Perception Regarding the Application of Artificial Intelligence Among Healthcare Personnel

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I. INTRODUCTION

Artificial intelligence (AI) is no longer a distant technological aspiration — it is an operational reality increasingly embedded in clinical environments worldwide. AI-driven applications in diagnostic radiology, clinical decision support, predictive analytics, natural language processing for electronic health records, and robotic-assisted surgery are redefining the boundaries of what is clinically achievable (Jiang et al., 2017; Topol, 2019). The global healthcare landscape is confronting an intersecting set of challenges: rapidly growing patient populations, critical shortages of trained healthcare personnel, escalating costs of care, mounting chronic disease burden, and rising expectations for patient safety and quality. Artificial intelligence offers a compelling suite of solutions — augmenting clinical decision-making, reducing diagnostic errors, streamlining workflows, and enabling population-level health monitoring (Davenport & Kalakota, 2019).

However, the deployment of AI in clinical settings is not merely a technological undertaking — it is a deeply human one. Healthcare personnel, particularly nurses and doctors, are the primary end-users of AI-based clinical tools. Their perceptions, attitudes, and readiness directly shape the trajectory of AI adoption. When healthcare workers hold positive and informed perceptions, they are more likely to engage constructively with AI tools, advocate for their appropriate use, and contribute to their safe implementation. Conversely, perceptions rooted in fear of job displacement, distrust of algorithmic decision-making, or unfamiliarity can constitute formidable barriers to integration, irrespective of the technical sophistication of the AI system (Kelly et al., 2019; WHO, 2021).

In the Indian healthcare context, the integration of AI is gathering momentum. The Government of India, through NITI Aayog's National Strategy for Artificial Intelligence (2018) and the National Digital Health Mission, has articulated a clear policy commitment to responsible and inclusive AI deployment in healthcare. Pioneering applications are emerging in areas such as diabetic retinopathy screening, tuberculosis detection, and telemedicine. Nevertheless, adoption in routine clinical practice — particularly in government tertiary care settings — remains uneven, and empirical data on frontline healthcare workers' perceptions remain limited (Singh & Rai, 2022; Krishnan et al., 2022).

This study was therefore undertaken to systematically assess the perception of healthcare personnel regarding the application of AI in a selected Indian tertiary care hospital, and to examine the associations between selected demographic variables and this perception. The findings provide context-specific, evidence-based data to inform institutional training strategies, curriculum planning, and healthcare administration policy.

II. REVIEW OF LITERATURE

2.1. Global Evidence on AI Perception Among Healthcare Workers

A growing body of international literature has examined healthcare professionals' perceptions of AI. A systematic review by Guo et al. (2020) of 26 studies identified that health professionals' acceptance of AI was positively associated with perceived usefulness, prior technology experience, and institutional support,

and negatively associated with age and years of clinical experience. Sit et al. (2020) found that professional category was generally a weak and inconsistent predictor of AI acceptance across settings. Blease et al. (2018) documented significantly greater receptivity to AI among younger clinicians, a finding consistently echoed across subsequent studies.

Research has identified four broad clusters of concerns among healthcare workers: (i) fear of professional displacement and de-skilling; (ii) ethical concerns regarding patient privacy and data security; (iii) lack of transparency in algorithmic decision-making (the 'black box' problem); and (iv) inadequate training and technical competence (Davenport & Kalakota, 2019; Kelly et al., 2019; WHO, 2021). Conversely, positive perceptions are most commonly associated with recognition of AI's potential to improve diagnostic efficiency, reduce clinical workload, and enhance patient safety outcomes.

Joo et al. (2025) conducted a systematic qualitative review of nurses' perceptions of AI in healthcare and found that nurses predominantly viewed AI as beneficial for patient monitoring and workload reduction, but expressed concerns about accountability, trust, and the impact on nurse-patient relationships. Huotari et al. (2026) in a meta-aggregation of 31 qualitative studies across healthcare professionals found that perceived competence gaps and lack of institutional support were the most frequently cited barriers to AI adoption.

2.2. Prior AI Training as a Determinant of Perception

Prior exposure to AI through formal training or workplace experience has consistently emerged as one of the strongest modifiable predictors of positive perception and adoption readiness. Nadarzynski et al. (2019) found that healthcare workers with any formal AI education were approximately three times more likely to hold positive attitudes towards AI tools. Ronquillo et al. (2021) demonstrated that integrating AI literacy into nursing curricula significantly improved students' confidence in AI engagement. Sharma et al. (2023) found that even a single AI-focused workshop produced significantly higher AI attitude scores among Indian nurses.

2.3. Indian Context

Within India, a limited but growing body of research has begun examining healthcare workers' AI perceptions. Sharma et al. (2022) conducted a cross-sectional survey at a tertiary care hospital in North India and found predominantly positive attitudes, though with substantial gaps in knowledge. Singh & Rai (2022) identified low AI awareness and variable attitudes among healthcare professionals in a primary care context, noting that prior training and urban institutional affiliation were significant positive predictors. Singh et al. (2024) found, in a multi-site descriptive study, that younger professionals and those working in technology-intensive departments showed higher AI acceptance.

Despite this growing evidence base, most available Indian studies are limited by small sample sizes, single-specialty focus, or inadequate stratified analysis by professional category, age, and experience. The present study addresses these gaps through a structured, large-sample, quantitative cross-sectional assessment at a major tertiary care government hospital.

III. STATEMENT OF THE PROBLEM

'A Descriptive Cross- Sectional Study to Assess the Perception Regarding the Application of Artificial Intelligence Among Healthcare Personnel in Selected Health Care Setting'

Objectives

The following objectives guided the present investigation:

1. To assess the overall level of perception regarding the application of Artificial Intelligence among healthcare personnel at the selected healthcare setting.
2. To determine the association between selected demographic variables — including age, sex, professional category, years of clinical experience, and prior exposure to AI tools — and the perception of healthcare personnel regarding the application of Artificial Intelligence.
3. To develop an informational brochure based on the findings of the study to enhance awareness and knowledge regarding the application of Artificial Intelligence in healthcare settings.

Research Hypotheses

Null Hypothesis (H_0):

There is no statistically significant association between the perception of healthcare personnel

towards AI and their selected demographic variables (age, sex, profession, years of experience, and prior AI training) at the 0.05 level of significance.

Research Hypothesis (H_1):
There is a statistically significant association between the perception of healthcare personnel towards AI and their selected demographic variables at the 0.05 level of significance.

IV. NEED FOR THE STUDY

The need for the present study is grounded in the intersection of three compelling imperatives: the rapid proliferation of AI technologies in healthcare, the critical role of healthcare professionals' perceptions in determining AI adoption outcomes, and the paucity of empirical evidence from the Indian tertiary care hospital context.

AI-powered diagnostic tools are being deployed in radiology departments for chest X-ray screening, in pathology laboratories for cancer cell detection, and in intensive care units for real-time patient deterioration prediction. Healthcare personnel working in these settings are increasingly expected to interact with, interpret, and act upon AI-generated outputs in their daily clinical practice. The degree to which they are prepared to do so, and their fundamental orientation towards AI as a concept, will substantially determine the quality and safety of AI-assisted care delivery (Davenport & Kalakota, 2019; Topol, 2019).

Most available studies on healthcare workers' perceptions of AI have been conducted in high-income countries with well-established digital health infrastructures, limiting applicability to the Indian healthcare environment, which is characterised by distinct resource constraints, workforce composition, digital literacy levels, and institutional cultures. The present study, conducted at a major government tertiary care hospital serving as a hub of clinical training, generates granular, context-specific data that directly inform institutional training strategies, curriculum planning, and policy at local, state, and national levels.

V. METHODOLOGY

5.1. Research Design

A descriptive cross-sectional research design with a quantitative approach was adopted. This design was selected for its ability to provide a snapshot of the distribution of AI perception and its demographic correlates across a defined population at a single point in time, without experimental manipulation.

5.2. Setting

The study was conducted at New Civil Hospital, Surat — a major government tertiary care hospital in Gujarat, India. The hospital serves a large and diverse patient population and accommodates significant clinical training activities.

5.3. Population and Sample

The target population comprised all nurses and doctors employed in the selected departments who were directly or indirectly involved in patient care delivery. A total of 330 participants were recruited through non-probability convenient sampling — comprising 300 nurses and 30 doctors — from those available and willing to participate during the designated data collection period.

5.4. Inclusion and Exclusion Criteria

Inclusion:
Registered nurses aged ≤50 years and doctors employed in the Radiology and Pathology departments of New Civil Hospital, Surat; those present and willing to participate during the data collection period; those who provided written informed consent.

Exclusion:
Personnel not directly involved in patient care; those absent during the data collection period; those unwilling to provide consent; student nurses and medical interns.

5.5. Data Collection Tool

Data were collected using a self-administered structured questionnaire comprising two sections:

- Section A — Socio-Demographic Profile: Captured age group, sex, highest educational qualification, professional designation, total years of clinical experience, and self-reported prior exposure to or formal training in artificial intelligence.
- Section B — AI Perception Scale: A validated 30-item, five-point Likert-scale instrument (Strongly Agree = 5 to Strongly Disagree = 1; reverse-scored for negatively worded items). Items assessed

knowledge and awareness of AI, perceived clinical benefits, concerns regarding AI risks, attitudes towards AI integration, and readiness to engage with AI tools. Maximum possible score: 150.

5.6. Scoring and Classification

Participants scoring ≥75 (≥50% of the maximum score of 150) were classified as demonstrating positive perception; those scoring <75 were classified as negative perception. The total score range was 30–150.

5.7. Validity and Reliability

Content validity was established through formal expert review by a panel of 15 recognised experts from nursing education, clinical medicine, healthcare informatics, and research methodology. Items were evaluated for relevance, clarity, comprehensiveness, and appropriateness. Reliability was assessed using Cronbach's Alpha, with an acceptable threshold of $\alpha \geq 0.70$, as established in the pilot study (conducted on approximately 33 participants drawn from a comparable setting and excluded from the main study).

5.8. Data Collection Procedure

Administrative approval and ethical clearance were obtained from the Institutional Ethics Committee, Government College of Nursing, Surat, and the Medical Superintendent, New Civil Hospital, Surat, prior to commencement. Written informed consent was obtained from all participants. Questionnaires were distributed in paper format or via Google Forms, allowing participants sufficient time to respond independently. Completed questionnaires were collected promptly to minimise inter-participant response influence.

5.9. Statistical Analysis

All data were coded and analysed using appropriate statistical software. Descriptive statistics included frequency counts, percentages, mean, and standard deviation. Normality of score distribution was assessed using the Shapiro-Wilk test, which confirmed non-normal distribution ($W = 0.987$, $p = .004$), necessitating non-parametric inferential tests. The following tests were applied:

- Chi-Square test of independence (χ^2): For categorical associations between demographic variables and perception category.
- Mann-Whitney U test: For two-group comparisons (sex; profession; prior AI training).
- Kruskal-Wallis H test: For multi-group comparisons (age group; years of experience).

Statistical significance was set at $p < .05$ (two-tailed) for all tests.

5.10. Ethical Considerations

The study was conducted in strict compliance with the ICMR National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017) and the Declaration of Helsinki. Ethical approval was obtained prior to commencement. All participation was voluntary, informed, and anonymous. No personal identifiers were recorded. The study involved no experimental intervention and posed no risk of harm to participants.

VI. INTERPRETATION OF FINDINGS AS PER OBJECTIVES

6.1. Objective 1: Overall Level of AI Perception

The mean AI perception score among the 330 healthcare personnel was 105.49 (SD = 20.54) out of a maximum of 150. A substantial majority — 93.9% (n = 310) — demonstrated positive perception (score ≥75), while only 6.1% (n = 20) demonstrated negative perception. This high rate of positive perception indicates a generally encouraging foundational orientation towards AI across the study population. The mean score, falling in the 'moderate-to-high positive' range, suggests that while overall orientation is favourable, there remains meaningful room for enhancement through targeted educational interventions.

6.2. Demographic Profile of Participants

The sample was predominantly young: 41.2% (n = 136) were in the 21–25-year age group, and 67.3% were aged 30 years or below. Females constituted 74.2% (n = 245) of the sample, consistent with the feminised composition of the nursing workforce in India. Nurses comprised 90.9% (n = 300) and doctors 9.1% (n = 30). The majority of participants had 1–5 years of clinical experience (52.1%; n = 172)

Table 1: Demographic Characteristics of Study Participants (N = 330)

Variable	Category	n	%	Rank
Age Group	21–25 years	136	41.2	1st
	26–30 years	86	26.1	2nd
	31–35 years	44	13.3	3rd
	36–50 years	64	19.4	4–6th
Sex	Female	245	74.2	—
	Male	85	25.8	—
Profession	Nurse	300	90.9	—
	Doctor	30	9.1	—
Experience	< 1 year	83	25.2	2nd
	1–5 years	172	52.1	1st
	6–10 years	49	14.8	3rd
	> 10 years	26	7.9	4th

6.3. Objective 2: Association Between Demographic Variables and AI Perception

Inferential analyses assessed the associations between each demographic variable and AI perception. Key findings are summarised in Table 2 below.

Table 2: Summary of Inferential Statistical Results (N = 330)

Variable	Test Applied	Statistic	p-value	Significance
Age Group	Chi-Square / Kruskal-Wallis H	χ^2=49.18 / H=22.25	< .001	Significant*
Sex	Chi-Square / Mann-Whitney U	χ^2=3.74 / U=11928.50	.053 / .039	Partial*
Profession	Chi-Square / Mann-Whitney U	χ^2=1.31 / U=3989.00	.252 / .817	Not Significant
Years of Experience	Chi-Square / Kruskal-Wallis H	χ^2=35.30 / H=27.84	< .001	Significant*

** Significant at p < .05*

Age Group and AI Perception

A highly significant association was observed between age group and AI perception category (χ^2 = 49.18, df = 5, p < .001). The proportion of positive perception was highest among the youngest groups: 97.1% (21–25 years) and 95.3% (26–30 years), declining progressively to 75.0% in the 46–50-year group. Kruskal-Walli's analysis confirmed significant differences in perception scores across age groups (H = 22.25, p < .001), with median scores declining from 108.0 (26–30 years) to 88.0 (46–50 years). The null hypothesis H_{o1} was therefore rejected.

Sex and AI Perception

The Chi-Square test did not demonstrate a statistically significant association between sex and perception category (χ^2 = 3.74, df = 1, p = .053), indicating that the direction of perception did not differ significantly by sex. However, the Mann-Whitney U test identified a statistically significant difference in perception scores (U = 11928.50, p = .039), with male participants recording a higher mean score (M = 109.84, Mdn = 106.0) compared to female participants (M = 104.03, Mdn = 103.0). The null hypothesis H_{o2} was partially rejected.

Professional Category and AI Perception

No statistically significant association was observed between professional category and AI perception, either in terms of perception category (χ^2 = 1.31, df = 1, p = .252) or perception score (U = 3989.00, p = .817). Nurses (M = 104.91, Mdn = 103.0) and doctors (M = 106.23, Mdn = 104.0) demonstrated comparable and uniformly high rates of positive perception (94.0% and 90.0% respectively). The null hypothesis H_{o3} was retained.

Years of Professional Experience and AI Perception

A statistically significant and notably non-linear association was identified between years of professional experience and perception (χ^2 = 35.30, df = 3, p < .001; H = 27.84, p < .001). Participants with 1–5 years of experience demonstrated the most positive profile (positive perception rate: 97.1%; Mdn = 107.0). The 6–10-year experience group exhibited the most negative profile — the lowest positive perception rate (77.6%) and highest negative perception rate (22.4%), with the lowest median score across all experience groups (Mdn = 82.0).

Participants with more than 10 years of experience showed a partial recovery (Mdn = 104.5). The null hypothesis H_{04} was rejected.

Prior AI Training and AI Perception

Prior AI training emerged as the single most powerful and practically significant predictor of AI perception. Both the Chi-Square ($\chi^2 = 8.26$, df = 1, $p = .004$) and Mann-Whitney U ($U = 15200.00$, $p < .001$) tests confirmed a highly significant association. Participants with prior AI training recorded a mean score of 113.66 (Mdn = 116.0) compared to 101.82 (Mdn = 100.0) for those without — a difference of approximately 12 points, the largest observed across all demographic comparisons. Notably, 68.8% of the sample had received no prior AI training, underscoring both the scale of the gap and the magnitude of the opportunity. The null hypothesis H_{05} was rejected.

6.4. Objective 3: Development of the Informational Brochure

Based on the findings of the study, an informational brochure was developed as a study deliverable to supplement awareness efforts at the institutional level. The brochure, validated by the expert panel, covers: foundational AI concepts and healthcare applications, key findings of the study, the significance of positive AI perception for patient care quality, available resources for AI training, and guidance on ethical considerations in AI-assisted clinical practice. The brochure was designed in both English and Gujarati to maximise accessibility for the study population.

VII. DISCUSSION

The present study provides empirical evidence from a large, representative sample of 330 healthcare personnel at a major Indian government tertiary care hospital, contributing meaningfully to the growing evidence base on AI perception in healthcare settings.

7.1. Level of Perception

The finding that 93.9% of participants demonstrated positive AI perception is striking and broadly consistent with contemporary evidence from both global and Indian contexts. Qianqian et al. (2025) found that over 85% of healthcare workers in a large-scale survey reported positive attitudes towards AI tools, while Singh et al. (2024) reported positive perception rates of approximately 78% in a multi-site Indian study. The somewhat higher positive perception rate in the present study may reflect the particular characteristics of the study setting — a large government teaching hospital where technology-mediated clinical practice is increasingly prevalent — and the relatively young age profile of the sample.

Despite this overall positivity, the mean score of 105.49 out of 150 indicates a moderate rather than maximum level of positive perception, suggesting meaningful room for enhancement through structured educational and institutional interventions. A small but clinically meaningful minority of 6.1% held negative perceptions — a group that warrants targeted educational attention, as Shenoy et al. (2021) have cautioned that even a modest proportion of negatively oriented healthcare workers can constitute a significant barrier to institutional AI integration if concentrated among influential staff.

7.2. Age and AI Perception

Age was among the most powerful and statistically robust predictors of AI perception ($\chi^2 = 49.18$, $p < .001$; $H = 22.25$, $p < .001$). The consistent and progressive decline in positive perception rates and median scores with advancing age — from a median of 108.0 in the 26–30-year group to 88.0 in the 46–50-year group — closely aligns with Blease et al. (2018) and Guo et al. (2020), both of whom documented significantly greater receptivity to AI among younger clinicians. The UTAUT framework (Venkatesh et al., 2003) provides theoretical grounding: age moderates the relationship between perceived ease of use and technology acceptance, with younger individuals more likely to perceive digital tools as intuitive and accessible. For Indian hospitals, this finding implies a particular need for age-sensitive AI orientation programmes that address the distinct concerns and learning preferences of senior clinical staff.

7.3. Sex and AI Perception

The study found no significant sex-based difference in AI perception category ($p = .053$), but did identify a statistically significant difference in perception scores (U: $p = .039$), with male participants recording higher scores. This nuanced pattern — in which the direction of perception does not significantly differ by sex, but the intensity does — has been partially reported in the literature. Sarwar et al. (2020) documented marginally

higher AI acceptance among male healthcare professionals in South Asian settings, while Sit et al. (2020) concluded that sex-related differences are typically small in magnitude and inconsistent across settings. Given the predominantly female composition of the Indian nursing workforce, understanding and addressing any sex-related attitudinal differences is of particular institutional relevance.

7.4. Profession and AI Perception

The absence of a statistically significant difference between nurses and doctors in AI perception — either categorically ($p = .252$) or by score ($p = .817$) — is one of the most practically significant findings of the study. This convergence is consistent with Sit et al. (2020) and Topol (2019), who argued that AI's increasing penetration across interdisciplinary clinical functions is blurring traditional profession-specific attitudes towards technology. In the Indian context, this likely reflects a shared educational environment where both professional groups have received similarly limited formal AI training (Singh & Rai, 2022). The practical implication is clear: unified, interdisciplinary AI education programmes are both effective and efficient for this institutional context.

7.5. Years of Experience and AI Perception

The relationship between years of professional experience and AI perception was found to be non-linear — a finding of considerable theoretical and practical significance. While the 1–5-year group demonstrated the most positive profile (Mdn = 107.0; positive perception rate: 97.1%), the 6–10-year group showed the most negative profile (Mdn = 82.0; negative perception rate: 22.4%), even surpassing the oldest age groups in negativity. This counterintuitive U-shaped pattern has been described in the technology acceptance literature as the 'experience paradox' (Venkatesh et al., 2003): mid-career professionals who have developed entrenched clinical routines may perceive AI as a disruptive threat rather than a useful adjunct. Guo et al. (2020) similarly found lower AI acceptance scores among the 5–10-year experience cohort. This group constitutes a priority target for tailored AI change-management and professional development interventions.

VIII. RECOMMENDATIONS

8.1. For Nursing Practice

- Hospital management and nursing administration should design and implement structured AI orientation programmes targeting all nursing staff, with particular emphasis on mid-career nurses (6–10 years of experience), who demonstrated the most negative perception profile in the present study.
- Ward-level AI champions — nurses with prior AI training and positive perception — should be identified and empowered as peer educators and role models, promoting bottom-up AI literacy within clinical teams.
- Patient care protocols should be progressively adapted to incorporate AI-assisted tools where evidence supports their use, with nurses involved in the co-design and evaluation of these protocols to foster ownership and positive engagement.

8.2. For Nursing and Medical Education

- The Indian Nursing Council (INC) and the Medical Council of India (MCI) should formalise AI literacy as a core competency within undergraduate and postgraduate curricula, encompassing foundational AI concepts, healthcare applications, ethical considerations, and basic data literacy.
- Faculty development programmes should equip nursing and medical educators with the knowledge and pedagogical skills needed to teach AI literacy effectively.
- Simulation-based and problem-based learning approaches should supplement didactic AI instruction, providing hands-on exposure to AI tools in controlled clinical simulation environments.

8.3. For Healthcare Administration and Policy

- Hospital administrators should develop institutional AI integration roadmaps with specific milestones for staff training, pilot implementation, and outcome evaluation, with mechanisms for ongoing feedback from clinical staff.
- The National Digital Health Mission should explicitly incorporate workforce AI readiness as a key performance indicator and allocate dedicated resources for training and capacity building at the institutional level.

- Interdisciplinary AI implementation teams — comprising nurses, doctors, informaticists, ethicists, and patient representatives — should be established within hospitals to ensure AI adoption is clinically relevant, ethically sound, and equitably beneficial.

8.4. For Future Research

- Longitudinal studies tracking changes in healthcare workers' AI perception before and after structured AI training interventions are needed to establish causality and quantify the impact of education on perception change.
- Multi-site studies across diverse hospital types (government, private, teaching, community) and different Indian states would enhance generalisability.
- Qualitative and mixed-methods studies exploring the specific concerns, misconceptions, and information needs underpinning negative AI perception — particularly among mid-career professionals — would generate richer, more actionable insights.
- Development and psychometric validation of a context-specific, culturally adapted AI perception instrument for Indian healthcare settings is recommended to improve measurement rigour in future studies.

IX. CONCLUSION

The present study provides robust empirical evidence that healthcare personnel at a tertiary care government hospital in India predominantly hold positive perceptions of artificial intelligence (mean score: 105.49 / 150; positive perception: 93.9%), reflecting an encouraging foundational readiness for AI integration in clinical practice. The study's inferential analysis establishes that this perception is not uniformly distributed across the workforce but is significantly shaped by age, years of professional experience, and prior AI training — three variables with distinct and actionable implications for institutional and policy-level planning.

The finding that prior AI training is the single strongest modifiable determinant of AI perception across the sample offers a clear, evidence-based mandate for action: structured, accessible, and contextually relevant AI literacy programmes must be embedded within the professional development infrastructure of Indian hospitals and integrated into the curricula of nursing and medical education programmes. Only 31.2% of the current sample had received any prior AI training, making the scale of the educational opportunity both sobering and compelling.

The convergence of AI perception across nurses and doctors — irrespective of professional category — further supports the case for interdisciplinary approaches to AI education and implementation planning. Meanwhile, the non-linear relationship between experience and AI perception, in which mid-career professionals (6–10 years of experience) exhibit the most negative attitudes, identifies a cohort that requires particular attention from institutional AI champions and change managers. Addressing this group's specific concerns, involving them meaningfully in AI implementation decisions, and providing role-appropriate, hands-on AI exposure are essential strategies for building a cohesive and positively oriented clinical AI culture across the full range of the healthcare workforce.

As India's digital health ecosystem continues to expand — driven by the National Digital Health Mission, NITI Aayog's AI strategy, and institutional innovation — the perceptions and readiness of its healthcare workforce will be among the most consequential determinants of whether the promise of AI in healthcare is translated into safe, equitable, and effective patient care. This study contributes a meaningful empirical foundation to that endeavour.

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