic sampling approach combined criterion sampling to target interviewees in pivotal healthcare roles and maximum variation sampling to ensure a broad spectrum of AI expertise. The incorporation of these methodological stages demonstrated the study's dedication to obtaining a comprehensive understanding of AI-related learning requirements while encouraging inclusiveness and usefulness in its conclusions. The aim was to explore the use of AI in healthcare within Flanders and to identify the existing AI training needs of the sector. The interview data were analysed using thematic analysis [CITATION Bra06 \l 1033], supported by NVivo software to systematically identify themes.

Interviewee	Background	Expertise on AI (scale 1-5)
Int1	General Practitioner	2
Int2	Logopedist	1
Int3	Research Nurse	3
Int4	Physiotherapist	4
Int5	Professor of geriatric psychiatry, psychotherapist	3
Int6	Professor Dentistry, Periodontologist	4

Int7	Professor of Cardiology and Head of Department	3
Int8	Associate Professor Urology	3
Int9	Cluster Manager Digital Health	3
Int10	Data Sciences Lead Pharmaceutical	4
Int11	Innovation Lead – Hospital	4
Int12	Self-Employed Home Care Nurse	1
Int13	Pathologist Hospital	1
Int14	General Practitioner	2
Int15	Professor of Internal Medicine and Engineering	5

Table 2 Background of Interviewees and AI-Expertise level

Building on the insights from the qualitative data, the study proceeded to design a survey aimed at conducting a comprehensive needs assessment [CITATION Civ22 \l 1033] across the regional medical workforce. The survey focused on several key areas: healthcare professionals' learning trajectories, their existing knowledge and skills related to AI, the impact of AI on their professional practices, and their specific learning needs regarding AI adoption. Developed using the EU Survey platform, the survey ran from July till the end of December of 2024. It was digitally distributed to a wide array of healthcare organizations across Flanders, including four hospitals, five healthcare professional associations, four healthcare-focused SMEs and enterprise associations, six additional SMEs, two university medical schools via their alumni lists, and one NGO, viz. VAIA – Flanders AI Academy. Additionally, the survey was shared through personal networks and disseminated via healthcare channels and conferences in the region. Despite extensive efforts, the survey yielded only 139 responses (see Table 3) from an estimated total population of 5,000 healthcare professionals, underscoring the challenges of engaging this demographic group in survey-based research [CITATION Hut19 \l 1033]². Five of the participants had filled less than 20% of the total questionnaire (more than 80% missing variables) and were excluded from the analysis, resulting in a final number of 134 respondents included in the analysis.

Table 3 Demographics of participants in the Survey

Participants			Participants		
Gender	Male	47 (35.07%)	Senior.	0-3	8 (5.6%)
	Female	83 (61.94%)		4-10	38 (26.57%)
	Other/NA	4 (2.9%)		10+	88 (58.74%)
Age	<30	16 (11.18%)	Occup.	Physician/Doctor	45
	30-40	42 (27.37%)		Nurse/Midwife	41
	40-50	34 (23.77%)		Manager	9
	50-60	34 (23.77%)		Dentist	8
	60-70	7 (4.9%)		Pharmacist	3
	NA	10 (7%)		Physio/Kinesist	12
				Other ³	16

² We need to note that EUsurvey website was offline for 10 days in the first weeks of September which we consider it a very important timeframe, since many potential participants returned from their holidays and multiple newsletters were shared.

³ Including: Podiatrist, Lab supervisor/geneticist, Radiographer, Medical Physicist, Biomedical informatics (3), Clinical Trial Center

In the final stage, three focus groups were conducted in December 2024, involving 39 medical practitioners and nurses, each, to help with an inclusive and interpretive examination of the survey information gathered. The focus groups played a crucial role in analyzing the survey results, allowing stakeholders from the healthcare sector to validate key findings and translate them into concrete actions. The survey data, presented to the participants before the focus groups, shaped the discussions, while insights from the focus groups further clarified and contextualized the survey results. By capturing a variety of viewpoints and ensuring that the study's results were in line with the realities of the healthcare workforce in Flanders, this iterative method enhanced the final analysis.

Integrating AI in healthcare

Preliminary insights from key informants

In order to inform the design of the following research survey, the preliminary semi-structured interviews explored the opportunities and challenges of AI integration in healthcare. The interviews highlighted a collective emphasis on the need for practicality in AI training as an overarching concern, as well as the reduction of administrative burdens and ethical considerations arising from AI use as specific content-related issues. Not least, they highlighted references for learning modalities and the role of accreditation for healthcare workers. To actively engage healthcare professionals in relevant training, the most common argument was that AI tools need to provide practical benefits to their daily workflows, soon after their training. As one of the interviewees emphasized, "there will be more people interested when it is really practical, when you know how to use it in your daily practice" (Int_1). Similarly, another one pointed out that many professionals have "little time to really delve completely into something new," (Int_2) underscoring the need for tools that integrate seamlessly into existing systems. By implication, online courses were widely preferred, but they were perceived as coming with challenges, such as reduced engagement compared to in-person settings. Although many professionals preferred online learning for its flexibility, a researcher pointed out that specifically nurses often favor in-person training (Int_3). One way or another, the critical parameter for AI training integration that had to be explored was its contribution to the peoples' workload.

On this point, the most important potential contribution of AI that emerged from the interviews was related to the overwhelming administrative burden faced by healthcare professionals: the use of AI to automate repetitive tasks such as form completion and report generation was viewed as a promising solution. Most interviewees consented on the view that healthcare -and nursing, in particular - could benefit from AI tools to decrease the administrative burden and get more time for the patients. In this context, the head of a cardiology department highlighted that administrative tasks had grown over the years, reversing the time allocation between patient care and paperwork: "If I compare with 20 years ago, my focus was more than 80% on the patient and 20% on the administration. What we do see now is that it is just the opposite" (Int_7). In this context, several key informants shared the sentiment that saving time spent in administration could be the most critical contribution of AI.

The shortage of time was related also to workforce shortages especially in nursing and psychiatry. Accordingly, AI's role in assisting with tasks that are increasingly difficult to manage due to workforce shortages "help make the job of a nurse easier to get care where it's needed" (Int_15). AI's potential to improve patient care was another focus area. From simplifying patient tracking to offering personalized health information, professionals identified various ways in which AI could benefit patients. For instance, someone stressed that "anything that can ensure that the patient is better informed and gets info tailored to them at the time they are ready" (Int_2) would be valuable. More information does not always come without challenges, as it can exacerbate the tendency to over-test, potentially tipping the balance further in favour of over-diagnosis, as one associate

professor of medicine expressed his concerns (Int_8). This perspective highlights the need for careful consideration of the role of AI in healthcare to avoid unintended consequences. Rather than reducing administrative burden due to overdiagnosis, AI may ultimately enhance it.

In addition to this, AI's adoption brings inherent challenges, particularly regarding privacy, data security, and trust in opaque "black box" systems. A doctor underscored this issue, stating, "Everything that we helped validate or set up ourselves is fully trustable, but everything else developed as black boxes outside our environment, I don't trust at all" (Int_6). This skepticism underscores the importance of transparency and stakeholder involvement in AI development and deployment. Along this line, another interviewee emphasized the critical importance of using AI judiciously: while acknowledging its potential to assist with tasks such as language translation, he cautioned against over-reliance on AI systems, advocating for a balanced approach to ensure its proper application in diverse contexts.

These normative and ethical challenges raise the need for extensive training in order for the integration of AI in healthcare to come organically. Along these lines, many interviewees agreed on the importance of accredited courses for AI training. One of them noted that professionals are drawn to accredited programs because "they get points for the accreditation" (Int_6)⁴. However, these courses must directly impact clinical practice to attract interest. As another interviewee observed, "You need something that's directly influencing the practice before you go to a course" (Int_8). From a research perspective, the challenges and training needs of AI integration in healthcare must include well-structured training trajectories grounded in extensive, multidisciplinary research. This is where the current research survey plays a pivotal role, offering wide insights across diverse professional groups and healthcare settings.

Mapping AI training trajectories

Informed by the preliminary interviews with key informants, the second stage of this research utilized a survey to evaluate the learning needs and interests of healthcare professionals in Flanders regarding AI-literacy in healthcare. The survey garnered responses from a diverse group, including doctors, nurses, and healthcare managers, revealing both a strong interest in AI literacy and significant gaps in existing knowledge and training.

More analytically, a significant survey indication was that AI knowledge levels vary across different professions. Managers, physicians, and dentists reported higher AI expertise, while nurses, physiotherapists and pharmacists showed lower familiarity (see Figure 3). This indicated that AI exposure is not uniform across medical fields, with some roles integrating AI more actively than others. Age played a crucial role in these variations also, as expected. Mid-senior professionals (40-50 years) reported the highest levels of AI knowledge, whereas older professionals (>60 years) had the least, with some indicating no AI expertise at all (see Figure 4). Responses from the 50-60 age group were mixed, suggesting varying degrees of AI exposure within this demographic. Contrary to what was initially expected we can see that younger ages (<40) are not yet as familiar with AI, indicating the fact that AI is not yet part of the main curricula of

⁴ In Belgium, many healthcare professionals must follow continuous professional development (CPD) to maintain their accreditation, which is legally required for some professions. This system ensures they stay up to date, and explains why they value training that aligns with their daily practice.

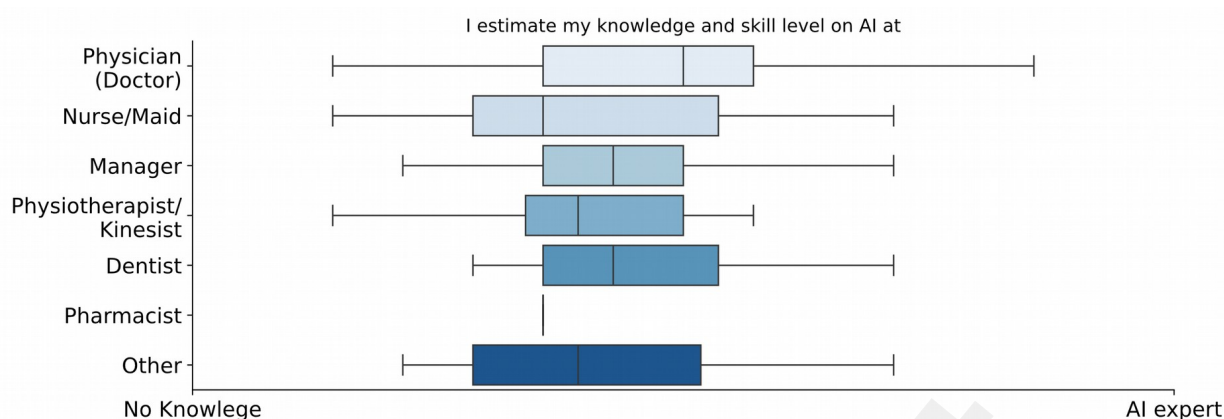


Figure 3 Self-estimation of AI knowledge based on occupation

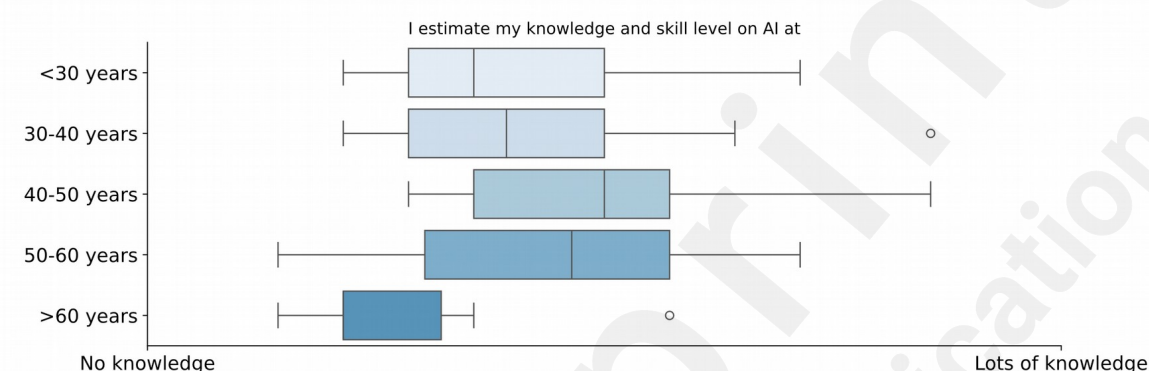


Figure 4 Self-estimation of AI knowledge based on age

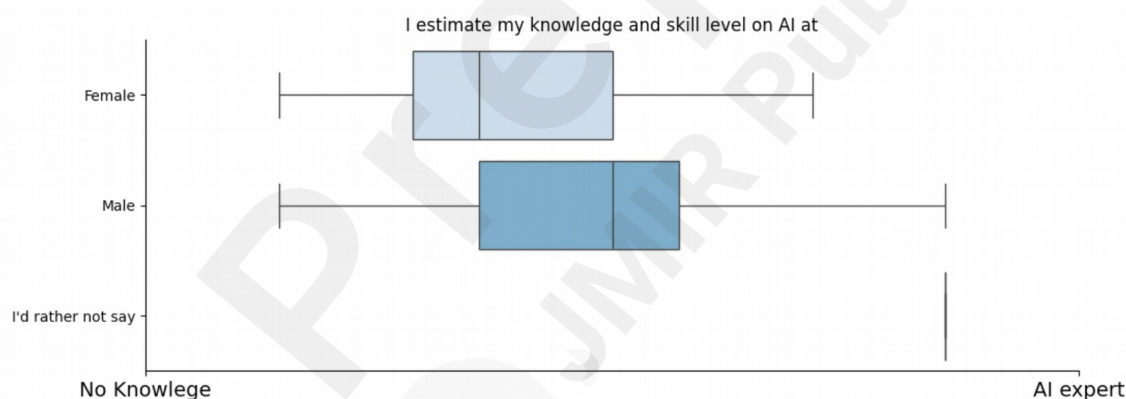


Figure 5 Self-estimation of AI knowledge based on gender

the universities in the healthcare faculties but a knowledge obtained by individuals in a later stage (either by post-graduate programs or by extra training courses). The only question where we observed a gender-based difference in responses was related to self-estimated AI knowledge (Figure 5). Male respondents generally reported higher self-estimations than female respondents. However, when analyzing responses within the same occupation, the differences disappeared. The overall gender disparity arises because our sample includes more female nurses (who tend to report lower AI knowledge self-estimations) and more male physicians, who report higher self-estimations. Therefore, the apparent gender difference shown in Figure 5 primarily reflect an occupational disparity rather than a true gender-based variation.

Concerning the type of knowledge that the respondents would like to acquire for AI, most respondents prioritized “gaining basic AI knowledge” (74.64%), learning to “be able to facilitate the

use of AI in my field (e.g. design a study, management, knowledge of ethics, etc.) - *no coding*" (70.29%), and "efficiently use pre-developed AI tools" (66.67%). Doctors and dentists were the two groups that were more interested (75.14% and 72.54%, respectively) in the facilitation of AI use in their field rather than the efficient use of pre-developed AI tools. Related to the exact topic of an AI course/training that they would like to follow, a significant majority of respondents expressed strong interest in an introductory AI course tailored to healthcare (85%), with nearly as many (80%) eager to acquire practical AI skills relevant to their field (see Figure 6). Learning priorities varied by age: younger professionals (<30 years) actively sought AI education, especially in decision-making and generative AI, while older professionals (>50 years) showed less interest in learning AI but acknowledged its role in reducing errors and improving patient confidence. The 30-50 age group balanced curiosity with concerns about practical implementation. These findings suggest AI education should be tailored - advanced AI training for younger professionals and practical implementation strategies for older ones. The survey further highlighted a strong preference for immediately applicable AI tools over advanced technical expertise.

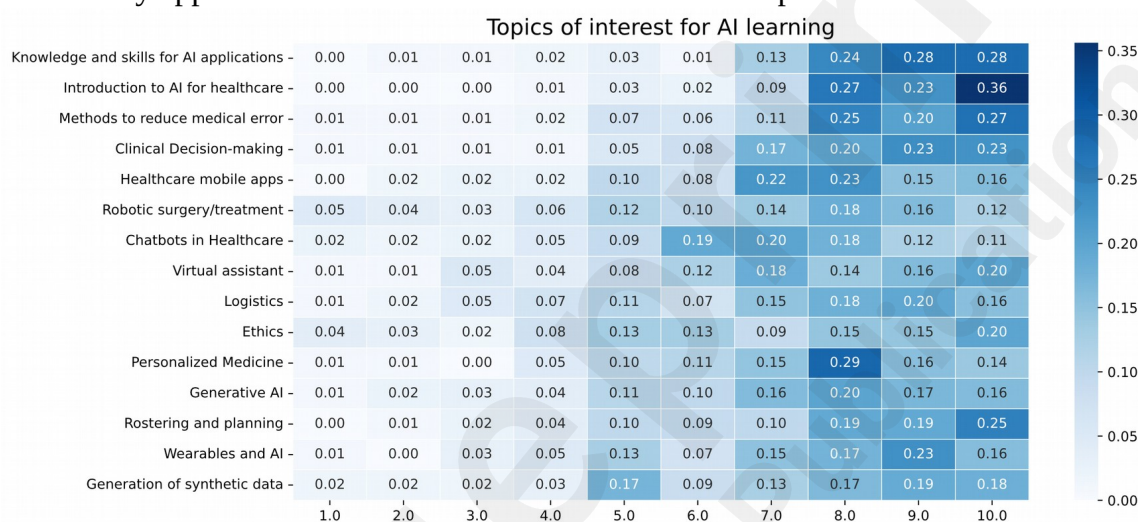


Figure 6 Topics of Interest for AI training (Likert Scale 1-10)

No significant difference was noted between respondents of different gender, while again a variability of the choices based on the occupation has been identified. The two most interesting topics for almost all the occupations are the two first of Figure 6, "Knowledge and skills for AI applications" and "Introduction to AI for Healthcare". For Nurses, though, "Rostering and planning" appears as the second most interesting topic (after the "Introduction to AI for Healthcare"), a topic which is much lower in the selection of the other occupations. "Personalized medicine" appears to be the third option for dentists, others and physicians (doctors), while "Methods to reduce medical error" appears more important for Managers, Nurses and Pharmacists. Another interesting finding is the fact that, contrary to previous studies [CITATION Civ22 \l 1033], the topic of "Ethics" is low in the interest of the respondents. The least interesting of the topics among almost all the groups (except for dentists, for which is penultimate) was the "Generation of synthetic data".

Different occupations exhibited distinct patterns in their training preferences and frequency. Dentists and clinicians were the most engaged in continuous learning, with the majority attending training sessions at least once per month. In contrast, professionals in other occupations typically participated in training once every three months or less. When selecting a course provider or topic, dentists, clinicians, and other healthcare professionals primarily trusted specialists in their respective domains, followed by their training institutions (universities or technical schools). However, physiotherapists and nurses prioritized recommendations from their employers over their training institutions. Managers stand out as the only group that places the highest trust in their employees'

suggestions regarding the choice of courses, rather than relying on peers or experts in their field. Across all groups, social media and government recommendations play only a small role in influencing training choices.

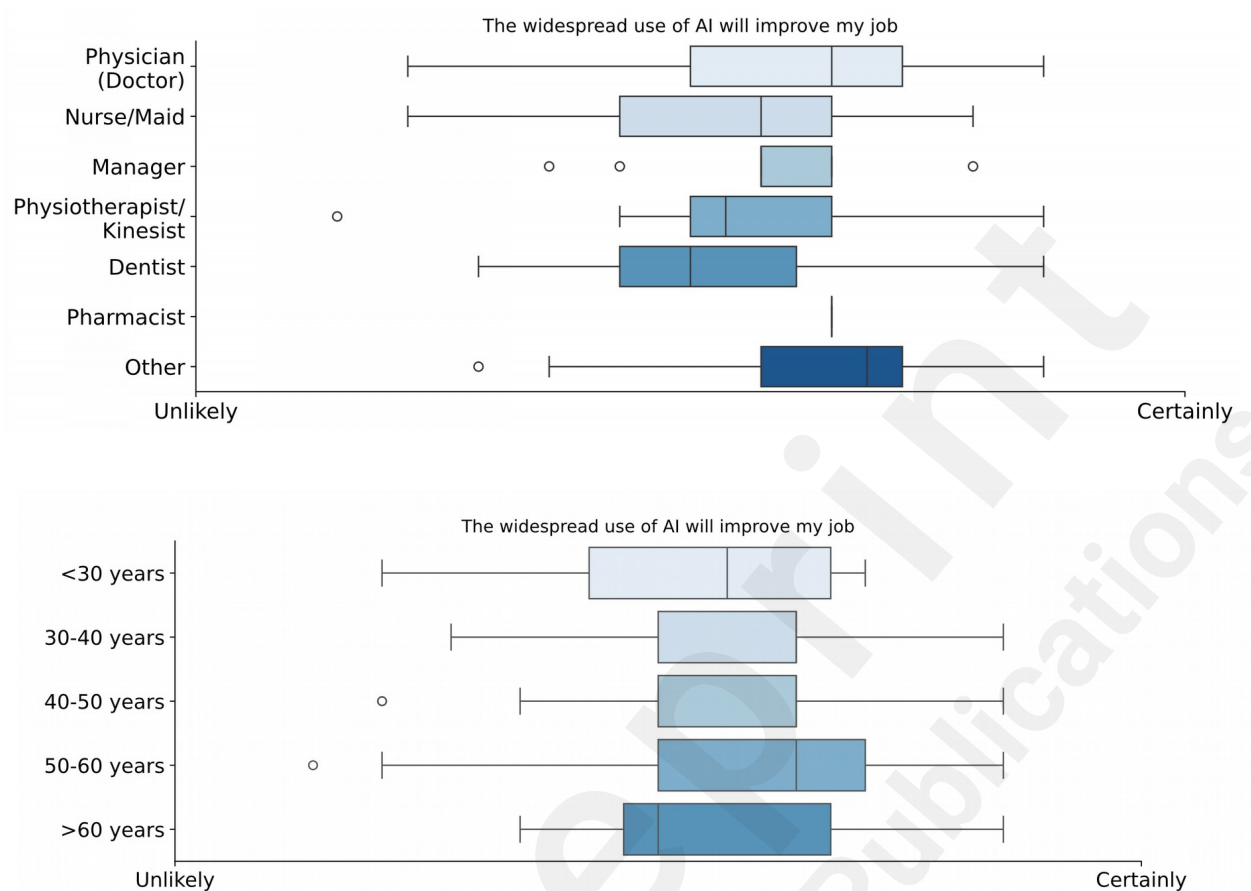


Figure 7
Opinion
about the

improvement that AI will bring into their job by occupation

Figure 8 Opinion about the improvement that AI will bring into their job by age

In parallel, perceptions of AI's impact on improving healthcare jobs varied by profession. Physicians and nurses were the most optimistic, while dentists and physiotherapists were more skeptical (see Figure 7). Managers and pharmacists held moderate to positive views. Similarly, younger professionals (<30 years) strongly believed AI would enhance their work, whereas older professionals (>50 years) were more cautious (see Figure 8). Regarding AI's future in healthcare, professionals identified its greatest contributions as increasing patient confidence, reducing diagnostic bias, enhancing decision support, and improving access to healthcare information (see Figure 8).

An interesting finding of the survey was how healthcare professionals perceive the risk AI poses to their work. Again, AI perception in healthcare varied significantly by profession, age, and potentially gender. Dentists and pharmacists felt the highest risk of AI replacing their jobs, likely due to automation in diagnostics and prescriptions. Physicians and nurses were more confident, with a broader distribution of responses (see Figure 10). Age also played a role, as younger professionals (<30 years) felt more at risk, whereas older professionals (>50 years) were less concerned, although neither were not significantly concerned (see Figure 11). This generational difference suggests that younger professionals, entering a rapidly evolving workforce, may feel more vulnerable to technological changes, whereas older professionals, with more established careers, perceive AI as less of a direct threat.

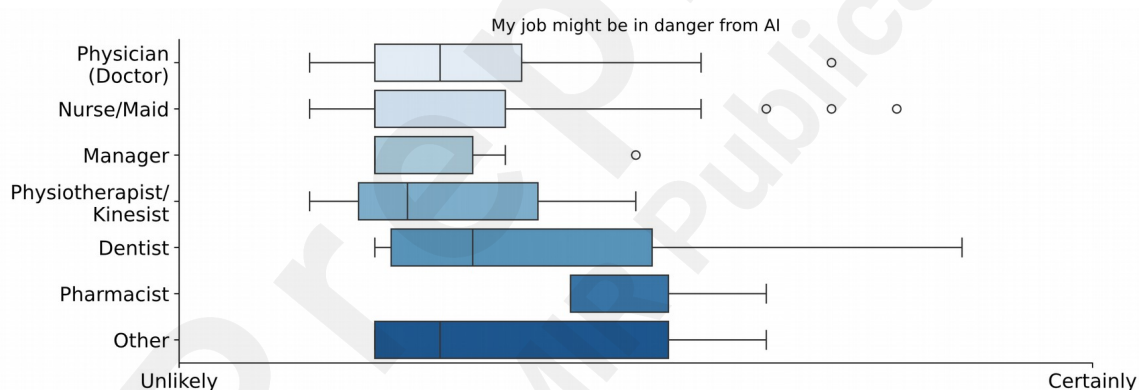


Figure 9 Opinion of the participants by occupation, about the danger that AI might bring to their job.

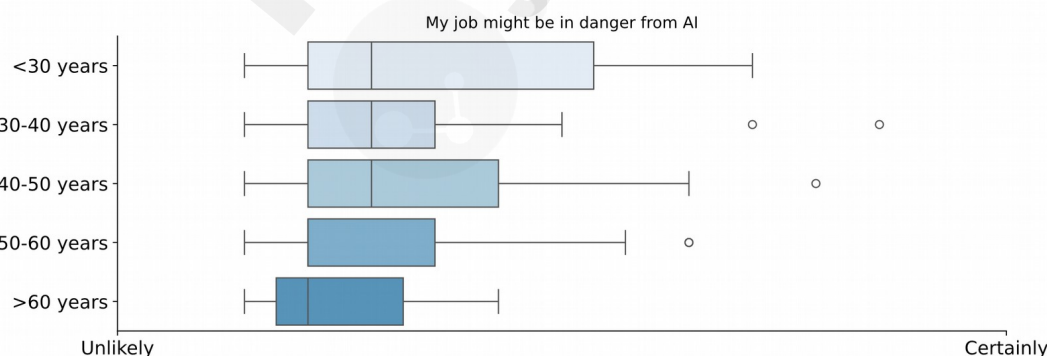


Figure 10 Opinion of the participants by age, about the danger that AI might bring to their job.

Younger professionals were more concerned about job displacement, likely, because they recognized AI's growing role in healthcare and wanted to stay competitive. This contrast reflects a mix of ambition and (modest) anxiety among younger professionals versus confidence and stability

among older ones. As mentioned by [CITATION Web19 \l 1033] the impact of AI on employment may manifest more through reduced entry into occupations—fewer young people starting these jobs—rather than through increased exits by older workers, leading to a disproportionate effect on younger workers and this “entry margin” effect might be reflected in the answers of the participants. If you consider the answers based on the occupation, we can note that pharmacists and dentists are the two groups that were slightly more concerned about their job and believed that AI will improve their jobs less (see Figure 10 and 6, respectively).

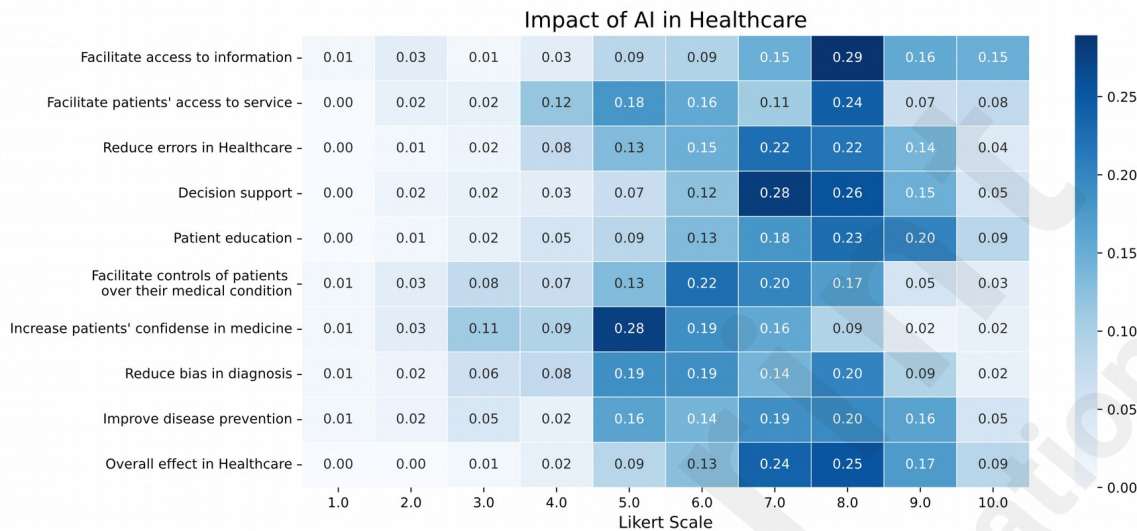


Figure 11

Impact of AI in Healthcare

The responses regarding the area where AI will have the greatest impact were quite diverse (see Figure 11). Participants generally agreed that AI would influence almost all the mentioned fields (access to information, patients' access to service, reduction of errors in healthcare, patients' education, control of patients over their medical conditions, reduction of bias in diagnosis, improvement of disease prevention and overall effect in healthcare). The only exception (or at least the area with the fewest responses based on the Likert score) was “increasing patients' confidence in medicine.” The most significant areas of impact, though closely followed by others, were “facilitating access to information,” “overall healthcare,” and “decision support systems.” Notably, no significant differences were observed across various demographic categories, including gender, age, occupation, or experience level.

Co-interpreting AI in Flanders' healthcare

The latest stage of this study focused on interpreting data through a collaborative framework of focus groups. A total of 39 participants took part in three focus groups, representing key stakeholders in healthcare and education, including lecturers from various disciplines (excluding practitioners), education and innovation hospital managers, representatives of nursing and radiology associations, and members of healthcare communities. To ensure efficient discussion and facilitation, the groups were structured as follows: 14 participants in the first group, 12 in the second, and 13 in the third. The focus groups were conducted in late December 2024, following a presentation of the initial survey results by the last author. Groups 1 and 3 were facilitated by the first author, while Group 2 was led by the last author (Groups 1 and 2 took place simultaneously following the “Split Groups Discussion” Methodology [CITATION RKr15 \l 1033]). Each group provided distinct perspectives on the integration of AI in healthcare, yet several overarching concerns emerged, particularly regarding generational differences in attitudes toward AI, trust in technology, and the evolving role of healthcare professionals.

Each focus group provided unique perspectives on AI integration in healthcare, confirming

several key survey insights while adding deeper practical and ethical dimensions to the discussion. Echoing survey responses, all three groups emphasized AI's role in reducing administrative burden, with particular interest in AI-driven solutions for documentation, scheduling, and workflow optimization. Discussions in the focus groups revealed a range of perspectives on AI in healthcare, with a particular emphasis on differences between professional groups, challenges in training, regulatory barriers, and disparities in available resources.

One of the central themes raised in the discussions was the difference between nurses and doctors in their access to and engagement with AI training. Participants noted that AI tools are primarily designed for doctors, while significantly fewer applications exist for nurses. This was seen as a major limitation, making it difficult for nurses to integrate AI into their daily routines. Additionally, nurses and doctors follow training at different times; nurses prefer courses during working hours and often expect compensation, whereas doctors tend to attend evening sessions. Some participants expressed frustration that funding for AI training is more readily available for doctors and research-oriented professionals, while nurses and paramedics have far fewer opportunities.

A recurring concern was the difficulty of developing hands-on AI courses. Many participants pointed out that the most relevant knowledge on AI implementation resides within private companies, but these companies are not interested in creating educational programs, rather, their focus is on selling AI products. This dynamic created a gap in practical training, as healthcare professionals needed guidance on AI applications but did not trust company-led training initiatives, rather than courses coming from universities. A few participants mentioned that radiologists were an exception, as companies do provide AI training in collaboration with the Radiology Society. However, in most other fields, there was a clear demand for co-created courses where universities and companies work together to ensure both credibility and relevance.

Another major topic discussed was the regulatory complexity surrounding AI in hospitals. Participants frequently emphasized that many AI tools were not allowed to be used in clinical practice, creating uncertainty about what is permitted. There was a strong sentiment that hospitals need clearer guidelines and policies to help professionals navigate AI implementation. Some participants felt that the lack of clarity leads to hesitation, making AI adoption slower than it could be.

Time constraints for training were another issue raised in the discussions. Doctors, especially those in private practices, had more flexibility in choosing when to follow AI courses, while nurses required training during work hours, which limited their opportunities. There was agreement that hospital management plays a crucial role in ensuring *all* healthcare professionals, not just doctors, have access to AI education. Several participants pointed out that doctors, who often earn more by seeing more patients, may have a financial incentive to adopt AI tools that improve efficiency, while nurses, who work on fixed salaries, focus more on how AI can support patient care and workflow improvements (supported also by the survey and their interest in courses related to Rostering and Planning). Participants also discussed the general lack of resources for AI education. There was widespread agreement that funding constraints made it difficult for hospitals and universities to develop robust training programs, especially for lifelong learning. Some attendees noted that universities tend to focus on AI education for students rather than professionals, as resources are limited, and institutional priorities are not always aligned with the needs of the workforce. A broader issue raised in the discussions was the lack of ready-to-use AI tools in clinical practice. Many participants emphasized that healthcare professionals need AI solutions that can be integrated immediately into their workflows, yet such tools are not widely available. Some expressed frustration that AI was often presented as a future technology rather than something that can help them today. Others pointed out that existing AI training often focuses on theoretical knowledge rather than practical applications.

A particularly interesting discussion arose around ethical considerations. While ethics courses are often integrated into broader AI programs, the focus groups revealed a clear generational divide in

how participants approached AI ethics. Some participants pointed out that younger professionals, particularly students, tend to prioritize ethical concerns, (as has also been pointed by previous studies contacted with students [CITATION Civ22 \l 1033]) whereas professionals in the workforce are more focused on AI as a functional tool. A common argument was that healthcare workers simply do not have the time to engage deeply with ethical discussions in their daily routines and believe that ethical concerns should primarily be handled by AI developers. However, there were diverging views within the groups. One participant argued that financial incentives drive much of the AI interest in healthcare, particularly among doctors who earn more with increased patient volume. In contrast, another participant from a postgraduate palliative care clinic shared that ethics was a major focus in their discussions, suggesting that ethical concerns become more prominent in fields dealing with sensitive end-of-life care. This small disagreement highlighted that while some professionals may deprioritize ethics, others see it as essential depending on the context in which AI is applied.

Across all three groups, discussions highlighted a complex and evolving landscape for AI adoption in healthcare. While there was general recognition of AI's potential, participants made it clear that their trust, learning needs, and expectations vary significantly based on their profession, work environment, and access to resources. Addressing these concerns will require targeted training strategies, clearer regulations, and better collaboration between academia, industry, and healthcare institutions.

Discussion

Commencing with Topol's argument that nearly every clinician at some point will be using AI (Topol, 2019), it became quite crucial to explore the requirements, obstacles and prospects of this wide AI adoption, as well as the key priorities and needs for AI training in these areas. In this regard, the current multifaceted, qualitative study provided a nuanced view of both opportunities and challenges in integrating AI into healthcare. This constituted the first comprehensive study of AI integration into the healthcare workforce and their learning needs. The study showed that while the vast majority of respondents recognized AI's potential to improve efficiency and reduce errors, it also revealed significant obstacles. Limited digital literacy (especially for older healthcare professionals), skepticism about AI's reliability, and lack of imminent "legally approved" AI solutions appeared as persistent barriers to adoption. Differences across age groups and healthcare occupations revealed intriguing trends. Younger respondents, particularly those under 30, were more likely to view AI as an integral part of their future careers and expressed a strong desire for hands-on training. Conversely, older participants often emphasized the practical benefits of AI in reducing administrative burdens, reflecting their focus on improving current workflows rather than acquiring new technical skills. In parallel, younger respondents expressed higher skepticism for the hazards of AI in replacing them.

While concerns regarding the ethical implications of AI in healthcare were frequently raised, ranging from bias in AI algorithms to patient data privacy, there was surprisingly little interest in dedicated training programs focused solely on AI ethics. This discrepancy suggests that while ethics remains a key concern, it is not seen as an immediate priority for skill development among healthcare professionals, who are more focused on practical AI applications and workflow integration. Given this reality, embedding ethical considerations within broader AI training, rather than presenting them as standalone courses, may be a more effective strategy. By integrating discussions on bias, transparency, and accountability into technical and clinical AI education, ethics can become a natural part of AI adoption rather than an isolated, optional subject. This approach ensures that healthcare professionals develop a nuanced understanding of AI's ethical challenges while remaining engaged in training that aligns with their immediate professional needs.

By aligning training with the expressed priorities of healthcare workers [CITATION Hua24 \l 1033] and overcoming barriers to accessibility [CITATION Des24 \l 1033], training programs can

play a pivotal role in creating a more AI-ready and digitally skilled workforce in Flanders thereby facilitating the broader scale-up of AI [CITATION Esm24 \l 1033]. What about scaling beyond Flanders and Belgium? Although the small sample size and limited scope of the current survey may raise concerns about the study's generalizability, this limitation is counterbalanced by the depth of qualitative data, which enhances confidence in the findings and provides a more nuanced understanding of the issue. Moreover, the study's primary aim is not to produce broad generalizations but rather to identify specific training needs and inform future research directions. Notably, existing studies in literature focus exclusively on medical students, overlooking the broader context of lifelong learning in healthcare, a gap that this research seeks to address.

The study reveals a complex relationship between age, occupation, resource availability, and attitudes towards AI in healthcare. Younger professionals non physicians, are generally more concerned about AI potentially replacing jobs, yet they remain more positive about using AI in their work. This dual perspective is likely linked to their limited access to resources, such as institutional support and opportunities for professional development and the fact that AI is not yet implemented in the bachelor programs of any (para) medical university/school in Flanders. Early-career professionals, facing restricted resources and administrative pressures (especially non-clinicians), may see AI as a valuable tool to alleviate workload and enhance their capabilities, making them more eager to integrate AI into their practice despite concerns about job security. In contrast, older professionals (>60 years) appear less concerned about AI replacing jobs but are more skeptical about actively using AI. This skepticism may stem from their well-established positions and greater access to resources, including institutional support, funding, and established networks, which reduce their perceived need for AI. Having navigated the early stages of their careers, they may feel less urgency to adopt new technologies, especially when their roles are more secure and supported. Essentially, their (more) resource-rich environment provides them with stability, reducing their perceived risk from AI but also limiting their motivation to engage deeply with new technology. Resource disparities significantly shape attitudes toward AI adoption, with some professionals (younger, nurses, physiotherapists and others) viewing AI as a crucial tool to mitigate resource constraints.

Occupations in healthcare show varying levels of exposure to AI. Clinicians such as radiologists and lab technicians face high exposure due to AI's growing capacity for data analysis and pattern recognition. In contrast, roles like nurses and care managers—where social intelligence, adaptability, and hands-on judgment are essential—are less exposed and more resilient to automation. This does not mean clinicians are at risk of replacement, but rather that their tasks are shifting. To stay relevant, they will need to adapt by integrating AI into their workflow, focusing on what AI cannot do: contextual reasoning, communication, and ethical decision-making. Meanwhile, roles with strong interpersonal and organizational components may see their value reinforced, provided they also adapt to AI-enhanced systems [CITATION Lan21 \l 1033].

Geographical context may further amplify these disparities, particularly in low- and middle-income countries (LMICs), where healthcare professionals often function as an invisible support workforce [CITATION MSa21 \l 1033], lacking the same access to AI training and infrastructure as their counterparts in high-income countries. Gender further complicates this equation: persistent gender discrimination in women's leadership roles within LMIC healthcare systems remains largely underexplored [CITATION Zah \l 1033]. Overall, AI adoption might hold the potential to promote fairer resource allocation, offering individuals in socio-economic constraints enhanced access to knowledge, skills and opportunities. However, the current study might imply that this progress comes with significant risks, since these same groups are also more vulnerable to job displacement and precarity, as AI-driven transformations may exacerbate existing inequalities rather than alleviate them.

These structural factors, while beyond the immediate scope of this study, represent key limitations. The research was conducted in a Belgian region, which may provide context for the lack of significant gender differences observed in the study. Belgium has a relatively high level of gender

equality in areas such as healthcare access, education, and workforce participation, which could contribute to minimizing disparities between genders in certain health-related or behavioral outcomes. Nonetheless, these findings highlight important directions for future research, urging a broader, intersectional approach that examines how AI acceptance in healthcare intersects with structural inequalities and more broadly access to resources. Recognizing these divisions is crucial for ensuring that AI integration fosters a more inclusive and equitable healthcare system, rather than reinforcing existing disparities.

Conclusion

This study provides the first comprehensive, region-specific investigation into the AI-literacy gap within the healthcare workforce. By triangulating insights from interviews, surveys, and focus groups, it offers a nuanced understanding of how healthcare professionals perceive, experience, and engage with AI and their needs related to AI literacy. While there is widespread recognition of AI's transformative potential—particularly in reducing administrative burden and enhancing clinical decision-making—significant disparities in access, training, and readiness persist across professional roles and age groups. Practical relevance, time constraints, and lack of legally approved tools emerge as consistent barriers, especially for nurses and mid-career practitioners.

Crucially, the findings suggest that a one-size-fits-all approach to AI training is inadequate. Instead, future learning trajectories must be stratified by occupation, age, and available resources, and they should prioritize hands-on applications over theoretical content. Embedding ethical considerations into practical modules—rather than isolating them—may also bridge the current disconnect between ethical awareness and perceived learning relevance. As Flanders prepares for the implementation of the EU AI Act, this research highlights a timely opportunity to co-create inclusive, accredited, and accessible AI training programs that reflect the lived realities of healthcare professionals. Doing so will be essential not only for scaling AI integration locally but also for informing broader European and global efforts to build an equitable, AI-ready healthcare workforce.

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APPENDIX

Survey



Defining the learning needs of healthcare professionals on artificial intelligence

This questionnaire is filled in anonymously. The survey team guarantees the privacy of all participants in this survey. The information you provide will be strictly confidential and will be used to define a learning trajectory for healthcare professionals, by VAIA and for academic purposes.

What is your profession?

1. What is your professional experience level? (years)

Maximum 1 selection(s)

- ☐ Entry level (0-3)
- ☐ Intermediate level (4-10)
- ☐ Senior-level (10+)

2. What is your healthcare occupation?

Physician (Doctor)
Dentist Pharmacist

Nurse
Midwife
Speech Therapist Dietician
Audiologist and Speech-Language Pathologist
Occupational Therapist
Podiatrist
Clinical Psychologist Other

Other

3. In which field are you working?

General Practice (Family Medicine)
Pediatrics

Internal Medicine Obstetrics
and Gynecology Surgery
Psychiatry
Cardiology Oncology
Neurology
Dermatology
Anesthesiology
Radiology

Emergency Medicine Other

Other

How do you learn?

4. How often do you follow training outside of your working hours:

Maximum 1 selection(s)

- ☐ Once per month
☐ Once every three
months ☐ Once per year
☐ Never

5. Whose suggestions do you value? Would you follow a training if it is suggested by (mark as many options as apply)

- ☐ My
employee ☐
My association
☐ My employer
☐ The government
☐ My training institution (university or
hogeschool) ☐ A specialist in my domain
☐ Facebook
☐ Linkedin
☐ X (former
twitter) ☐ Other

Other

What do you know about AI in healthcare?

AI, or Artificial Intelligence, is a technology that enables machines to **perform tasks that typically require human intelligence** and powers various tools beyond chatbots, like ChatGPT.

AI in Healthcare can act like:

- **Smart Assistants:** AI acts as a smart assistant, helping professionals by taking on complex tasks that usually require human intelligence. For example, AI can analyze X-rays or scans to detect diseases quickly, customize treatments based on a patient's unique genetic makeup, and assist in surgeries with high precision.
- **Virtual Health Advisors:** AI includes virtual assistants that provide health advice, remind patients about medications, and help manage chronic conditions. By integrating AI, healthcare professionals can offer more accurate, efficient, and personalized care to patients.
- **Administrative Support:** AI can handle administrative tasks such as scheduling appointments, managing patient records, and streamlining communication between patients and healthcare providers. This reduces the administrative burden on medical staff, allowing them to focus more on patient care.
- **Predictive Analytics:** AI systems can analyze vast amounts of data to predict health trends and potential outbreaks. This helps in early intervention and prevention strategies, improving overall public health outcomes.
- **Robotic Assistance in Surgery:** AI-powered robotic systems assist surgeons during complex procedures, providing enhanced precision and control. These systems can perform minimally invasive surgeries, reducing recovery times and improving surgical outcomes.
- **Image Segmentation:** AI techniques are used in image segmentation to accurately identify and label different structures within medical images. This aids radiologists in diagnosing conditions more precisely, leading to better patient outcomes.
- **Analysis of Wearables:** AI analyzes data from wearable devices, such as fitness trackers, smartwatches or wearable EEG, to monitor patients' health in real-time. This continuous monitoring helps detect irregularities early, manage chronic diseases, and promote proactive health management. The vast amount of data created by wearables are really time-consuming to be analyzed by doctors.

AI is a versatile tool enhancing many aspects of healthcare, not just through conversation via chatbots but also through analysis, assistance, and personalized care management. The integration of AI into healthcare systems promises to revolutionize patient care, making it more efficient, accurate, and tailored to individual needs.

7. How would you estimate the possible influences of AI on healthcare in these situations?
(1=low influence, 10=high influence)



	1	2	3	4	5	6	7	8	9	10
AI will facilitate medical staff's access to information.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will facilitate patients' access to the service.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will reduce errors in health-care provision.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will enable the physician to make more accurate decisions.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will facilitate patient education.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will allow patients to increase control over their own medical conditions	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will increase patient's confidence in medicine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will reduce bias in diagnoses	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI will improve disease prevention	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
AI's overall effect on medicine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Do you see other situations in which AI can have a low/high influence? Add your score in brackets ()

Do you see other situations in which AI can have a low/high influence? Add your score in brackets ()

8. The widespread use of AI will improve my job

9. My job might be in danger from AI

10. There should be a structured training on AI for healthcare occupations

11. Importance of topics that should be integrated into an AI training in medicine (1 low importance, 10 high importance)

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	1	2	3	4	5	6	7	8	9	10
Knowledge and skills about AI applications	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Introductory course to AI tailored to healthcare professionals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Techniques to reduce medical error	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Application for assisting clinical decision-making	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Widely used preventive health mobile applications	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Robotic surgery/treatment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Virtual assistant	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Large Language Models in Healthcare (chatbots)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Logistics	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Ethics (explainability, bias, objectivity, etc)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Applications of personalized medicine	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Generative AI (ChatGPT, CoPilot, Dall-E, Stable Diffusion ...)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rostering and planning	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wearables and AI	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Generation of synthetic data for privacy preservation and to augment the training data	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Are you thinking of another subject that might interest you? Add the importance grade in brackets ().

Are you thinking of another subject that might interest you? Add the importance grade in brackets ().

12. What outcomes would you expect from your training on AI

- ☐ Efficiently use pre-developed AI tools
- ☐ Gain basic knowledge on AI
- ☐ Be able to facilitate the use of AI in my field (e.g. design a study, management, knowledge of ethics, etc.) - *no coding*

- ☐ Technically implement AI - *coding*
☐ Become an AI
expert ☐ I am not
interested in AI

13. Are you interested in following training on AI?

- ☐ Yes
☐ No

14. Would you be willing to pay for a high-quality AI course focusing on healthcare

- ☐ No
☐ Yes
☐ Yes, only if it is accredited

Demographic information

15. What is your age?

- Maximum 1
selection(s) ☐
Under 30 years old
☐ 30-40 years old
☐ 40-50 years old
☐ 50-60 years
old ☐ Over 60
years old

16. What is your gender?

- Maximum 1 selection(s)
☐ Male
☐
Female ☐
Other
☐ I'd rather not say

17. Would you be willing to participate in a potential focus group for the discussion of training needs related to AI for healthcare professionals?

- ☐ Yes
☐ No

18. Would you be willing to participate in similar surveys?

- ☐ Yes
☐ No

19. We appreciate the time you took to fill in this questionnaire. That is why we will give away 10 books of "Zelf aan de slag met AI. Praktische gids om artificiële intelligentie te gebruiken in je dagelijks leven en werk" among the people who filled in this questionnaire. Would you like to receive one of these books?

- ☐ Yes

☐ No

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If your answer is yes for any of the questions 17, 18 and 19, please write down your email (we will not use this information for any other purpose than those explicitly mentioned in either question 17, 18 or 19).

According to the new data protection guidelines in the European Union, your approval is needed to allow us to use the data of your questionnaire. Data will be used for scientific use only. Do you agree to allow us, VAIA, to use your statements for scientific use? (Please note, if you select “no”, your answers cannot be used and will be deleted immediately.)



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Contact

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