The artificial intelligence (AI) competence paradox: how AI reshapes clinical expertise

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Abstract

Purpose – This study aims to examine how health-care professionals perceive artificial intelligence's (AI) impact on clinical competencies.

Design/methodology/approach – A qualitative methodology using semi-structured interviews with health-care professionals and AI experts.

Findings – Clinicians reported no deskilling with current AI applications, primarily attributing this to their narrow scope and pre-AI clinical training. However, they expressed concerns about deskilling risks for future generations of health-care professionals as AI capabilities expand and become more deeply integrated into clinical practice. A notable shift emerged in how competence is conceptualised: deskilling concerns centred on individual capabilities, while upskilling was framed through collective human–AI performance.

Research limitations/implications – The research is based on the specific context of the Swedish health-care system. Organisational structures and regulations may affect the transferability of results to other countries and systems. The purposive sampling method was designed to identify participants with practical experience of AI-driven automation in clinical settings. Few health-care providers in Sweden are working with AI today. This limits the selection of participants, but above all, it is often tech enthusiasts and enthusiasts who work with AI. These risks create a distorted picture that potentially creates a self-selection bias may underrepresent more critical perspectives on AI integration.

Practical implications – Health-care organisations face a critical but narrow window of opportunity to shape AI integration effectively. While current clinical competencies remain stable, this period of stability is likely temporary. Organisations must proactively identify core clinical competencies to preserve and develop targeted strategies to protect these skills. Key actions include strategic decisions about what to automate, human-centred system design, redesigned training programs and implementation of safeguards to prevent erosion of essential clinical expertise. These findings provide health-care leaders with a framework for managing the transition to AI-enhanced practice while preserving critical medical competencies.

Social implications – Patients' trust and relationship with doctors are a cornerstone of health care. As AI is increasingly incorporated into health care, it is crucial for society that essential human elements such as trust and empathy are not disrupted, but rather developed.

Originality/value – This study reveals how AI integration shifts focus from individual to collective capabilities. It advances the understanding of how AI integration affects professional expertise by revealing the complex interplay between individual clinical competencies and emerging forms of human–AI collaboration.

Keywords AI, Health care, Deskilling, Upskilling, Competence

Paper type Research paper

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Introduction

Medical expertise is one of the most crucial factors in health care as it directly impacts patients' health, quality of life and survival. As artificial intelligence (AI) becomes increasingly integrated into health care, we face a critical balance: taking advantage of technology without jeopardising core professional competencies. With the rise of advanced technologies, automation enables organisations to automate an increasing portion of their knowledge work (Parasuraman *et al.*, 2000; Rinta-Kahila *et al.*, 2023). In health care, AI is gaining momentum as a transformative technology, with a growing role in optimising clinical workflows, decision-making processes and improved diagnostic accuracy (Meskó and Topol, 2023; Shah *et al.*, 2024).

Against this backdrop, the study explicitly explores the following research question:

RQ1. How do health-care professionals perceive the impact of AI integration on their clinical competence?

Addressing this question is essential because understanding clinicians' perceptions can reveal critical implications for training, competence management and future clinical practice. Studies indicate that AI is increasingly reshaping diagnostic imaging, demonstrating high accuracy in image segmentation, computer-aided diagnosis and predictive analytics – sometimes even outperforming radiologists in specific tasks (Najjar, 2023). This result is a promising advance for medicine, but it is also a development that suggests that the role of doctors is likely to undergo significant changes in the future. Physician competence is a cornerstone of health care and encompasses medical skills, clinical judgement, ethical reasoning and the ability to manage uncertainty in complex patient cases (Epstein and Hundert, 2002). These skills are essential for providing patient-centred care and ensuring good care (Kaldjian, 2010).

With AI systems increasingly expected to support clinical workflows, it becomes important to understand how these technologies interact with and potentially reshape the core competencies that define medical practice (Pavuluri *et al.*, 2024). Several researchers warn that deskilling could become increasingly severe as technology automates more cognitive tasks (Aquino *et al.*, 2023; ElHassan and Arabi, 2024; Lu, 2016; Pesapane *et al.*, 2018). Deskilling refers in this study to the reduction in judgment, autonomy, decision-making quality and knowledge required to perform specific tasks (Aquino *et al.*, 2023).

Insights from domains such as aviation (Rignér, 2020), maritime operations (Bhardwaj, 2013) and accounting (Rinta-Kahila *et al.*, 2023) demonstrate that automation diminishes human skills as the degree of automation increases. For instance, global positioning system (GPS) use has been linked to impaired spatial memory and reduced cognitive engagement (Czerwinski *et al.*, 2008; Dahmani and Bohbot, 2020). When relying too much on GPS, even experienced navigators risk losing the intuitive feel of map reading and terrain. Doctors who rely increasingly on AI systems may face a similar challenge. Just as navigators lose their "mental map" of terrain when over-relying on GPS, doctors risk losing their "clinical map" – the intricate Web of knowledge and intuition built through years of diagnosing, observing and synthesising information.

Understanding the perceptions of health-care professionals is valuable, as they are not just observers but key stakeholders. They influence how AI technologies are integrated into clinical practice, and their perceptions of the present and future can provide valuable insights.

While earlier research has identified risks of technology dependence weakening patient care, the impact on physicians themselves has been relatively unexplored (Lu, 2016). Macnamara *et al.* (2024) argued that interdisciplinary research is needed to ensure that advancements in AI do not come at the expense of human expertise. They pose questions about whether reliance on AI contributes to deskilling among professionals and what factors influence this process. However, while there is a risk of deskilling, there are simultaneously opportunities for upskilling. By automating monotonous tasks, doctors can be free to engage in more developmental and skill-building activities (Morandini *et al.*, 2023). AI can also be a potent tool for developing doctors' skills in medical education. One such area is virtual patient simulators, which allow clinical reasoning practice. In addition, educators can add intelligent tutoring systems to provide personalised feedback that develops students' medical reasoning (Gordon *et al.*, 2024).

This paper addresses a notable gap in current research by shifting focus from what AI does in clinical settings to how it transforms health-care professionals' own understanding of competence, learning and role development. While the implications of AI for workflows and decision-making in health care have gained attention, we still know little about how health-care professionals interpret its influence on their own skills, learning paths and evolving roles. Existing studies often focus on performance metrics, implementation barriers (Guo *et al.*, 2024, 2025; Shah *et al.*, 2024; Siira *et al.*, 2024). This study takes a different approach by focusing on how professionals interpret the evolving role of competence when working alongside AI. While clinicians rarely question the individual nature of competence explicitly, their descriptions of improved performance through AI collaboration indicate an emerging logic of shared expertise. These reflections, as the paper will show, raise new questions about how competence is understood and where it is seen to reside – especially in light of increasing collaboration between humans and AI. As clinicians describe their own experiences alongside concerns for future practitioners, new interpretive possibilities begin to surface. In doing so, the study offers an interpretive lens on how AI integration may affect not only what professionals do, but how they come to understand competence itself.

The paper is organised accordingly: following the introduction, previous research on AI in health care and theoretical perspectives on deskilling and upskilling are presented. The methodology section outlines the study's design, data collection and analysis methods. The results section is structured around key themes identified through the Gioia method. Finally, the discussion and conclusion reflect on the study's contributions, limitations and suggestions for future research.

Previous research

Artificial intelligence in health care

Previous research has highlighted the transformative potential of AI in health care, particularly in diagnostics, clinical decision-making and personalised medicine (Alowais *et al.*, 2023; Secinaro *et al.*, 2021). As AI systems increasingly handle tasks traditionally reserved for human expertise, such as image interpretation, complex pattern recognition and predictive assessments, they pave the way for substantial changes in clinical practice (Lai *et al.*, 2021; Nadella *et al.*, 2023). Predictive decision support systems, such as prescience, have the potential to assist clinicians in enhancing real-time decision-making. For instance, the system can leverage vital signs data to predict and alert anaesthetists up to five minutes before a critical event, such as hypoxaemia during surgery, enabling earlier detection by up to 15% (ElHassan and Arabi, 2024).

Due to its long history with technological tools, radiology was one of the first fields to adopt AI solutions (Pesapane *et al.*, 2018), and they are still at the forefront. One example is implementing an AI-based decision support system for mammography analysis at Capio Sankt Göran Hospital in Stockholm, Sweden. This implementation led to a 4% increase in cancer detection rates compared to conventional double reading by radiologists (Dembrower *et al.*, 2023). Similarly, deep learning models for chest X-ray interpretation have significantly improved diagnostic accuracy across 80% of clinical findings, underscoring AI's potential to refine radiological assessments (Seah *et al.*, 2021). Pathology, a field that has begun exploring adaption of AI tools, shows significant promise but faces unique challenges, such as handling gigapixel images. While radiology benefits from well-established standards like digital imaging and communications in medicine and picture archiving and communication system, digital pathology still needs to define a dominant standard, which complicates broader adoption (Bumgardner *et al.*, 2023). Broader AI applications are emerging in areas such as robotic surgery and predictive patient monitoring. Despite this, AI has yet to achieve widespread clinical implementation across other areas of health care in Sweden. For example, evidence from internal surveys in Region Stockholm revealed well over 100 AI applications in various stages of research and pilot testing, but only a handful have been fully implemented in clinical practice as of November 2024 (Region Stockholm AI Project, unpublished data).

Given AI's rapid development and organisations' renewed interest in increasing their use of AI, the rate of adoption will likely increase in the coming years. The expected developments reinforce the importance of understanding the impact of AI-infused automation on physician competencies.

Theoretical perspectives on deskilling and upskilling

The concept of deskilling – the reduction or loss of skills required for specific tasks due to new technologies or changes in work processes (Aquino *et al.*, 2023; ElHassan and Arabi, 2024) – has been a recurring theme throughout history. In *Phaedrus*, Plato quotes Socrates warning that the emerging writing technology would lead to forgetfulness and diminished learning ability, as people would rely on external tools rather than exercising their memory (Plato, 2005/Original work ∼370B.C.E.). This historical reference reflects the timeless question of how technology weakens human capabilities.

It was in the 1970s that Braverman, an American Marxist, introduced the term "deskilling" to describe the effects of mechanisation and automation during the Industrial Revolution (Braverman, 1974). He argued that deskilling was a systematic process driven by the logic of capitalism. By standardising tasks, employers were able to replace specialised workers with cheaper and less skilled labour. Inspired by Taylor's (1911) scientific management, Braverman emphasised the role of division of labour, where complex jobs break down into simple, repetitive tasks. Deskilling, according to Braverman, undermined workers' autonomy and professional pride.

This deterministic view, however, has been challenged by scholars like Attewell, Littler and Salaman (Attewell, 1987; Littler and Salaman, 1982), who argue that the relationship between technology and skill is far more nuanced and multifaceted. Attewell emphasises that while some tasks may become simplified, new technologies often create roles requiring advanced technical expertise. This view sees deskilling as part of a bigger reshaping of skills, driven by how organisations work and managers' decisions, rather than something technology automatically causes.

Similarly, Orlikowski and Barley (2001) underscored the importance of considering both the material properties of technologies and the role of human agency in shaping their effects. They argue that deskilling is not a consequence of technology alone but a result of the interplay between design decisions, organisational environments and user engagement with these technologies. This perspective builds the argument that deskilling is not an inevitable consequence of technological change but depends on how technologies are adopted and integrated into specific work environments.

In contemporary discussions, a growing strand of the deskilling debate focuses on how AI-induced automation affects cognitive abilities (Gerlich, 2025; Rinta-Kahila *et al.*, 2023; Sutton *et al.*, 2023). In this context, concepts like automation bias, automation complacency, human-in-the-loop and cognitive offloading play important roles. Automation bias refers to the tendency to rely too much on AI recommendations (Rinta-Kahila *et al.*, 2023), and automation complacency describes the reduced vigilance that occurs when AI systems are assumed to be infallible (Rinta-Kahila *et al.*, 2023). The human-in-the-loop approach addresses the importance of maintaining human oversight (Sezgin, 2023). Cognitive offloading refers to the tendency to rely on external systems for cognitive tasks, which can lead to a weakening of independent analytical skills (Gerlich, 2025).

In the ongoing debate, AI is also seen as a potential enabler of skills development – illustrating the paradox that AI-infused automation can both erode and enhance professional competence. Rather than only eroding cognitive abilities, AI can facilitate skill development by enhancing specific aspects of professional growth (Gerlich, 2025). Sawant *et al.* (2022) defined upskilling as increasing an individual's competence in the same occupational domain. Upskilling usually occurs when the individual learns new techniques or tools that are relevant to their current work. The aim is to improve performance and continued relevance in their field. Upskilling goes beyond core knowledge to include ethical behaviour and broader professional development.

Deskilling and upskilling in health-care settings

The integration of AI into health-care systems brings multiple challenges that require urgent attention. Scholars have extensively focused on challenges such as data security, privacy, ethical considerations, biases and lack of transparency (Bergquist *et al.*, 2024; Murphy *et al.*, 2021), but they have given comparatively less attention to how automating cognitive tasks might impact clinicians' skills.

This is despite it being acknowledged that deskilling is a potential issue (Aquino *et al.*, 2023; Lu, 2016). At the same time, upskilling – where new competencies emerge, or existing skills are enhanced – also remains an underexplored dimension of AI-enabled clinical practice. Aquino *et al.* (2023) have conducted one of the few empirical studies exploring stakeholders' attitudes towards AI automation in health care. In their study, they present a multifaceted perspective. The utopians see deskilling as a prerequisite for creating space for long-term upskilling, which in turn should lead to improved care. The dystopian group instead sees deskilling as a significant danger. Doctors' skills will deteriorate in terms of both clinical judgement and diagnostic reasoning. This, they argue, risks leading to reduced empathy in health care. However, the majority of stakeholders in Aquino's study occupy a middle position where they see both the risks of deskilling and the opportunities for increasing competence.

Automation bias is a well-known risk associated with the automation of cognitive tasks. When Goddard *et al.* (2014) examined how doctors reacted when a clinical decision support system made assessments different from their own, they found that in 5.2% of cases, the doctors changed their previously correct decisions to incorrect ones. However, the overall accuracy of decisions was still improved. Additionally, Goddard and colleagues found that less experienced clinicians were more prone to decision-switching than their more experienced counterparts.

A recently published study in Nature Medicine examined the individual effects of AI assistance on 140 radiologists in interpreting chest radiographs (Yu *et al.*, 2024). The analysis indicated significant individual differences in the usefulness of AI support. It also showed that neither experience-based factors, such as years in the profession, specialisation or previous experience with AI tools, could reliably predict how AI support would affect individual radiologists' performance.

Method

This study uses a qualitative interpretative approach (Elliott and Timulak, 2005; Szklarski, 2002) to explore the perceived impact of AI-driven cognitive automation on clinical competencies. The following sections describe the empirical selection, data collection and analysis method.

Empirical selection

The recruitment process used a combination of purposeful sampling (Patton, 2015) and snowball sampling (Biernacki and Waldorf, 1981) to ensure a rich, relevant and diverse set of perspective of AI usage in different clinical contexts. This approach ensured access to key informants with varied perspectives on using AI in health care. Participants included professionals such as radiologists (4), pathologists (4), radiation physicists (1), general practitioner (1), nurse (1), AI expert and AI researchers (4), each with direct experience working with AI-based clinical systems. Several participants held multiple professional roles or had experience across categories, but are listed here according to their primary role or the capacity in which they were interviewed. The 15 participants were purposefully selected to achieve sufficient diversity and depth of experiences while remaining manageable within a qualitative, interpretive study framework. The inclusion criteria required participants to be health-care professionals or AI researchers with experience in health-care applications, specifically either (1) health-care professionals with experience using AI-based support systems in clinical practice or (2) AI experts/researchers working in health-care-related roles or conducting AI research in medical/health-care contexts. While recognising that this sample size is limited, the chosen number aligns with established qualitative guidelines recommending smaller, deeply analysed samples for exploratory research, especially when the topic requires rich, in-depth narratives (Elliott and Timulak, 2005). Given the current scarcity of health-care professionals regularly working with AI in Sweden, particularly within diagnostic contexts, identifying and recruiting qualified respondents posed significant practical constraints. For example, according to one of the interviewed participants, Sweden currently has only approximately 370 pathologists, and in most places, AI support is not yet being used. Thus, the selected sample size represents a balance between methodological rigor, depth of analysis and pragmatic considerations related to participant availability.

Data collection

Semi-structured interviews (Pin, 2023) were conducted via Teams from June 2024 to February 2025. Each interview lasted between 30 and 50 min. An interview guide outlined key themes: current use of AI and experiences, benefits, risks and potential, perceived impact on clinical skills and expectations for the future.

Interview questions were adjusted over time based on insights from previous interviews.

Ethical considerations

The research was conducted in compliance with standard ethical guidelines for qualitative studies in social sciences and information systems research (All European Academies, 2023; Vetenskapsrådet, 2024). Participation was voluntary, informed consent was obtained from all interviewees and anonymity was ensured in data reporting. Given the nature and scope of the study, and according to national research guidelines for qualitative studies without sensitive personal data, formal ethical approval was deemed unnecessary.

Method of analysis

The data analysis followed the Gioia methodology (Gioia *et al.*, 2013), chosen for its ability to inductively identify theoretical insights directly grounded in participants' experiences while systematically structuring findings into clear and replicable categories. This approach is suitable for exploring nuanced perceptions and experiences. It facilitates the transparent extraction of meaning from qualitative data. The analysis was structured explicitly following Gioia's prescribed approach. First-order concepts were identified directly from participant transcripts, closely reflecting their original wording. Second-order themes emerged through interpretive analysis, synthesising recurring patterns and theoretical significance. Aggregate dimensions were subsequently developed, representing broader categories linking second-order themes. The analytical process was iterative and recursive, moving repeatedly between raw data and emergent analytical themes. To support transparency, rigor and consistency throughout the coding process, the qualitative software Atlas.ti was used. The following section presents key themes emerging from the data, structured according to the Gioia methodology (see Table 1). Atlas.ti was used to facilitate the analysis.

Results

Through the Gioia approach, I identify four dimensions that form the structure of the results section.

Sustained clinical competence amidst current artificial intelligence integration

A consistent finding across all interviews was that the AI solutions currently implemented in Swedish health care are limited to narrow, highly task-specific applications. Participants emphasised that these systems only perform specific tasks that complement rather than replace clinical expertise. "The AI we currently use is almost just a really highly, highly advanced calculator with enormous performance", noted a general practitioner and researcher. Similarly, a pathologist explained that AI only performs computational tasks without analytical reasoning: "AI only counts the cells and performs the quantification". Respondents emphasised that AI operates as a supportive tool rather than a disruptive force in clinical practice. "For us, AI is more of a sophisticated tool, not something that completely changes our core skills", explained a radiologist. Echoing this view, a pathologist highlighted the role of AI as one piece of a larger clinical puzzle:

> It is during the multidisciplinary discussions with oncologists and radiologists where the results are presented […] The oncologist then looks at the results, together with their own algorithms, and determines which treatment to use.

Reinforcing this notion, an orthopaedic surgeon noted, "I do not see any major threats to our competence".

None of the respondents indicated any perceived decline in their clinical competence due to AI implementation. The respondents attributed this perceived absence of deskilling to the current narrow nature of AI applications in health care. "Just as a calculator has not diminished math skills, AI is enhancing clinical work without reducing core skills," stated a radiologist. Echoing this sentiment, another respondent remarked:

> It is a bit like when calculators were introduced, and people thought it would make us worse at math. We have not lost math skills by using calculators; we have just upgraded the level.

Another radiologist added, "Despite automation, no one has lost competence yet; it has just helped us be more precise".

Table 1. Gioia coding structure

Example quotes	First-order concepts	Second-order themes	Aggregate dimensions
The AI we currently use is almost just a really highly advanced calculator with enormous performance	AI is primarily used for narrow, task-specific applications	Narrow and task-specific AI applications	Sustained clinical competence amidst current AI integration
AI only counts the cells and performs the quantification	AI performs computational tasks without analytical reasoning		
For us, AI is more of a sophisticated tool, not something that completely changes our core skills	AI is a supportive tool that complements clinical expertise	Supportive tool rather than a disruptive force	
However, I do not see any major threats to our competence	AI poses no major threats to current competence		
It is during the multidisciplinary discussions with oncologists and radiologists that the results are presented and statements … The oncologist then looks at the results, together with their own algorithms, and determines which treatment to use	Multidisciplinary decision-making process		
Just as a calculator hasn't diminished math skills, AI is enhancing clinical work without reducing core skills	No observed deskilling with current narrow AI applications	Perceived absence of deskilling among current practitioners	
It's like when calculators were introduced, and people thought it would make us worse at math. We haven't lost math skills by using calculators; we've just upgraded the level	Current tools enhance clinical work without reducing skills		
Despite automation, no one has lost competence yet; it's just helped us be more precise	Automation increases precision without reducing competence		
We still belong to a generation that is fully trained in making independent assessments, and I believe that is crucial	Confidence in current clinicians' ability to make independent decisions		
Quantity training … simply looking at a lot, a lot of images that build up some kind of knowledge bank in the head … how can it be ensured? If double-checking disappears, for example	Risk of losing foundational knowledge-building through hands-on image review	Declining opportunities for foundational skill development	Future risk of deskilling
With future generations, there is a risk they might not develop foundational skills	Risk of skill underdevelopment		
What happens to those who start performing surgeries with robots without ever learning the classical methods?	Concern for erosion of fundamental surgical skills due to reliance on robotics		
Double-reading with AI [instead of two humans] risks diminishing training for junior radiologists who benefit from extensive case review with senior professionals	Junior radiologists risk reduced training opportunities with AI		

(*continued*)

Table 1. Continued

Example quotes	First-order concepts	Second-order themes	Aggregate dimensions
All tools have the potential to erode competence	The inherent risk of AI-tools to deskill	Ever-present risk of deskilling	
It's important to keep the human aspect … if we rely too much on AI, we might lose the human creativity and curiosity that often leads to important discoveries	Risk of losing human creativity and curiosity due to over-reliance on AI	Erosion of human-driven innovation and foundational skills in AI-reliant environments	
If AI says one thing and I think differently, how do I handle that? Or worse, I might defer to AI's judgment, assuming it's correct, even when I would have reached a different decision on my own	Risk of deferring to AI judgment over personal clinical reasoning	Automation bias among less experienced clinicians	
When you're inexperienced, it's easy to lean on the AI's assessment if it differs from your own. There's a risk this could negatively affect your own judgment	Inexperience increases reliance on AI, risking diminished independent judgment		
What will be the long-term change from this? That we become dependent on technology, and that much of the competence resides within IT rather than in healthcare?	Long-term risks of dependency on technology over clinical skills	Expanding capabilities of AI	
My perception, intuitive and speculative, is that we will move towards a general intelligence that will essentially handle 80% of jobs	Potential for general AI to replace a significant portion of tasks in the job market		
I don't think it [deskilling] is a significant issue today, but it has the potential to quickly develop into a major problem. The reason is that the implementation of these models will occur exponentially, and the models themselves will become increasingly complex at the same pace	Exponential implementation and increasing complexity in AI models leading to deskilling		
As a result, we risk losing a crucial dimension: the transition from junior to senior levels within various professions			
If double-reading disappears because of AI, we need to establish new processes to ensure residents still get the experience they need. Maybe involving a resident, a radiologist, and AI together	New processes needed to ensure experience	Redesign training framework to sustain competence	Need for adapted education and training

(*continued*)

Table 1. Continued

Example quotes	First-order concepts	Second-order themes	Aggregate dimensions
It's crucial that training adapts, ensuring future radiologists don't rely solely on AI, as that could affect their skills	Adapting training to balance reliance on AI and skill retention		
There needs to be regular exposure so that competence doesn't erode	Find a way to ensure continuous exposure		
AI can be a fantastic tool for enhancing pathologists' training. It gives us a chance to get faster feedback on our assessments, which can be very helpful in the learning process	AI as a tool for hands-on learning and feedback	AI as a tool for learning	AI for upskilling
Digital pathology and AI are a major asset for training in pathology	AI as a training asset		
When AI and human experts combine, the quality improves significantly	Collaboration between AI and humans improves diagnostic quality	Enhanced clinical outcomes through combined human–AI capability	
I believe AI enhances radiological competence	AI enhance radiological competence		
It would be extremely valuable to have two assessors for each individual cancer case, given how critical the diagnostics we are working with are	AI integration can enable double-review processes in diagnostics		
The important thing here is that AI will not replace pathologists, but we will become much better pathologists by using AI	AI will enhance professional competence rather than replace pathologists		
If we can develop an AI that eliminates many of the routine examinations, we will save a significant amount of resources. Those resources can then be allocated to more complex cases	Resource reallocation from routine tasks to complex cases with AI		
We are in co-evolution with AI	Development in collaboration with AI		
AI gives us more capacity, allowing us to focus on complex tasks and patient interaction	AI integration enhances capacity for complex tasks and interaction		
I specifically sought out a workplace with advanced digital and AI use – it's one of the important factors	Workplace appeal linked to AI use	AI integration contributes to professional satisfaction and meaningful work	
We have students who have only worked with digital pathology, and they are very satisfied and knowledgeable	Students trained with AI are satisfied and knowledgeable		

Source(s): Created by authors'

An additional reason cited for current clinicians' lack of deskilling is their comprehensive training in making independent [non-AI-assisted] decisions, a capability respondents highlighted as vital for preserving competence and clinical judgment: "We still belong to a generation that is fully trained in making independent assessments, and I believe that is crucial" (orthopaedic surgeon).

The common perception was that today's AI tools do not undermine clinicians' core competencies. However, two AI experts expressed a somewhat divergent standpoint, suggesting that *all* forms of automation and tools can contribute to some degree of competence degradation: "All tools have the potential to erode competence" (AI expert).

Future risks of deskilling

In contrast to the respondents' perception that AI had not diminished their clinical competence, they conveyed a concern that future generations of clinicians may face a risk of deskilling. The respondents provided several reasons for why they feared upcoming generations of clinicians would be at a higher risk of deskilling. A common concern was that automation could result in declining opportunities for foundational skill development.

Respondents linked this concern to their expectations that in the future, AI will take over more and more tasks that have previously been part of training and skills development:

> Quantity training […] simply looking at a lot, a lot of images that build up some kind of knowledge bank in the head […] how can it be ensured? What if double-reading disappears, for example?

Double-reading is the process entailing two radiologists assessing every image, which is standard practice during mammography in Sweden. The method increases safety and provides training opportunities for more junior radiologists. However, the anticipated integration of AI into this workflow – replacing one of the human reviewers – has raised specific concerns regarding the training of junior radiologists: "Double-reading with AI risks diminishing training for junior radiologists who benefit from extensive case review with senior professionals". This concern about diminishing opportunities for skill development was also echoed by an orthopaedic surgeon, who reflected on the potential long-term effects within their field: "What will happen in a few generations […] What happens to those who start performing surgeries with robots, without ever learning the classical methods?"

Another dimension of the concern about deskilling relates to the potential erosion of human creativity and curiosity in environments that become overly reliant on AI. A radiologist highlighted this risk, emphasising the importance of maintaining the human element in clinical practice: "It is important to keep the human aspect… If we rely too much on AI, we might lose the human creativity and curiosity that often leads to important discoveries".

Participants were also concerned about automation bias and its potential implications, particularly for junior clinicians, in the future. Respondents emphasised that less experienced clinicians may be particularly vulnerable to overconfidence in AI output, which could undermine the development of critical thinking and independent clinical judgment: "When you are inexperienced, it is easy to lean on the AI's assessment if it differs from your own. There is a risk this could negatively affect your judgment," explained one respondent. A significant factor contributing to respondents' concerns about future deskilling was their belief that AI systems will become far more advanced, capable and tighter integrated into clinical workflows than they are today. One respondent described how IT competence risked becoming increasingly important for patient outcomes at the expense of clinical competence: "What will be the long-term change from this? That we become dependent on technology, and that much of the competence resides within IT rather than in healthcare?" Another respondent reflected on the potential for general AI to replace a substantial portion of tasks in the job market: “My perception, intuitive and speculative, is that we will move towards a general intelligence that will essentially handle 80% of jobs.” One participant described how exponential implementation and increasing complexity in AI models could amplify deskilling risks:

> I do not think it [deskilling] is a significant issue today, but it has the potential to quickly develop into a major problem. The reason is that the implementation of these models will occur exponentially, and the models themselves will become increasingly complex at the same pace. As a result, we risk losing a crucial dimension: the transition from junior to senior levels within various professions.

Need for adapted education and training

The interviewees emphasised that the training must adapt so that the competence of future doctors does not decline. They underscored the importance of preserving hands-on learning opportunities and practical skill acquisition as AI takes on an increasing number of tasks in health care. “It is crucial that training adapts, ensuring future radiologists do not rely solely on AI, as that could affect their skills,” explained one radiologist. Another respondent highlighted the necessity of redesigning training frameworks to ensure residents still gain the experience they need:

> If double-reading disappears because of AI, we need to establish new processes to ensure residents still get the experience they need. Maybe involving a resident, a radiologist, and AI together.

Similarly, the respondents stressed the importance of regular exposure to clinical tasks: “There needs to be regular exposure so that competence does not erode,” noted a general practitioner and AI researcher.

One radiologist reflected on how foundational skills might be preserved in future training: “Perhaps during my training, I need to do a lot of manual work myself to learn the basics, while AI can serve as a support.” These reflections illustrate a shared concern among respondents about the challenges of adapting education and training to sustain competence in an increasingly AI-driven environment.

Artificial intelligence for upskilling

According to all participants in the study, AI also has great potential for professional development and learning. Participants highlighted how AI can support education by providing faster feedback and hands-on learning opportunities: “Digital pathology and AI are a major asset for training in pathology,” noted a pathologist. Another pathologist emphasised:

> AI can be a fantastic tool for enhancing pathologists’ training. It gives us a chance to get faster feedback on our assessments, which can be very helpful in the learning process.

Respondents also envisioned AI to improve clinical outcomes through collaboration between human expertise and machine intelligence. A pathologist and researcher observed, “When AI and human experts combine, the quality improves significantly.” At the same time, another respondent stated, “The important thing here is that AI will not replace pathologists, but we will become much better pathologists by using AI.” Similarly, a radiologist remarked, “I believe AI enhances radiological competence.” An example of this potential collaboration is the possibility of AI enabling double-review pathology diagnostics processes currently limited by resource constraints. One respondent explained:

> It would be extremely valuable to have two assessors for each individual cancer case, given how critical the diagnostics we are working with are.

AI can increase capacity and improve diagnostic accuracy by being an additional examiner.

AI is also associated with increased professional satisfaction and more meaningful work. Respondents anticipated that physicians could focus more on complex cases and patient-centred care by automating repetitive tasks. A general practitioner and AI researcher described this dynamic as being i*n* “co-evolution with AI,” explaining that “AI gives us more capacity, allowing us to focus on complex tasks and patient interaction.” Similarly, a senior radiologist noted:

> If we can develop an AI that eliminates many of the routine examinations, we will save a significant amount of resources. Those resources can then be allocated to more complex cases.

Several respondents highlighted how workplaces with advanced digital tools could attract professionals seeking innovative environments. One pathologist shared, “I specifically sought out a workplace with advanced digital transformation and AI use—it is one of the important factors.” At the same time, another noted the potential satisfaction of students trained exclusively with digital tools: “We have students who have only worked with digital pathology, and they are very satisfied and knowledgeable.”

Discussion

This study examines the paradoxical impact of AI integration on clinical competencies in health care, where the same technology can simultaneously drive both upskilling and deskilling among health-care professionals. Clinicians in this study reported no signs of deskilling, and explained this with two main factor: the current narrow and task-specific AI applications in Swedish health care, which act as augmentative tools rather than replacements for clinical judgment, and the clinicians’ extensive pre-AI clinical experience that supports the maintenance of core competencies when working with AI tools. In contrast, they voiced clear concerns about future generations. Despite these concerns, optimism is high and the advantages far outweigh the disadvantages, including in terms of skills development. They emphasised its ability to provide instant feedback, offer scenario-based training in safe environments and automate routine tasks so clinicians can focus on more advanced work.

The analysis revealed two main findings. Firstly, a striking tension emerged from practising clinicians’ perceptions. While they declared no signs of deskilling in their current professional practice, they expressed significant concerns about future deskilling risks for emerging health-care professionals. Secondly, I uncovered a fundamental shift in how competence is conceptualised: while deskilling concerns are framed in terms of individual clinical capabilities, discussions of upskilling drift towards a collective perspective achieved through human–AI collaboration.

The clinicians in this study consistently report that they have not experienced any deskilling themselves. Their main explanation was that they currently use AI for such limited and narrow tasks. While this is plausible, research shows that deskilling can transpire without users realising it. Macnamara *et al.* (2024) suggest that users may gradually offload critical cognitive processes to AI systems without realising it, leading to AI-induced deskilling. Similarly, Sutton *et al.* (2023) highlight that cognitive deskilling can develop gradually and imperceptibly. An interesting observation was that while all clinicians were convinced that no deskilling had taken place, AI experts working in a hospital setting but in non-clinical roles suggested that such deskilling may have already started. This highlights a potential oversight in practitioners’ self-assessment. This study neither definitively confirms nor refutes AI-induced deskilling, as it focuses on perceived experiences rather than objective measurements of clinical competence. However, while existing research suggests that deskilling can occur without practitioners noticing, several mitigating factors may help limit its impact in the current clinical setting. The use of AI is still minimal, both in terms of scope and tasks. Users today are generally educated and trained without AI, which strengthens their ability to resist deskilling. These factors suggest that if deskilling is occurring, it is likely to be incremental rather than extensive at this stage.

Another factor identified in research as mitigating deskilling is the deliberate design and adaptation of clinical workflows to maintain human engagement and oversight (Rinta-Kahila *et al.*, 2023). In the findings of this study, at least one clear example of such an intentional adaptation is evident – a structured approach aimed at preserving clinicians' competencies. One respondent illustrated this by describing the AI integration at her hospital's mammography screening. The AI system supports a double-reading process that was previously performed by two radiologists, now involving one radiologist and an AI system. The radiologist makes an independent assessment without prior knowledge of the AI's findings. If humans and AI make conflicting judgements, the case is flagged and escalated to a multidisciplinary review panel. In addition, the hospital holds monthly validation sessions where both detected and missed cases are reviewed and discussed, which should encourage continuous learning and active clinical reasoning.

The tension between how clinicians perceive today's absence of deskilling and their concerns about the risks of deskilling for future generations of doctors is striking. It is one of the most apparent emerging patterns in the results. Respondents' concerns for the future are in line with previous research suggesting that coming generations are at risk of increased skills depletion as AI becomes increasingly advanced and deeply integrated into clinical workflows (Macnamara *et al.*, 2024).

A majority expressed apprehensions that doctors in the coming decades, growing up in an environment where AI handles an increasingly significant portion of clinical tasks, might be deprived of the hands-on experience critical for developing independent clinical reasoning and technical proficiency. Such fears resonate with systemic critiques of automation, including those by Sawant *et al.* (2022), who highlight those diminishing opportunities for hands-on practice risk undermining the transfer of essential clinical skills to new practitioners. This underscores that concerns about increased deskilling risks for future generations of health-care professionals are well-founded and supported by both clinical perspectives and existing research.

If the assessment that health-care has largely avoided significant deskilling thus far proves accurate, we face a window of opportunity between our current relative stability and the substantial challenges that emerging evidence suggests lie ahead. It should be a priority to make conscious decisions to implement systematic strategies and safeguards to prevent the deskilling of protected competences and skills. A key question that needs to be addressed is whether all deskilling is detrimental. Contemporary research suggests that some degree of skill erosion is both inevitable and potentially beneficial during technological transitions (Gerlich, 2025; Rinta-Kahila *et al.*, 2023). This raises a critical question:

Q1. Which skills must be safeguarded, and which can be allowed to fade as technology advances?

The challenge for organisations is not to prevent all forms of deskilling but to strategically determine which competencies are fundamental and must be preserved. Morandini *et al.* (2023) emphasised the importance of explicitly focusing on transversal skills – such as critical thinking, problem-solving and adaptability – as key enablers of resilience and effective navigation in AI-integrated environments.

A pattern emerges when respondents discuss competencies in relation to AI. When addressing deskilling risks, they consistently frame it in terms of individual human capabilities – focusing on a clinician's personal judgment and skills. This holds true both when referring to their experience of the absence of deskilling and when expressing concerns about the future deskilling of the next generation of doctors.

In the discussions on upskilling, however, their perspective shifts towards collective capabilities, that is, collaboration between humans and AI. In this context, this is primarily since upskilling is associated, whether unconsciously or not, with improved patent results expected in the future, i.e. outcome. These outcomes are automatically the result of the collective effort of the AI-human team. This goes beyond how Sawant *et al*. (2022) define upskilling. Sawant describes upskilling as an individual skill development within existing professional domains. This orientation aligns with Pieper's (Pieper and Gleasure, 2025) findings, which suggest that emerging AI-supported work practices increasingly function as forms of distributed collective intelligence, where knowledge is embedded and mobilised across systems and human actors.

This shift in perspective, from individual competence to collective outcomes, challenges the traditional view of medical competence as primarily an individual skill, making a reassessment necessary. One could argue that this is nothing new. Doctors have historically adopted technology and tools that have improved diagnostics and treatment – everything from simple tools like the stethoscope to advanced technologies like the X-ray machine. However, while previous tools augmented human capabilities without fundamentally altering the *locus* of expertise, AI's capacity to process vast amounts of data, identify patterns and support complex decision-making at unprecedented speed introduces a new dimension.

If we measure performance through patient outcomes achieved by human–AI teams, it becomes difficult to isolate and evaluate clinicians' underlying competencies. AI does not merely disrupt the causal link between individual clinical expertise and patient results – it restructures it. Improved outcomes may no longer indicate stable or enhanced physician competence, but rather an increasing reliance on AI systems for diagnostic reasoning. As Macnamara *et al.* (2024) pointed out, AI's ability to improve outcomes can mask a gradual deskilling of the user by creating the illusion of competence. This raises a pressing concern: improved patient outcomes alone cannot anymore serve as evidence of stable clinical competence. Mechanisms are needed to assess whether clinicians maintain and develop core skills independently of AI, as vital competencies risk being eroded unnoticed. By combining Gioia's inductive approach with a focus on professional interpretation, this study offers novel insights into how AI reshapes clinicians' meaning-making around competence. The findings suggest a need for policy attention to how core clinical competencies are defined, assessed and maintained in AI-supported care. Ensuring professional integrity and trust in hybrid human–AI environments requires societal and regulatory foresight.

Another perspective on upskilling linked to respondents' emphasis on collective capability was the potential for AI to take over routine and repetitive tasks, allowing doctors to concentrate on more advanced and skill-building tasks. This task allocation may involve, for example, doctors handling particularly complex cases or focusing on developing their patient relations skills. Respondents also highlighted that this redistribution of tasks could enhance their job satisfaction and contribute to a greater sense of meaning in their work, as they were able to focus on the core aspects of their profession that they found most fulfilling. The findings show that the respondents view AI as a valuable tool for training. One pathologist explained that she saw AI's ability to provide immediate feedback in a review situation as particularly valuable for upskilling. In addition, they recognised the potential of using AI to prepare medical students for the profession by allowing them to practice in realistic, life-like scenarios. These scenarios allow students to develop their clinical reasoning and decision-making in a controlled environment, where mistakes can be made and learnt from without real-world consequences.

Conclusion, limitations and contributions

This study makes two main contributions to research on the understanding of how health-care personnel perceive the impact of AI on clinical competencies. Firstly, it reveals a tension between how clinicians view the current status and the concerns of future generations of doctors. Secondly, it uncovers a shift in how competence is conceptualised. Deskilling concerns remain anchored in individual capabilities, while upskilling discussions increasingly focus on collective human–AI performance.

This study makes one main contribution to practice by identifying a slim window of opportunity for health-care organisations to proactively address the challenges of AI integration and deskilling. Although the results indicate that we are currently in a relatively stable situation, significant risks loom on the horizon. To seize this opportunity and maximise the benefits of AI while minimising the risks, organisations need to implement systematic strategies and safeguards. By emphasising the importance of proactive action and providing a framework for moving forward, this study contributes to the effective management of AI integration in health care.

This study has several methodological and contextual (Bannister, 2007) limitations that should be considered when interpreting the results. It is grounded in the specific context of the Swedish health-care system. Organisational structures and regulations may affect the transferability of results to other countries and systems. Participant selection also presents certain challenges. The purposive sampling method (Patton, 2015) was designed to identify participants with practical experience of AI-driven automation in clinical settings. However, a limitation of this study is the small sample size ($n = 15$), which restricts the generalisability of the findings. This limitation was largely driven by practical constraints in the Swedish context, where AI implementation in health care remains limited. The scarcity of health-care professionals with hands-on AI experience severely constrained the available participant pool, making it challenging to achieve a larger, more diverse sample. This not only restricts the pool of potential participants but also means that those involved are often particularly interested in or positive towards the technology. Such self-selection may contribute to a skewed representation, potentially underrepresenting more critical perspectives on AI integration (Elston, 2021). This “technology enthusiast bias” is exemplified by one pathologist who actively sought employment at institutions with advanced AI capabilities. Consequently, the findings, particularly the optimism about upskilling potential and the absence of reported deskilling, may overestimate AI’s benefits and underestimate its challenges. A more representative sample might reveal greater scepticism about AI integration and more sensitivity to early signs of deskilling.

I identify two avenues for future research. Firstly, longitudinal research is needed to understand how the relationship between different types of AI use and clinical competence changes and develops over time. Secondly, the ethical implications of AI’s expanding role in health care deserve thorough investigation from multiple disciplinary perspectives. This includes examining how the division of clinical tasks between humans and AI affects professional autonomy, responsibility and accountability. Research should also explore the patient perspective and analyse how trust in health care is affected as clinical expertise is increasingly shared between human professionals and AI systems.

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