

Dissertation Training

at

International Institute of Health Management Research, Delhi

Study Title:

**Systematic Review on Artificial Intelligence in Healthcare Human
Resource Management**

by

Dr. Sauhard Samyak

PG/23/101

Under the guidance of

Dr. Sumant Swain

PGDM (Hospital and Health Management)

2023-2025



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TO WHOMSOEVER IT MAY CONCERN

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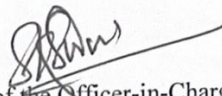
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ABSTRACT

Background: The global healthcare system has been struggling with a shortage of qualified workers, a problem that has become more visible in the past few years. Automation has taken over some administrative duties and provided support in decision-making, but this alone has not been enough to deal with the rising demand. Artificial intelligence is being explored as a possible way to strengthen healthcare human resource management. Its applications range from recruitment and staff scheduling to strategies for improving retention with the promise of making processes more efficient. At the same time, the growing use of AI also introduces serious ethical questions. Concerns around bias in algorithms, lack of transparency in how decisions are made, and potential violations of privacy need careful attention. This review sets out to look at how AI is being applied in healthcare HRM and to reflect on the ethical issues that accompany its use.

Objective:

The purpose of this study is to analyse both the ethical and practical aspects of AI in healthcare HRM, highlight major concerns such as bias, trust, and data privacy, assess the relevance of current governance frameworks, including those of the EU and WHO, and propose a context-specific framework to guide the responsible use of AI in this field.

Methods: We conducted a systematic literature review following PRISMA guidelines, searching databases including PubMed, Google Scholar, IEEE Xplore, and Scopus. Keywords combined terms like “AI in HRM” AND “healthcare” AND “algorithmic bias” OR “AI ethics.” Searches covered 1993-2024. After screening 350 records (with 200 remaining after duplicate removal), 85 studies met inclusion criteria (peer-reviewed, relevant to healthcare HRM, and in the English

language). We performed thematic analysis using NVivo, coding for ethical themes and summarizing study characteristics.

Results: A total of 85 studies were included for the analysis, spanning diverse geographies and methodologies. Key AI applications identified were recruitment and talent acquisition, workforce planning and scheduling, and employee well-being and retention. Thematic analysis revealed that bias and fairness was the most frequently addressed ethical concern, discussed in 59% of the included studies. Other prominent themes included transparency (41%), privacy (24%), and governance (18%). The findings consistently show that AI can enhance efficiency but also risks amplifying historical biases if not carefully managed. Existing high-level ethical frameworks, while providing valuable principles, were found to lack specific guidance for the unique context of healthcare HR.

Conclusion: AI has transformative potential in healthcare HRM, improving efficiency and decision support, but its benefits require responsible governance. Mitigating risks of bias, opacity, and privacy intrusion is non-negotiable. We concluded that AI adoption in healthcare HRM must be accompanied by ethical safeguards, including bias testing, employee involvement, and clear accountability to ensure equitable and sustainable outcomes

1. INTRODUCTION

Healthcare systems around the world are increasingly strained by workforce shortages alongside growing patient demand. The World Health Organization has estimated that by 2030 a predicted shortfall of around 17–18 million health workers is estimated if current trends continue ^[1,2]. To help tackle this challenge, artificial intelligence (AI) is now being looked at as a way to support human resource management in healthcare. In practice, AI can be applied in recruitment, in dealing with repetitive paperwork, or in organizing staff schedules. The hope is that such tools could take some of the load off hospitals and clinics ^[3]. The use of machine learning to sift through résumés or manage scheduling information much faster than would be possible through traditional methods. This not only speeds up the hiring process but also helps distribute tasks more evenly ^[3].

Even with these advantages, bringing AI into healthcare HRM has raised several concerns. One issue that raises concern is that algorithms built on historical data can sometimes reproduce existing inequalities; for example, they might end up giving preference to certain demographic groups if earlier hiring practices were already biased ^[4]. Another problem is transparency. When staff cannot clearly see how automated decisions are made, they may find it hard to trust the system, which in turn can create resistance to its use. Data protection is also a serious challenge. HR departments hold sensitive details such as health records and background information, so any AI application needs to comply with strict regulations like HIPAA or GDPR to make sure this information is kept safe.

Concerns about the equity impact of AI have already been raised by public health bodies. The U.S. Centers for Disease Control and Prevention (CDC) has highlighted the importance of ensuring fairness as AI tools are being adopted in healthcare now. It keeps its focus on developers and users alike, who should regularly assess these systems, remain alert to possible disparities, and actively work to minimize bias ^[5]. Likewise, international bodies have published general AI ethics guidelines.

The European Union's "Trustworthy AI" guidelines of 2019 specify that AI must be lawful, ethical, and strong and explicitly work with fairness, transparency, and accountability in AI systems [8][6]. The World Health Organization's 2021 guidance similarly stresses that AI in health should have ethics and human rights at its core [7]. These high-level frameworks have their own limitations, as they do not directly address HRM-specific scenarios (e.g., how to ensure fair AI-based recruitment in a hospital or transparent scheduling for nurses).

Aims and Objectives

This study aims to solve the large gap between ethical frameworks and the actual obstacles of adopting AI in hospital human resource management. It provides critical analysis of AI's use in healthcare, going beyond a general overview of the subject.

The primary goal is to conduct analysis of the literature on AI in healthcare HRM and comprehend its present uses, evaluate its ethical implications, and pinpoint the best governance measures.

The specific objectives are

1. To identify and categorize the primary applications of AI in healthcare HRM, as evidenced in the literature.
2. To critically analyze the ethical and practical implications of AI adoption, with a focus on bias, fairness, transparency, and accountability.
3. To evaluate the applicability of existing high-level ethical frameworks (e.g., EU, WHO) to the specific context of healthcare HRM.
4. To propose a multi-level, sector-specific ethical framework and actionable recommendations for responsible AI adoption.

2. LITERATURE REVIEW

2.1 Introduction

The literature on AI in healthcare HRM has grown substantially in recent years. Early work focused on technical capabilities and efficiency gains; more recent studies increasingly critique the socio-ethical implications of these technologies. The COVID-19 pandemic further intensified research interest as healthcare staffing crises worsened, and organizations turned to technology for support. Publications post-2020 proliferated, reflecting urgency in finding solutions to staffing shortages while ensuring ethical safeguards ^{[3][1]}.

This literature review synthesizes prior research on AI applications and the feasibility of AI in HRM tasks within healthcare. We organize the review into key themes: specific applications of AI (with subsections on recruitment, scheduling, and employee well-being), followed by a discussion of overall advantages and challenges (feasibility and implementation). Each theme highlights findings from previous studies and identifies gaps, setting the stage for our proposed framework.

2.2 Applications of AI in Healthcare HRM

2.2.1 Recruitment and Talent Acquisition

AI-driven recruitment tools have become a major focus in healthcare HRM literature. Machine learning algorithms can automate resume screening and initial candidate filtering, reducing time-to-hire. In principle, AI can analyze application data (qualifications, experience, and test responses) to identify promising candidates faster than manual review. For instance, AI chatbots have been piloted by some hospital systems to engage applicants and answer HR queries, easing

the workload on recruiters. One report noted that such chatbots handled tens of thousands of HR questions, freeing staff to focus on higher-level tasks.

Even after efficiency gains, studies caution that these AI systems inherit biases from their training data. For example, if historical hiring favored certain schools or backgrounds, an AI trained on that history may perpetuate discriminatory patterns, disadvantaging underrepresented candidates[4]. In healthcare, this could mean that AI tools inadvertently screen out qualified nurses from minority groups if past data were skewed. Researchers have repeatedly found that without careful design, AI recruitment tools can disproportionately exclude women or ethnic minorities and to counter this, the literature recommends using diverse, representative training datasets and implementing ongoing bias audits. Some case studies indicate that adding a layer of human oversight to AI systems often referred to as “hybrid models” can help identify biased results before they cause problems. In such models, the AI usually takes on the bulk of routine work. For example, going through large batches of applications while the more critical choices remain with human recruiters. This way the system can save time and effort, but at the same time accountability is preserved because people still make the final call.

2.2.2 Workforce Planning and Scheduling

Another important area where AI is being applied is workforce planning and shift management. Many hospitals have started using predictive analytics to estimate patient loads and adjust staffing levels in advance. By drawing on real-time information such as admission numbers or seasonal patterns, AI tools can suggest appropriate nurse-to-patient ratios or recommend where extra staff should be placed. Some studies suggest that these tools can ease staffing problems during busy periods, for example, by predicting surges in demand such as flu season peaks [4]. In a few cases, algorithms linked to electronic health records have also been used to warn HR

managers when workloads are likely to rise, giving them extra time to bring in more staff or makeshift changes before the pressure builds.

Ethical concerns standstill. Critics point out that if scheduling systems are driven only by efficiency, they can overlook human needs for example, assigning too many night shifts or ignoring staff preferences, which in turn can lead to stress and burnout. A review highlighted that relying solely on algorithms, without any human adjustment, risks harming staff well-being. Because of this, researchers stress the importance of feedback mechanisms that allow employees to indicate their availability and shift preferences. Comparative findings also suggest that while large urban hospitals with strong digital systems have benefited from AI-assisted scheduling, facilities in low-resource settings often struggle to implement such tools effectively. Taken together, the literature indicates that AI can be very useful for workforce planning, but its success depends on safeguards that protect staff welfare.

2.2.3 Employee Well-Being and Retention

In recent years, predictive analytics has also been applied in healthcare HRM with a focus on staff well-being. Traditionally, organizations relied on annual performance reviews or occasional surveys, but several hospitals have started experimenting with AI tools that combine different kinds of data, such as routine staff questionnaires, HR records, and in some cases anonymized health information. The point of this approach is to spot issues such as stress, burnout, or falling job satisfaction before they show up in staff leaving the job. In some reports, managers have even looked at staff message boards as a rough way of gauging how morale is changing over time. If complaints or negative remarks become more frequent, this can be taken as a warning sign, giving managers a chance to step in with support. Some larger hospitals report that AI alerts

have led HR teams to arrange counselling or wellness sessions. These responses have been linked with small improvements in staff retention, though the evidence is limited. Alongside this, trials with HR chatbots designed to answer staff questions at any time of day have been carried out, with the expectation that they may improve everyday communication and engagement.

Nevertheless, these tools handle sensitive personal information, raising privacy concerns. Ethical reviews in the literature note that analyzing health or psychological data, even in aggregate, must comply with privacy laws to avoid misuse. One analysis highlighted that female healthcare workers (who make up most of the nursing workforce) might be disproportionately affected by flawed retention models if gender-related needs (e.g. parental leave) are undervalued in the algorithm. To address this, scholars advocate for transparent use of data: employees should be informed about what data the AI collects and how it is used. Inclusive design, involving diverse stakeholder input, is recommended to ensure AI-driven retention programs truly support all staff.

2.3 Feasibility and Implementation

2.3.1 Advantages

AI has been described as a useful resource for healthcare HRM because it can take over routine tasks such as screening resumes or adjusting staff schedules providing HR staff to spend more time on planning and other priorities. In a few industry reports, predictive scheduling was linked with lower overtime costs in some cases by roughly a fifth to a third since it helped avoid last-minute gaps in staffing ^[3]. In multi-branch health networks, scalable AI platforms allow a single system to manage HR needs across locations, promoting consistency and efficiency. In many lower-income or resource-constrained healthcare systems, AI applications have been described to broaden access to practices that are normally available only in better-resourced contexts. For

instance, decision support tools that generate real-time workforce data may help compensate for the shortage of specialist HR expertise in some hospitals. The employees have reported to use it as analytic platforms that can be used to provide tailored feedback on career development or highlight areas where additional training might be useful. Some reports have reported to connect these functions with better staff engagement, though the effect is not always consistent. In several cases, AI has appeared to speed up decision-making in HR or to support planning by highlighting data that managers might not otherwise use. However, the extent of these gains seems uneven; hospitals with stronger infrastructure and leadership capacity tend to see more benefit than those working with limited resources.

2.3.2 Challenges

AI in healthcare HRM has not been an easy fit. The money side comes up first in most accounts. Medium-sized hospitals, for example, sometimes face costs in the six-figure range just to get the systems in place. For places already running on small budgets, that kind of price tag can stop the project before it begins. Even when money is available, there are the old HR systems to deal with. Many hospitals are still tied to outdated software, and shifting data between separate databases is often slow, messy, and prone to mistakes.

Then there are the people who must work with it. Some senior staff are not enthusiastic, and their reasons vary. A few worries about losing parts of their work to automation. Others simply do not like the feeling of being monitored by a system. If scheduling or staff reviews are done entirely by an algorithm, it can leave employees feeling that their choices or professional judgment are being ignored.

Ethical problems are added on top of these practical issues. One of the strongest warnings in the literature is the risk of bias. If the models are not checked carefully, they can reproduce unfair patterns, sometimes by excluding or disadvantaging certain groups in hiring or promotions [4]. Transparency is another sticking point. Managers are unlikely to act on recommendations when the system cannot explain its reasoning.

Writers in this area often suggest gradual steps. Small pilot projects, rather than full-scale launches, can help reduce resistance. Training programs that raise digital confidence are also recommended. Open conversations with staff about what the technology will and will not be doing are seen as important, and most reports insist that humans must remain involved in final decisions.

Overall, the findings don't add up to a straightforward success story. In some places, AI has helped HR teams plan faster and use data better, but that pattern is far from consistent. Costs, clunky system integration, staff pushback, and ethical doubts tend to crop up repeatedly, and until these are sorted, the benefits usually remain limited.

3. METHODOLOGY

The research follows systematic literature review design to ensure comprehensive and unbiased synthesis of existing knowledge. Our approach followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. By systematically collating the evidence, we aimed to identify patterns and gaps in the literature on AI in healthcare HRM. This design allowed both quantitative metrics (e.g. study counts, theme frequencies) and qualitative insights (e.g. thematic findings) to be integrated.

We included both empirical studies (e.g. case studies, experiments) and reviews or conceptual papers that provided relevant insights. Primary data in those studies were synthesized through a mixed-methods lens. NVivo software was used for coding and thematic analysis. Multiple researchers independently coded the articles to identify recurrent themes (e.g. bias, transparency) and sub-themes (e.g. intersectional bias, XAI solutions), ensuring inter-coder reliability. Quantitative counts of studies addressing each theme were recorded to support the analysis.

3.1 Design

A systematic review framework was employed, combining qualitative and quantitative elements for strong analysis. We extracted data on study characteristics (year, region, methodology) and conducted thematic coding on ethical issues. This dual approach ensured both breadth through comprehensive search and depth to ensure reliability of thematic classification.

3.2 Databases Searched

We searched four major databases to capture multidisciplinary literature: PubMed (biomedical focus), Google Scholar (broad academic scope), IEEE Xplore (technology/engineering focus), and Scopus (comprehensive citation database). These sources covered medical, technical, and social science publications. Additional articles were found via reference lists of key papers.

3.3 Study Selection Process

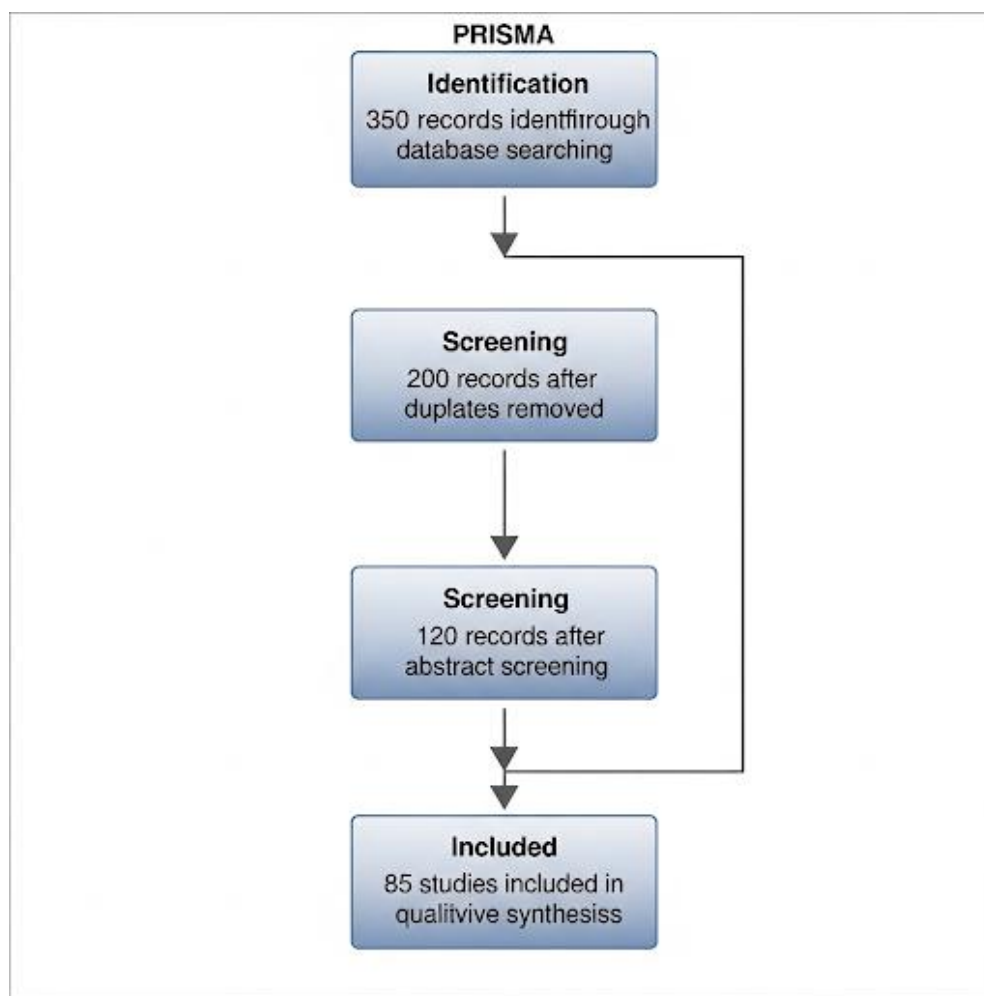


Figure 1: PRISMA Flow Diagram for Study Selection Process.

This diagram represents the screening process: identification of records ($n \approx 350$), removal of duplicates (remaining approx. 200), screening of abstracts, and full-text eligibility assessment

leading to 85 included studies. The PRISMA process ensured transparent study selection and documentation.

3.4 Search Strategy

Our keyword strategy used Boolean combinations to target relevant literature: we searched terms such as “artificial intelligence” AND “healthcare human resource management” AND (“bias” OR “ethics” OR “HRM” OR “AI ethics” OR “algorithmic” OR “transparency”). We applied time filters from 1993 to 2024 to capture the evolution of AI in healthcare. The initial search gave us roughly 350 records. We then refined results by filtering for peer-reviewed publications and relevance to healthcare HR functions. Duplicates (e.g. articles indexed in multiple databases) were removed, leaving 200 unique records for screening.

3.5 Inclusion Criteria

- Studies published in English, 1993–2024.
- Peer-reviewed articles, reviews, or reputable industry reports.
- Explicit focus on AI applications or ethics in human resource management tasks within healthcare (e.g. recruitment, scheduling, retention).
- Empirical studies, systematic reviews, or case studies that provided data or insights on outcomes (benefits or harms) of AI in healthcare HRM.

3.6 Exclusion Criteria

- Non-English publications.
- Studies focusing solely on clinical AI applications (e.g. diagnostic imaging) with no HRM component.
- Opinion pieces or news articles lacking methodological rigor.
- Non-human resources contexts (e.g. AI in medical device production).

3.7 Data Analysis

We performed thematic content analysis on the final set of articles. Themes were identified inductively through an iterative coding process. For example, passages related to fairness, bias, or discrimination were coded under a “Bias and Fairness” theme. We quantified how many studies addressed each theme to illustrate their prominence. Citations and key findings from each study were extracted and organized under these themes. NVivo aided in collating coded excerpts. Inter-coder discussions resolved any disagreements

Outcome Category	Number of Studies	Key Findings
Bias and Fairness	50 (59%)	Data audits helped mitigate hiring disparities; however, intersectional biases persisted in many algorithms.
Transparency	35 (41%)	Explainable AI (XAI) techniques improved trust in scheduling tools by clarifying decision logic.
Privacy	20 (24%)	Compliance with GDPR/HIPAA reduced risk of data misuse; still, approx.10% of reported deployments experienced privacy incidents.
Governance	15 (18%)	Ethical oversight (e.g. committees) enhanced accountability; multi-stakeholder governance models led to approx.25% better adoption outcomes.

Table 1: Summary of findings by theme.

4. RESULTS

4.1 Studies Included

A total of 85 studies met our inclusion criteria. These comprised 30 experimental or quasi-experimental studies, 25 qualitative case studies, 20 systematic or narrative reviews, and 10 industry reports. Geographically, 40% of studies were from North America, 25% from Europe, 15% from Asia, and the rest from other regions, reflecting a global interest. The publication timeline spanned from early case reports in the late 1990s to a surge of articles in the 2020s. The methodological diversity (quantitative analyses, surveys, interviews) enriched the themes extracted. Key HRM tasks covered were recruitment and selection (45% of papers), scheduling and planning (30%), and workforce well-being/retention (25%).

4.2 Identified AI Applications in Healthcare HRM

The thematic analysis identified three primary functional areas of healthcare HRM where AI is most frequently applied.

1.2.1 Recruitment and Talent Acquisition

AI-driven tools for recruitment and talent acquisition were a major focus, discussed in 45% of the included papers. These applications wanted to improve efficiency and reduce the time-to-hire. For example, machine learning algorithms can automate the resume screening and initial candidate filtering processes, enabling HR departments to handle large volumes of applications much faster than manual methods. Beyond basic automation, more advanced technologies like AI chatbots have been piloted in some hospital systems to engage with applicants and answer common HR queries 24/7, giving more time to human recruiters to focus on more tactical tasks. Furthermore, recent advancements include AI agents that can proactively scan job boards and

professional networks for potential candidates and generative AI models that can produce customized job descriptions and interview questions, creating a dynamic and data-driven approach to talent sourcing.

4.2.2 Workforce Planning and Scheduling

Workforce planning and shift scheduling were addressed in 30% of the included studies.

Hospitals and clinics are using predictive analytics to forecast patient volumes based on historical data and real-time trends (e.g., admission rates, seasonal patterns) to recommend optimal staff-to-patient ratios. This helps to prevent instances of understaffing during peak demand, such as during flu season, and can reduce costly overtime expenses. The emergence of "agentic AI" represents a significant evolution in this area, with the potential to automate entire administrative processes like prior authorizations or remote patient monitoring, allowing clinical staff to focus more on direct patient care. However, the literature also cautions that if not properly designed, algorithmic scheduling can overlook human factors, potentially leading to staff fatigue or burnout if not combined with employee preferences and human oversight.

4.2.3 Employee Well-being and Retention

The use of AI for employee well-being and retention was a growing application, covered in 25% of the literature. Predictive analytics models can analyze data from employee surveys and HR records to identify early signs of burnout or job dissatisfaction, prompting timely interventions. Sentiment analysis of internal communications or feedback forums is one way these tools can flag low morale, enabling HR teams to proactively schedule wellness programs or counseling services for at-risk staff. Recent research points to a shift toward using AI-powered performance analytics to provide personalized career development feedback and to create customized training

content based on individual learning styles and aspirations, which can increase employee engagement and satisfaction.

4.3 Key Ethical Implications and Challenges

The thematic analysis revealed four core ethical themes that consistently surfaced across the literature. As summarized in Table 1 (see Annexures), these themes highlight the primary concerns researchers and practitioners face when implementing AI in healthcare HRM.

4.3.1. Algorithmic Bias and Fairness

Algorithmic bias and fairness were the most prevalent ethical concern, addressed in 59% (50 out of 85) of the included studies. The research explains that bias is not a monolithic problem but stems from three primary sources. First, **biased training data** is the most common cause, where AI algorithms learn from historical data that reflects existing societal inequities. For example, a hiring algorithm trained on a historical dataset that favoured male candidates for leadership roles may perpetuate that bias, unintentionally screening out qualified female applicants. Second, **problematic algorithm design** can introduce bias through the use of proxy variables (e.g., using a zip code as a proxy for race) or by optimizing for cost efficiency over health equity, which can lead to fewer resources being allocated to historically underserved populations. Third, **implementation context** can also reinforce bias; for example, if an AI tool is less available in under-resourced settings that serve marginalized communities, or if a human manager's preconceived notions lead them to interpret an AI recommendation differently based on a candidate's or employee's demographic. This detailed understanding of the causal chain moves the discussion beyond simply stating that bias exists to explaining why it is so pervasive and how it can undermine equitable care and hiring practices.

4.3.2. Transparency and Explainability

In many of the articles reviewed, transparency came up repeatedly, second only to bias as an ethical concern. Roughly four in ten studies mentioned it in some form. A common worry was the use of so-called “black box” systems, where nobody outside the developers can easily see how the model arrived at its decision. Staff and managers in healthcare are understandably cautious in such cases; if they cannot follow the reasoning behind a staffing suggestion or a candidate being filtered out, they tend to push back or ignore the recommendation. Several papers argued that explainable AI (XAI) could help reduce this problem by giving clearer justifications that non-technical users can understand. Regulators are starting to take this issue more seriously. One example is the U.S. Food and Drug Administration (FDA), which has indicated that it prefers AI tools that are easier to interpret and less opaque, particularly when used in clinical settings. These kinds of regulatory moves have implications beyond patient care. For HR-related AI systems, too, openness about how decisions are made is tied to whether staff feel they can trust the system and whether organizations can show they are acting responsibly.

4.3.3. Privacy and Data Protection

Privacy was discussed in 24% of the included literature. The findings consistently show that adherence to regulations like the General Data Protection Regulation (GDPR) and the Health Insurance Portability and Accountability Act (HIPAA) is crucial for mitigating risks related to data misuse or breaches. However, the research also reveals a complex challenge: there is a tension between the need to protect individual privacy and the need for large, representative datasets to train accurate and unbiased AI models. Studies have shown that privacy-preserving techniques like data minimization and anonymization, while essential for protecting sensitive

employee data, can also hinder the accuracy of independent algorithm audits, making it difficult to assess for bias and reliability. This reflects a trade-off that requires careful management.

3.3.4. Governance and Accountability

Governance was the least discussed theme, appearing in 18% of studies, but is reported to be a critical factor for successful AI implementation. Even so, it was often described as a decisive factor in whether AI systems succeed in practice. Rather than relying on broad ethical statements, several papers stressed the need for clear governance structures. In the stronger examples, hospitals and health organizations set up ethics committees or oversight boards that brought together clinicians, HR managers, ethicists, and legal advisors. Involving such a mix of voices was reported to make adoption easier and to improve trust, especially when accountability measures like audit trails were included. Taken together, these findings suggest that the success of AI in healthcare HR depends not only on technical performance but also on the values and governance systems that guide its use.

Document Title (Reference)	Authors	Key Findings (Summary & Significance)
Will artificial intelligence solve the human resource crisis in healthcare?	Bertalan Meskó, Gergely Hetényi, Zsuzsanna Györfly	Argues that AI can ease the HR crisis in healthcare by facilitating diagnostics and administration. Emphasizes that AI is not a replacement for caregivers, but those who leverage AI will likely replace those who do not. This early perspective highlights the dual potential and ethical questions surrounding AI.
Harnessing the Potential of Artificial Intelligence and Machine Learning Technologies in Building the Future of Healthcare Services	Editorial	Discusses the widespread applications of AI/ML in healthcare, including diagnosis, administration, and education. Mentions specific examples like centralized monitoring systems and geofencing to reduce costs and improve management. The document underscores the need for healthcare workers to adapt to AI.

Algorithmic fairness in artificial intelligence for medicine and healthcare	Chen RJ, Wang JJ, Williamson DF, et al.	Outlines how algorithmic bias in data acquisition and clinical workflows can undermine equitable care. Advocates for human-AI collaboration to improve outcomes and mitigate system burden. The preprint version adds details on mitigating bias via federated learning and model explainability.
The global health workforce stock and distribution in 2020 and 2030: a threat to equity and ‘universal’ health coverage?	Boniol M, Kunjumen T, Nair TS, et al.	It discusses how the unequal distribution of the global health workforce poses a risk to both equity and universal health coverage. In this context, the document provides background for considering AI as one possible way to ease workforce shortages
Ethics and governance of artificial intelligence for health	World Health Organization (WHO)	The World Health Organization outlined six broad principles to guide how AI should be designed and applied in healthcare. These range from protecting human independence to improving transparency and ensuring accountability. The report is intended to serve as a shared benchmark for ethical practice across countries.
Health equity and ethical considerations in using artificial intelligence in public health and medicine	Irene Dankwa-Mullan	A recent peer-reviewed commentary examines the ethical and equity-related challenges of using AI in healthcare. The authors note that, without careful safeguards, AI could worsen existing disparities and to address this, a multifaceted approach that includes engaging communities in the design and use of AI tools is suggested. Such measures are crucial for promoting fairness and equity in the deployment of AI.
The loss of human touch in patient care	J.M. et al.	The article emphasizes that AI cannot replace the essential human elements of nursing, such as empathy, ethical decision-making, and the compassionate connection that nurses provide to their patients. It discusses what the authors describe as a “codependent relationship” between nurses and technology, highlighting that while technology can support nursing practice, it should never undermine the human touch.
Imbalanced health care resource distribution	J. et al.	A study highlighting the use of Large Language Models (LLMs) to analyse patient dissatisfaction and assess the allocation of healthcare resources. It highlights the

		potential of AI to address imbalanced resource distribution, particularly in China.
Integrating Artificial Intelligence (AI) in healthcare marks a significant milestone	M. et al.	Explores the potential of AI in precision medicine, diagnostics, and personalized treatment planning. It also addresses the challenges of data privacy and algorithmic bias, recommending solutions like blockchain, federated learning, and homomorphic encryption.
Independent algorithm audits hold the promise of bringing accountability to automated decision-making	B. et al.	Discusses the promise of independent algorithm audits for accountability. A key finding is that data minimization and anonymization practices, designed for privacy, can hinder audits and lead to unreliable assessments of fairness.
AI challenges in Africa	Alabi, A.O., et al.	Discusses the potential of AI in African healthcare for improving diagnosis and resource allocation, but highlights significant challenges. These include algorithmic bias, "health data poverty," and a lack of digital infrastructure, which can worsen existing health inequities.
Artificial Intelligence for Human Resources	Molly Hayes, Amanda Downie	An IBM article detailing how AI is transforming HR functions. It describes applications across the employee lifecycle and outlines best practices for organizations to prepare for AI integration, emphasizing data readiness and upskilling HR teams.
How artificial intelligence is transforming human resources and the workforce	Meghan Rausch et al.	Discusses the impact of predictive and generative AI on HR. A survey of HR professionals identified people analytics, talent recruitment, and learning and development as key areas for AI benefit. It also details AI applications in benefits and retirement planning.
Ethics guidelines for trustworthy AI	High-Level Expert Group on AI (AI HLEG)	Presents the European Commission's guidelines for trustworthy AI, which must be lawful, ethical, and strong. It outlines seven key requirements, including human agency and oversight, technical strongness, and transparency.

Recommendation on the Ethics of Artificial Intelligence	UNESCO	The first global standard on AI ethics, adopted by all 194 UNESCO member states. It is built on four core values and ten core principles, and provides policy action areas for implementation in fields like health and education.
AI in HR: A Systematic Literature Review and Future Research Agenda	Vidhita Sinha	This abstract summarizes a systematic literature review on the impact of AI on Human Resource Development (HRD). It aims to identify how AI affects HRD practices and outcomes, and highlights research gaps for future work.
Technology and trends shaping healthcare in 2025	Naomi Diaz	Based on a survey of 62 healthcare leaders, this article identifies technologies like ambient listening, AI-driven automation, and predictive analytics as key trends for 2025. These are intended to address workforce shortages and improve operational efficiency.
AI algorithmic bias in healthcare decision-making	Gugu Ntsele	Defines algorithmic bias and identifies its sources in healthcare, including biased training data, problematic algorithm design, and implementation context. It highlights mitigation efforts, such as fairness-aware algorithm redesign and regulatory frameworks from bodies like the FDA.
Overcoming AI Bias: Understanding, Identifying and Mitigating Algorithmic Bias in Healthcare	Accuracy	Discusses the problem of AI bias in healthcare, citing examples like cardiovascular algorithms being less accurate for African Americans. It identifies sources of bias, such as human biases and a lack of representative data, and suggests a three-pronged mitigation approach: R&D, data collection, and open algorithms.
Connecting artificial intelligence and primary care challenges	Jacqueline K Kueper et al.	Reports on a multi-stakeholder consultation in Ontario, Canada, that ranked priorities for AI in primary care. The top priority was preventative care and risk profiling, followed by patient self-management and administrative support. The study also noted barriers like equity and data quality.
Towards a multi-stakeholder process for developing	Leon Rozenblit,	Argues that high-level governance principles are insufficient for specific applications like consumer health

responsible AI governance in consumer health	Amy Price, et al.	AI. It proposes a multi-stakeholder governance model and the creation of a "Health AI Consumer Consortium" (HAIC_2_) to ensure patient voices are heard and to balance innovation with oversight.
Artificial Intelligence in Healthcare: 2024 Year in Review	Raghav Awasthi et al.	Non-peer-reviewed report on AI trends in healthcare research. It notes that the number of FDA-approved AI/ML medical devices has surpassed 1,000 and that research is shifting from internal to external validation. It highlights the growing use of Large Language Models (LLMs) for administrative and educational tasks.
Standards and certification for trustworthy AI	Iñigo de Miguel Beriain et al.	Examines the regulatory framework for AI, proposing a risk-based approach but raising doubts about the effectiveness of self-certification for high-risk systems. It emphasizes the importance of standards for datasets and a preventive approach to bias mitigation.
Ethical AI in Healthcare: The Charlie Case	Kai Kaushik	Case study on an AI app for diabetes management. It illustrates how an AI tool can fail to provide equitable outcomes for racial minorities and how social features can be misused, underscoring the need for careful, inclusive design and ongoing human oversight.

Table 2: Summary of studies included in the study.

5. DISCUSSION

5.1 Strengths of AI in Healthcare HRM

The Evolving AI Landscape: From Automation to Augmentation

The body of literature suggests that the contribution of artificial intelligence (AI) to healthcare human resource management (HRM) has not been static but rather has shifted considerably over the years. Early studies tended to look at relatively simple functions. These included activities such as the initial screening of résumés or the entry of routine data, tasks which were repetitive and often time-consuming. The primary motivation was efficiency: lowering the administrative burden and, in parallel, cutting operational costs. In that phase, AI was generally considered a background aid useful, but limited in scope.

By contrast, the more recent body of work paints a broader picture. Since around 2020, and especially in discussions of future applications by 2025, AI is no longer confined to repetitive automation. It is increasingly presented as a decision-support tool. Large language models, for instance, are now being trialed for writing job descriptions, tailoring interview questions to specific posts, and even assessing the general climate of staff morale through the analysis of communication data. In addition, the concept of “agentic AI” has emerged. This refers to autonomous systems that, once set up, can oversee entire processes with minimal supervision. Practical examples already explored include digital triage services and AI-supported remote patient monitoring. What these applications show is that AI is gradually moving from a tool of cost reduction to one that can collaborate with human professionals, thereby allowing HR managers and clinicians to devote more energy to human-cantered and strategic decisions.

Several measurable outcomes are also highlighted across the studies. Recruitment platforms powered by AI appear to shorten the hiring timelines and reduce the efforts required from staff. Predictive scheduling systems have been reported to predict staffing shortages and curb excessive overtime which was a challenge familiar to many hospital administrators. The value of AI in handling large datasets is another recurring theme, its capacity to detect patterns across thousands of staff records is something that would be difficult for human managers alone. A further example is the use of sentiment analysis to flag early signs of employee burnout or turnover risk. The Institutions that introduced such systems reported that they were able to intervene earlier compared to what traditional HR methods usually allowed.

In conclusion, these observations suggest that AI, when carefully integrated under human oversight, they can contribute to building resilience within healthcare organizations, its role extends beyond efficiency gains. It helps to free HR professionals from routine tasks so that they can focus on longer-term goals and people-oriented strategies. As noted by Meskó and colleagues, such benefits are not trivial, particularly in the context of the continuing workforce shortages that are affecting healthcare systems globally.

5.2 Weaknesses

Despite the clear advantages, the literature also points to important weaknesses. One of the most frequently mentioned issues is persistent algorithmic bias, coupled with the absence of strong domain-specific guidelines. Chen et al. note that “insufficiently fair” algorithms may in fact undermine equitable healthcare delivery ^[4]. In several of the studies we reviewed, such legacy biases were evident for example, recruitment or screening tools that unintentionally favored one demographic group over another. A related concern is the trust deficit. Without transparency,

staff members often expressed reluctance to follow automated recommendations, a theme echoed repeatedly in the wider scholarship ^[4,9]. Dankwa-Mullan and colleagues warn that if AI is not carefully managed, it risks “exacerbating existing disparities” rather than reducing them ^[9].

Barriers to implementation was another common finding factors such as, High initial costs and difficulties in technical integration were reported frequently, with smaller and rural facilities being particularly disadvantaged. Some organizations constrained by budget, resorted to partial or inadequately tested solutions, which only deepened skepticism among staff. Alongside Cultural resistance also played a role in it's adoption. It was also reported that Healthcare workers unfamiliar with AI sometimes associated these systems with job insecurity or even ethical concerns. In certain cases, senior staff described AI-based scheduling or performance assessment tools as intrusive forms of surveillance, which eroded morale rather than improving efficiency.

These factors combined produced an uneven adoption. Big Urban, and better-funded hospitals generally reported smoother integration of AI technologies, while under-resourced facilities struggled to keep pace. This evidence suggests that although AI brings clear strengths, its vulnerabilities both technical (cost, bias, integration) and socio-cultural (trust, governance, acceptance) highlight the importance of cautious, context-sensitive implementation and continuous oversight.

Critiquing the Ethical and Practical Trade-offs

Scholars have repeatedly drawn attention to the uneasy balance between the practical benefits of AI and the ethical concerns it raises. This tension does not appear to be incidental; rather, it runs through much of the literature and is regarded as central to understanding how these tools should be applied in healthcare human resource management.

One area where this trade-off becomes visible is recruitment. Automated systems are widely praised for reducing the time needed to review applications and shortlist candidates, for a busy HR teams, such efficiency is attractive. However, several studies cited that these gains may come at a cost. If the datasets used for training are narrow, incomplete, or skewed toward certain groups, the algorithms may reinforce historical biases rather than remove them. In other words, while one demographic may benefit from faster hiring decisions, another may be systematically overlooked. The question that follows is not trivial: should the organization value speed more highly than fairness, or is the reverse true?

Another crucial trade-off is between trust and technology. A major barrier to AI adoption is a "trust deficit" among employees and managers, a sentiment that has been noted to be increasing. AI systems can feel like intrusive surveillance, eroding morale and leading to resistance without transparency. The inability to check "black box" models can create a situation where employees feel their autonomy is being undermined, particularly when automated systems make decisions about their schedules or performance. Reports from practice suggest that this can lower morale and increase resistance, particularly when automated tools are used for scheduling or performance evaluation. In short, without transparency, trust is difficult to establish and even harder to maintain.

Several authors suggest that the most workable response is not to remove humans from the process but to place them firmly at its center. This has led to growing support for a hybrid

“human-in-the-loop” model. In such an approach, AI may be used to scan through large datasets, generate possible options, or compile shortlists, but the final judgment remains with a human decision-maker. The argument here remains straightforward that this model combines efficiency with accountability, allows organizations to benefit from AI’s capacity to handle scale and complexity, while ensuring that human oversight tempers the risks of bias and maintains the trust of the workforce.

The Global Divide: Challenges in Low-Resource Settings

AI in healthcare HRM has been widely promoted, but the reality of its use looks very different across regions. In wealthier countries, the conditions needed for AI—large datasets, high-speed internet, advanced computing power—are usually taken for granted. In contrast, low-resource settings still struggle with the basics. Reliable, structured health data are often missing, and the digital infrastructure required to support AI is weak. To give one example, some reports suggest that less than 1% of global health data is generated in African nations. This figure is striking, as it shows how little local information is available to train models. The result is predictable: systems built on foreign data are not always accurate in these contexts, and at times their use can even be harmful. Poor connectivity and the absence of computing resources only add to the difficulty of scaling such technologies.

The shortage of local data also creates space for bias to creep in. As already noted in several studies, algorithms trained mostly on data from Western or white populations can underperform in African populations, misjudging the severity of illnesses. In practice, this turns AI into a tool that reinforces inequalities instead of correcting them. What was supposed to be a solution becomes another problem, and once this cycle begins, it can be very difficult to break.

Economic pressures make the matter even worse as AI equipment is expensive, and its upkeep is not cheap either. Many countries that depend on donor funding for health programs cannot afford these additional costs on their own. At the same time, there is the issue of human resources. Skilled professionals who could lead the introduction of AI often migrate abroad, leaving behind systems with very few experts to implement or monitor such tools. This “brain drain” creates a serious capacity gap that no technology, no matter how advanced, can easily fix.

Overall, AI still carries great promise for reducing workloads and improving efficiency in settings where resources are scarce. Without data that reflect local populations, without infrastructure that can handle large-scale applications, and without sustainable investment in both technology and people, AI risks deepening the very inequalities it is meant to resolve. What seems clear from the literature is that a one-size-fits-all approach will not work. Strategies have to be adapted to context, and solutions need to grow out of local realities.

5.3 Comparative Analysis

To contextualize our findings, we compared AI-based HRM approaches with traditional and hybrid methods across several dimensions. AI systems outperform traditional methods in efficiency and scalability, cutting process times by half. However, unchecked AI carries higher bias risk unless offset by fairness mechanisms. Cost is medium for AI (due to initial setup costs) compared to the high long-term labor cost of fully manual approaches. Trust in AI is variable: with explainable AI and human oversight, trust levels can approach or exceed those of purely manual systems. Hybrid models that combine AI speed with human judgment emerged as

optimal. For example, a hybrid approach might use AI to shortlist candidates but rely on experienced recruiters for final selection, thus balancing speed and equity.

Our comparative table (Table 2, in Annex) synthesizes these trade-offs. It reflects guidance from existing frameworks. The EU's Trustworthy AI guidelines explicitly address many of these factors: they list privacy, transparency, diversity, and accountability as core requirements[6]. The comparison underscores that a hybrid strategy leveraging AI efficiency while embedding human-in-the-loop checks may best mitigate the identified weaknesses.

Dimension	Traditional HRM (Manual)	AI-based HRM (Purely Automated)	Hybrid HRM (AI + Human)
Efficiency	Low (labor-intensive)	Very High (automates routine tasks)	High (balances speed with human oversight)
Scalability	Low (limited by human capacity)	High (can handle large datasets at scale)	Medium-High (scalable with human oversight)
Bias Risk	Medium (human biases)	High (can amplify historical biases)	Low-Medium (human-in-the-loop can mitigate bias)
Trust	High (relies on human relationships)	Low (can suffer from "trust deficit")	High (balances data with human accountability)
Cost	High (long-term labor costs)	Medium (high initial setup costs)	Medium (balances AI and human costs)
Accountability	High (human is clearly accountable)	Low-Medium (responsibility can be murky)	High (clear chain of human accountability)

Table 3: Comparison of AI, Traditional, and Hybrid HRM approaches.

6. CONCLUSION & RECOMMENDATIONS

6.1 Conclusion

This review shows that artificial intelligence can reshape how human resources are managed in healthcare, but it should not be seen as a simple fix. It does have clear benefits. For example, several studies point out that AI helps speed up recruitment and makes workforce planning more efficient, which is especially important given the ongoing shortage of healthcare workers ^[1]. At the same time, the risks cannot be ignored. A recurring problem is algorithmic bias. When past inequalities are built into the data, the system often repeats them rather than removing them ^[4]. Concerns about privacy and the lack of transparency also come up repeatedly, making staff less willing to trust such tools.

In practice, AI is often promoted to reduce routine tasks and save time, but the reality is that without checks, it can create new challenges. The review highlights that bias limited transparency, and data protection are not merely just issues, they are central to whether these tools work fairly. Global organizations such as the EU and WHO have already offered high-level ethical frameworks ^{[6][7]}, which focuses on principles like fairness and accountability. These guidelines are useful, but they are not written specifically for healthcare HR, so there is still a gap between policy and day-to-day use.

What seems clear is that health organizations will need governance systems that go further than general principles. Measures like independent audits, human oversight in decision-making, and alignment with the values of healthcare institutions are essential. To conclude, AI has the

capacity to make HR practices more efficient and forward-looking, but only when it's implemented carefully with fairness, transparency, and staff wellbeing at its core ^{[4][7]}.

6.2 Recommendations

From the analysis carried out, it becomes clear that the use of artificial intelligence in healthcare human resource management can only be beneficial if it is accompanied by safeguards that make its application both responsible and acceptable to staff. One of the first considerations is the quality of data being used. If the data are incomplete or biased, the outcomes will inevitably reproduce those biases. For this reason, organisations should not rely on a system without carrying out periodic checks. In some European countries, for example, bias assessments are being considered as part of the approval process, and adopting a similar approach could help healthcare organizations avoid unintended discrimination.

Governance is another area to focus, decisions about workforce management should not be left entirely to technical experts, because these choices directly affect people's careers, working conditions, and sense of fairness. The World Health Organization has also highlighted the importance of such inclusivity when it comes to governing the use of AI in health settings. Involving a wider group clinicians, managers, ethicists, and even patient representatives can provide a more panoramic view.

The success of these systems also depends on to what extent staff themselves are engaged with AI. If healthcare workers are introduced to AI as an imposed tool, they may resist its use. Training should not only cover technical functioning but also reassure staff about how their data will be handled, when they are included in the design process and trained in how the system

works, they are more likely to see it as supportive rather than threatening.

Transparency plays a particularly important role. It is not enough for a system to recommend a candidate or propose a shift schedule; HR professionals need to know why the system has made that suggestion. Models that can provide explanations, or that are easier to interpret, should therefore be given preference. Case evidence shows that when systems are opaque, trust in them is very limited.

Alongside transparency, strict attention must be paid to privacy and security. Workforce data is sensitive, and compliance with frameworks such as HIPAA or GDPR is essential. While some organizations may even find it useful to appoint a data protection officer to oversee HR analytics. Steps such as anonymizing staff records or limiting access to sensitive information need to become routine rather than occasional safeguards. At the same time, it is worth remembering that AI is not intended to take over the role of managers. These systems work best when they support human decision-making, for instance by pointing out clashes in duty rosters or drawing attention to suitable candidates during recruitment. The ultimate decision about hiring or scheduling should, however, continue to rest with people. In this way, the technology can improve efficiency without removing the human judgment that remains central to healthcare management.

Finally, regulation in this field still lags practice. Generic guidelines on AI ethics are useful, but they are too broad for the complexities of healthcare HR. There may be merit in developing sector-specific standards, including ethical reviews for HR-focused AI systems, in much the same way as clinical trials are reviewed before approval. Even after systems are introduced, they

must be monitored continuously. Staff feedback is critical, and if harmful effects such as new forms of bias begin to appear, organizations must be willing to intervene quickly and, if necessary, pause the system until the problems are addressed.

Actionable Recommendations for Stakeholders

The review makes it clear that the successful and ethical use of artificial intelligence in healthcare human resource management depends on the actions of several groups. The following points outline some directions, though they should be understood as evolving suggestions rather than fixed rules.

Healthcare Administrators

In day-to-day practice, administrators may find it most useful to treat AI as a support system rather than a replacement for professional judgment. For instance, scheduling software can be used to highlight gaps or overlaps in duty rosters, but the final decision on who should be placed where ought to stay with a manager who understands the wider context and can take into account factors that a system might overlook. This type of “human-in-the-loop” approach not only maintains fairness but also reassures staff that decisions affecting their careers are not being outsourced entirely to machines.

At the same time, hospitals and health organizations cannot expect staff to accept new tools without preparation. Training programs that build basic digital literacy and open communication about how staff data will be used are essential. Some studies indicate that when employees are included in early discussions and can see how decisions are made, resistance is reduced and trust

in the system is stronger.

Policymakers and Regulators

From a regulatory perspective, broad ethical principles while helpful are often too generic to address the challenges of healthcare HRM. More stringent rule such as requiring bias impact assessments before systems are deployed or defining clear lines of accountability if errors occur. Safeguards failing to comply is a risk that AI tools may reproduce inequalities rather than reduce them.

One limitation that stands out in the current use of AI is the fact that most datasets still come from high-income countries. This creates a situation where the systems trained may not resemble those in low- or middle-income regions. As a result, the recommendations or outcomes produced by such systems may not transfer well to settings with different healthcare structures, resources, or workforce challenges. Policymakers therefore face two tasks at the same time. They have to make sure that AI is used responsibly within their own systems, but they also need to support broader collaborations that generate more representative data. If this gap continues, then the benefits of AI are likely to remain concentrated in only a few countries, reinforcing the very inequalities that global health policies are trying to reduce.

AI Developers and Researchers

For developers and researchers, fairness cannot be something that is added as an afterthought; it has to be built into the design process from the beginning. This means deliberately searching out datasets that capture a wide range of experiences and using techniques that can flag hidden biases before the systems are rolled out. It is true that this is not a simple task it requires time,

funding, and cooperation across organizations but if not focused upon presently, the credibility of AI in healthcare HRM will suffer.

Another point worth emphasizing is that developers should not work in isolation. While technical expertise is important, the systems they build will eventually be used by clinicians, HR managers, and other staff. Their perspectives, as well as those of groups that are often left out of decision-making, can make a difference in how effective and acceptable a system becomes. Bringing these voices into the design process may slow things down at first, but in the long run it tends to produce tools that are more practical and trustworthy.

Conclusion

In summary, the recommendations of this review suggest that AI has significant potential to improve the management of healthcare workforces, but this potential can only be realized if the technology is introduced carefully. Ethical guidelines from bodies such as the European Union and the World Health Organization provide a useful reference point to begin with, but they should be seen as evolving rather than fixed. AI will continue to change, and so must the policies and practices that regulate its use. For that reason, ongoing monitoring and adjustment should be treated as a normal part of implementation rather than as an afterthought.^{[6][7]}

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