HEALTHCARE WORKERS' PERSPECTIVES ON ARTIFICIAL INTELLIGENCE IN PRIMARY CARE

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Abstract

This study examines primary healthcare workers' perceptions of artificial intelligence (AI), focusing on perceived benefits, readiness, organizational support, ethical concerns, and practical experience in daily work. A cross-sectional quantitative survey was conducted in March–June 2024 across 43 primary healthcare institutions (n = 678). The data was collected using a structured 32-item questionnaire rated on a five-point Likert scale. Exploratory factor analysis confirmed a six-factor model explaining 71.2% of total variance (perceived AI benefits, threat to professional autonomy, personal readiness, organizational support and training, ethical concerns, and practical experience). Overall attitudes toward AI were positive, with high perceived benefits (M = 4.12, SD = 0.61) and personal readiness (M = 3.98, SD = 0.55), while practical experience remained limited (M = 2.87, SD = 0.72). Significant differences were identified by age, professional role, and years of experience ($p < 0.05$): younger and less experienced staff reported greater readiness, whereas older and more experienced professionals expressed stronger autonomy- and ethics-related concerns. Organizational support was positively associated with AI acceptance, highlighting the need for targeted training and clear ethical accountability to translate readiness into implementation.

Keywords: artificial intelligence; primary healthcare; employee attitudes; organizational support; ethical concerns.

INTRODUCTION

Research topicality and problem. Artificial intelligence (AI) is increasingly integrated into healthcare systems worldwide, promising improvements in diagnostic accuracy, workflow efficiency, and accessibility of services. In primary healthcare, AI tools are promoted as solutions to growing workforce shortages, administrative burden, and rising patient demand (Li et al., 2023; Ahmed et al., 2024). However, despite rapid technological development, the practical implementation of AI in primary care remains uneven and limited. Previous studies indicate that healthcare professionals often express positive expectations toward AI while simultaneously experiencing ethical concerns, lack of trust, and insufficient organizational support (Kraus et al., 2023; Delaney et al., 2024). Research in this field has predominantly focused on hospital-based settings and physicians' perspectives, leaving primary healthcare environments and multidisciplinary staff underexplored. This creates a scientific and practical gap in understanding how AI is perceived and adopted in everyday primary care practice.

The aim of the research. The aim of this study is to examine primary healthcare workers' attitudes toward artificial intelligence, their readiness and practical experience with AI, and the organizational and ethical factors influencing AI acceptance in primary healthcare settings.

Research methodology. A cross-sectional quantitative research design was applied. Data was collected using a structured self-administered questionnaire distributed to employees of primary healthcare institutions. The sample consisted of 678 healthcare workers representing different professional groups. Data analysis included descriptive statistics, exploratory factor analysis, t-tests, ANOVA, and correlation analysis to identify key factors and group differences related to AI acceptance.

Research results. The study revealed generally positive attitudes toward AI and high perceived benefits and personal readiness among primary healthcare workers, while practical experience with AI tools remained limited. Significant differences were identified according to age, professional role, and work experience, and organizational support was found to be positively associated with AI acceptance.

Originality/Value of the article. This study provides original empirical evidence on AI acceptance in primary healthcare by including a broad range of professional groups and integrating organizational and ethical dimensions. The findings contribute to the scientific

literature by highlighting the gap between perceived potential and actual AI use and offer practical insights for developing targeted training, ethical frameworks, and sustainable AI implementation strategies in primary healthcare.

LITERATURE REVIEW

Artificial intelligence (AI) has become a transformative force in healthcare, reshaping clinical decision-making, data management, and service delivery. Recent advances in machine learning and natural language processing have enabled AI tools to assist in diagnostic accuracy, workflow optimization, and predictive analytics (Li et al., 2023; Wang & Li, 2024). Global initiatives increasingly recognize AI to enhance healthcare quality and accessibility, particularly in systems facing workforce shortages and growing patient demands (Ahmed et al., 2024). Despite this potential, AI implementation remains uneven and is often constrained by technological, ethical, and organizational barriers (Delaney et al., 2024; Zhou et al., 2023).

Primary healthcare represents a particularly complex environment for adoption of AI. Unlike tertiary care institutions, primary care emphasizes long-term relationships, preventive services, and person-centered continuity of care. In such settings, digital innovations must support human-centered workflows rather than replace them (Meier et al., 2024). However, empirical evidence indicates that both research and policy frameworks continue to prioritize hospital-based AI applications—such as diagnostic imaging, risk prediction, or electronic triage—while comparatively little attention is devoted to AI use in everyday primary care practice (Lin et al., 2023; Kraus et al., 2023). This imbalance limits understanding of how general practitioners, nurses, and allied health professionals perceive and adapt to AI within their routine clinical work.

Existing studies reveal a nuanced combination of enthusiasm and caution among healthcare professionals. On the one hand, AI is perceived as a valuable tool for reducing administrative burden, supporting diagnostic reasoning, and improving patient coordination (Johansson et al., 2023; Nguyen et al., 2023). On the other hand, professionals' express concerns regarding potential threats to clinical autonomy, limited transparency of algorithmic decision-making, and possible erosion of trust in clinician–patient relationships (López-Pineda et al., 2023; Park et al., 2024). These attitudes are influenced by multiple interrelated factors, including perceived usefulness, digital competence, ethical awareness, and institutional support (Díaz-García et al., 2023; Kim et al., 2023). For example, Kraus et al. (2023) demonstrated that physicians' acceptance of AI is strongly associated with perceived control and organizational readiness, whereas nurses more frequently emphasize the preservation of human contact and empathy in care delivery (Tang et al., 2024). Consequently, willingness to adopt AI is closely linked to professional identity, confidence, and perceived responsibility.

Organizational preparedness has emerged as a critical determinant of successful AI implementation. Healthcare institutions that provide structured training, transparent communication, and reliable technical support report higher levels of employee confidence and acceptance (Moore et al., 2023; Turner et al., 2023). In contrast, organizations lacking clear strategies or sufficient resources often experience resistance, uncertainty, and fragmented technology uptake (Rimmer et al., 2023). A recent multi-country study by Vila-Corcoles et al. (2024) demonstrated that staff engagement and trust are stronger predictors of successful AI adoption than technological capability alone. Nevertheless, many primary healthcare organizations continue to operate without consistent implementation frameworks, leaving professionals to navigate digital transformation with limited guidance or training opportunities.

Ethical and psychological considerations further complicate AI integration. Ongoing debates focus on accountability, data privacy, and the "black box" nature of algorithmic reasoning (Kwok et al., 2023; Akhtar et al., 2023). Healthcare professionals question who bears

responsibility when AI-supported decisions lead to adverse outcomes and whether automated systems can adequately account for patient individuality and contextual nuances (Braga et al., 2023). Moreover, the transition to AI-assisted systems may intensify psychological strain among professionals, contributing to what has been described as "digital stress"—a combination of cognitive overload and uncertainty related to new workflows (Lee et al., 2024). These challenges highlight that AI integration is not solely a technical or procedural issue but also a cultural process requiring attention to professional trust, ethical alignment, and staff well-being.

Despite growing international interest, empirical research examining how primary healthcare professionals experience and evaluate AI in everyday clinical practice remains limited. Existing studies are often fragmented, frequently focusing on physicians while overlooking nurses, administrative staff, and other members of primary care teams (Kraus et al., 2023; Creswell & Plano Clark, 2018). Furthermore, most available evidence originates from technologically advanced healthcare systems, leaving smaller or resource-constrained contexts underrepresented. Understanding how institutional readiness, access to training, and ethical culture shape professional attitudes toward AI is therefore essential for developing equitable and sustainable adoption strategies.

Addressing these research gaps requires an approach that integrates both individual and organizational dimensions of AI acceptance. Current evidence suggests that successful AI integration depends on three interrelated pillars: professionals' trust in AI usefulness and reliability, the availability of organizational support and training infrastructure, and the presence of transparent ethical and accountability frameworks (Tang et al., 2024; Vila-Corcoles et al., 2024; Kwok et al., 2023). Collecting empirical data from diverse professional groups can clarify how these factors interact and influence AI acceptance in real-world primary care environments.

This research aims to examine primary healthcare workers' attitudes, experiences, and perceived barriers related to the application of artificial intelligence in professional practice. Specifically, the study seeks to identify key factors influencing AI acceptance and to explore how demographic and organizational characteristics shape these perceptions. The findings are expected to contribute to evidence-based strategies supporting ethical, inclusive, and sustainable AI implementation in primary healthcare settings.

RESEARCH METHODOLOGY

This study employed a cross-sectional quantitative design aimed at examining primary healthcare workers' attitudes, experiences, and perceived barriers regarding the use of artificial intelligence (AI) in professional practice. The research was conducted between March and June 2024 across primary healthcare institutions in Lithuania. The design was chosen to enable systematic assessment of professional perspectives across different occupational groups and organizational contexts within a defined time frame (Creswell & Plano Clark, 2018).

A purposive sampling strategy was used to ensure the inclusion of diverse professional categories directly engaged in primary healthcare delivery, including physicians, nurses, administrative staff, and allied health professionals. Each participating institution appointed a designated contact person who distributed an electronic invitation containing a secure survey link to all eligible employees. Participation was voluntary and anonymous, and informed consent was obtained before starting the questionnaire.

Out of 812 invited healthcare workers from 43 institutions, 678 completed the questionnaire, resulting in a response rate of 83.5%. This high response rate minimizes non-response bias and supports representativeness across professional roles. Inclusion criteria

required participants to be employed in a primary healthcare institution for at least six months and to have direct involvement in patient care or care coordination.

The sample size exceeded the minimum recommendations for exploratory factor analysis (EFA), which typically require at least 5–10 participants per item or a minimum of 300 total cases (Polit & Beck, 2021; DeVellis & Thorpe, 2021). With 32 items included in the instrument, the obtained sample was considered more than adequate for robust statistical analysis.

The study instrument is a structured self-administered questionnaire that was developed following an extensive literature review on healthcare professionals' acceptance and use of AI (Streiner et al., 2015; Polit & Beck, 2021; Hair et al., 2022). Several items were adapted from validated instruments used in previous studies addressing digital readiness, ethical perceptions, and organizational support for innovation, while others were newly developed to capture context-specific aspects of primary care, such as workload perception and patient data security.

To ensure content validity, the initial 40-item version of the questionnaire was reviewed by an eight-member expert panel consisting of specialists in medical informatics, nursing, healthcare management, and psychology. Experts evaluated each item for clarity, relevance, and representativeness using a four-point scale. The Content Validity Index (CVI) reached 0.91, indicating excellent agreement among experts (Polit & Beck, 2021). Based on expert feedback, three redundant items were removed, and two items were reworded to improve conceptual precision.

The final instrument consisted of 32 statements grouped into six thematic domains: perceived benefits of AI, threat to professional autonomy, personal readiness and motivation, organizational support and training, ethical concerns, and practical experience. The factorial structure of the instrument was initially explored using exploratory factor analysis and subsequently verified using confirmatory factor analysis. The "Practical Experience with AI" domain included items assessing the frequency and type of interaction with AI-enabled tools commonly used in primary care, such as clinical decision support systems, automated triage algorithms, electronic documentation assistants, and prescription support modules.

All items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). This scale was selected due to its widespread application in attitudinal research and demonstrated reliability in health services studies (Tavakol & Dennick, 2011; Streiner et al., 2015).

A pilot study was conducted in March 2024 with 25 healthcare professionals from two primary healthcare institutions not included in the main survey. Participants represented different professional roles, including physicians, nurses, and administrative staff, to ensure comprehensive feedback on item clarity and response consistency.

Pilot feedback indicated that several items were conceptually clear but linguistically complex, particularly those addressing ethical responsibility, data protection, and organizational support. Based on this feedback, five items were refined to improve wording clarity (e.g., replacing "ethical accountability" with "responsibility for AI-related decisions"). Ambiguous or overlapping phrases were simplified, and illustrative examples were added to distinguish training opportunities from technical assistance. Questionnaire instructions were shortened and reformulated to enhance understanding of the Likert-scale anchors.

These refinements improved face validity, internal consistency, and respondent comprehension. Additionally, average completion time was reduced from approximately 15 to 13 minutes.

Preliminary reliability was assessed during the pilot phase using Cronbach's alpha coefficients for each subscale (Table 1). All domains demonstrated satisfactory to excellent internal consistency, with values ranging from 0.76 to 0.90, confirming the instrument's readiness for large-scale administration (Tavakol & Dennick, 2011; Lee & Kim, 2023).

All statistical analyses were performed using IBM SPSS Statistics (version 29). Data were screened for missing values, normality, and outliers prior to analysis. Descriptive statistics, including means, standard deviations, and frequencies, were used to summarize demographic and professional characteristics.

To identify the underlying dimensions of the questionnaire, an exploratory factor analysis was conducted using Principal Axis Factoring with Varimax rotation. Sampling adequacy was confirmed using the Kaiser–Meyer–Olkin measure (KMO = 0.92) and Bartlett's Test of Sphericity ($\chi^2 = 4867.21$, $p < 0.001$). Factors were retained based on eigenvalues greater than 1.0 and visual inspection of the scree plot. Items with factor loadings below 0.40 were excluded. The final six-factor model explained 71.2% of the total variance, consistent with methodological recommendations (Hair et al., 2019; Field, 2018).

Internal consistency for the final sample was assessed using Cronbach's alpha, with values ≥ 0.70 considered acceptable (Polit & Beck, 2021; Hair et al., 2019). Subscale reliability ranged from 0.78 to 0.91, indicating strong internal coherence across all domains.

Group differences were examined using independent-samples t-tests and one-way analysis of variance (ANOVA) for demographic and professional variables. Post hoc Tukey's HSD tests were applied to identify specific differences between-groups. Spearman's rho correlation coefficients were calculated to explore associations between organizational support, readiness, and AI acceptance. A significance level of $p < 0.05$ was applied throughout the analysis.

The study was conducted in accordance with the Declaration of Helsinki (2013 revision) and received ethical approval from the Institutional Bioethics Committee of the SMK College of Applied Science (Approval No. BE-2024-15). Participation was voluntary, informed consent was obtained electronically, and data confidentiality was strictly maintained.

All methodological decisions were grounded in recognized scientific guidelines to ensure transparency and reproducibility. The study followed established standards for reliability and validity in social and health sciences research (Polit & Beck, 2021; Streiner et al., 2015; Hair et al., 2019). Reporting was structured in accordance with the STROBE statement for cross-sectional studies (von Elm et al., 2008)

RESEARCH RESULTS AND DATA ANALYSIS

A total of 678 healthcare professionals from 43 primary healthcare institutions completed the survey, yielding a response rate of 83.5%. Participants represented all major professional categories in primary care: 71.8% were nurses, 18.9% physicians, and 9.3% administrative or allied staff. The average participant age was 44.7 years (SD = 9.2), with the majority (82.5%) being female. The mean professional experience was 17.3 years (SD = 8.7), reflecting a well-established workforce with substantial exposure to digital systems and organizational practices (see Table 1).

1 table. Sociodemographic characteristics of participants (n = 678)

Variable	Category	n (%)
Gender	Female	559 (82.5)
	Male	119 (17.5)
Age group (years)	20–34	114 (16.8)
	35–49	317 (46.8)
	≥50	247 (36.4)
Professional group	Nurses	487 (71.8)
	Physicians	128 (18.9)
	Admin/allied	63 (9.3)
Work experience (years)	≤10	158 (23.3)
	11–20	216 (31.9)

	≥21	304 (44.8)

Source: compiled by the author according to the conducted research

The demographic composition indicates that the study captured a diverse and representative professional spectrum within Lithuanian primary healthcare, allowing for reliable comparisons across occupational and demographic groups.

Respondents' overall attitudes toward AI were predominantly positive, with a mean composite score of 3.94 (SD = 0.52) on a 5-point Likert scale. As shown in Table 3, the most positively rated domain was Perceived Benefits of AI (M = 4.12, SD = 0.61), reflecting widespread belief that AI can enhance diagnostic accuracy, reduce administrative workload, and improve patient management. Similarly, Personal Readiness and Motivation scored high (M = 3.98, SD = 0.55), suggesting openness to technology and willingness to engage in AI-related learning.

In contrast, the lowest mean score was observed in Practical Experience (M = 2.87, SD = 0.72), indicating that direct use of AI tools in daily practice remains limited. Moderate scores were recorded for Organizational Support and Training (M = 3.43, SD = 0.63) and Ethical Concerns (M = 3.41, SD = 0.64), suggesting that while respondents recognize institutional commitment, uncertainties about data protection, patient safety, and professional accountability persist (see Table 2).

Table 2. Descriptive statistics and reliability of questionnaire domains (n = 678)

Domain	Mean	SD	Cronbach's α
Perceived benefits of AI	4.12	0.61	0.88
Threat to professional autonomy	3.26	0.67	0.81
Personal readiness and motivation	3.98	0.55	0.87
Organizational support and training	3.43	0.63	0.84
Ethical concerns	3.41	0.64	0.82
Practical experience	2.87	0.72	0.90

Source: compiled by the author according to the conducted research

The high internal reliability of all domains (α = 0.81–0.90) confirms the robustness of the instrument and consistency of responses across diverse professional groups.

The Exploratory Factor Analysis (EFA) confirmed the six-factor model proposed during questionnaire development. The Kaiser–Meyer–Olkin (KMO) value of 0.92 and a significant Bartlett's Test of Sphericity ($\chi^2 = 4867.21$, $p < 0.001$) verified the adequacy of the data for factor analysis. The extracted six factors accounted for 71.2% of the total variance, indicating a robust factorial structure. As summarized in Table 4, primary factor loadings were consistently higher than cross-loadings, and the highest cross-loading ranges remained below the corresponding primary loading ranges, supporting clear construct separation.

The factor loading matrix (Table 4) revealed that all items loaded appropriately (>0.50) on their designated factors, without substantial cross-loadings. The first three factors—Perceived Benefits, Threat to Autonomy, and Personal Readiness—explained more than 50% of the total variance, suggesting these dimensions are central to understanding professional perspectives on AI (see Table 3).

Table 3. Summary of exploratory factor analysis results (Principal Axis Factoring, Varimax rotation)

Factor	Domain	Eigenvalue	Variance explained (%)	Item loading range	Highest cross-loading range
F1	Perceived benefits of AI	8.11	25.3	0.64–0.84	0.18–0.31

F2	Threat to professional autonomy	4.27	13.5	0.52–0.79	0.20–0.42
F3	Personal readiness and motivation	3.68	11.4	0.58–0.83	0.28–0.39
F4	Organizational support and training	2.76	8.6	0.59–0.82	0.32–0.44
F5	Ethical concerns	2.11	6.6	0.57–0.77	0.34–0.47
F6	Practical experience	1.89	5.8	0.55–0.80	0.26–0.36
Total	—	—	**71.2**	—	—

Note. Primary loading range refers to standardized factor loadings on the assigned factor. Highest cross-loading range indicates the maximum observed loadings on non-assigned factors, demonstrating the absence of problematic cross-loadings.

Source: compiled by the author according to the conducted research

The EFA results provide strong empirical support for the multidimensional nature of professional attitudes toward AI, combining technological optimism with ethical and organizational caution.

A one-way ANOVA revealed several statistically significant differences between professional groups (Table 5). Physicians reported the highest scores for Perceived Benefits of AI (M = 4.25), followed by nurses (M = 4.08) and administrative staff (M = 3.91), $F(2,675) = 4.81$, $p = 0.009$, $\eta^2 = 0.014$. This indicates a small but meaningful effect size, suggesting that physicians are more confident about AI's clinical advantages.

In contrast, nurses exhibited higher Ethical Concerns (M = 3.48) compared to physicians (M = 3.21), $F(2,675) = 6.12$, $p = 0.002$, $\eta^2 = 0.018$. This difference likely reflects nurses' closer engagement in patient care and data handling responsibilities. Administrative staff scored lowest in Practical Experience (M = 2.61), differing significantly from physicians (M = 3.05; $p < 0.01$, Cohen's $d = 0.47$) (see Table 4).

Table 4. Differences in domain scores by professional group (n = 678).

Domain	Professional group	n	M ± SD	F(df)	p	η²	Post-hoc (Tukey HSD)
Perceived Benefits	Physicians	128	4.25 ± 0.54	4.81 (2,675)	0.009	0.014	Physicians > Admin*
	Nurses	487	4.08 ± 0.62				-
	Admin / Allied staff	63	3.91 ± 0.68				-
Ethical Concerns	Physicians	128	3.21 ± 0.66	6.12 (2,675)	0.002	0.018	Nurses > Physicians*
	Nurses	487	3.48 ± 0.63				-
	Admin / Allied staff	63	3.33 ± 0.71				-
Organizational Readiness	Physicians	128	3.94 ± 0.59	5.34 (2,675)	0.005	0.016	Physicians > Nurses*
	Nurses	487	3.72 ± 0.64				-
	Admin / Allied staff	63	3.68 ± 0.60				-
Personal Readiness	Physicians	128	4.17 ± 0.55	2.92 (2,675)	0.055	0.009	Non-significant
	Nurses	487	4.06 ± 0.59				-

	Admin / Allied staff	63	3.92 ± 0.64				-
Practical Experience	Physicians	128	2.61 ± 0.73	3.41 (2,675)	0.034	0.010	Physicians > Nurses*
	Nurses	487	2.43 ± 0.70				-
	Admin / Allied staff	63	2.39 ± 0.67				-

Note. Values are means (M) ± standard deviations (SD). Post-hoc comparisons conducted using Tukey's HSD test. *Significant difference at $p < 0.05$. Effect sizes (η^2) interpreted as small (0.01), medium (0.06), large (0.14) according to Cohen (1988). Group sample sizes: Physicians (n = 128), Nurses (n = 487), Administrative/Allied staff (n = 63).

Source: compiled by the author according to the conducted research

Age-related patterns were consistent with expectations (Table 6). Younger respondents (20–34 years) scored significantly higher on Personal Readiness (M = 4.18) compared to older participants (≥50 years; M = 3.82), $F(2,675) = 9.03$, $p < 0.001$, $\eta^2 = 0.026$, 95% CI [0.18, 0.42]. Similarly, employees with ≤10 years of experience demonstrated greater readiness for AI adoption (M = 4.11) than those with ≥21 years (M = 3.78), $t(460) = 4.21$, $p < 0.001$, Cohen's $d = 0.41$, indicating a moderate effect size.

No significant differences were found across gender, suggesting that AI-related attitudes are not gender-dependent in this professional sample (see Table 5).

Table 5. Differences in personal readiness by age and experience.

Variable	Category	Mean	SD	F/t	p	Effect size	95% CI
Age group	20–34 years	4.18	0.50	-	-	-	-
	35–49 years	3.94	0.53	9.03	<0.001	$\eta^2 = 0.026$	[0.18, 0.42]
	≥50 years	3.82	0.59	-	-	-	-
Experience	≤10 years	4.11	0.49	4.21	<0.001	$d = 0.41$	[0.20, 0.46]
	≥21 years	3.78	0.57	-	-	-	-

Source: compiled by the author according to the conducted research

These findings suggest generational and experiential differences in technological acceptance, emphasizing the role of exposure, adaptability, and professional socialization in shaping AI-related readiness.

Spearman correlation analysis revealed a coherent pattern of relationships among the six domains (Table 7). Perceived Benefits exhibited a strong positive correlation with Personal Readiness ($r = 0.64$, $p < 0.001$), reflecting the logical alignment between recognizing AI's usefulness and willingness to use it. Organizational Support showed moderate positive associations with both Perceived Benefits ($r = 0.48$, $p < 0.001$) and Practical Experience ($r = 0.41$, $p < 0.001$), underscoring the role of institutional context in enabling AI implementation (see Table 6).

Conversely, Ethical Concerns correlated negatively with Personal Readiness ($r = –0.32$, $p < 0.001$) and Perceived Benefits ($r = –0.28$, $p < 0.001$), suggesting that heightened ethical apprehensions can hinder motivation and perceived utility. The correlations' magnitudes were interpreted according to Cohen's (1988) guidelines: $r < 0.3$ (weak), 0.3–0.5 (moderate), >0.5 (strong) (Davis, 1989).

Table 6. Spearman correlations among key domains.

Variable	1	2	3	4	5	6
1. Perceived benefits	—	—	—	—	—	—
2. Threat to autonomy	-0.21***	-	-	-	-	-

3. Personal readiness	0.64***	-0.27***	-	-	-	-
4. Organizational support	0.48***	-0.19***	0.46***	-	-	-
5. Ethical concerns	-0.28***	0.42***	-0.32***	-0.24***	-	-
6. Practical experience	0.41***	-0.15**	0.39***	0.37***	-0.26***	-

***p < 0.001; **p < 0.01

Source: compiled by the author according to the conducted research

This relational structure indicates that while professional confidence and motivation are primarily driven by perceived benefits, they are also reinforced by supportive organizational climates and diminished ethical ambivalence.

The study results demonstrate that primary healthcare professionals hold generally favorable attitudes toward AI, acknowledging their potential to enhance clinical accuracy, reduce administrative burdens, and optimize patient management. However, these positive views coexist with practical limitations, notably insufficient real-world experience, variability in institutional support, and persistent ethical doubts related to data protection and accountability.

Younger professionals and those with less work experience exhibited greater readiness and optimism, reflecting generational adaptability and exposure to digital technologies. In contrast, older and more experienced staff tended to emphasize ethical risks and professional identity concerns, signaling a need for targeted educational interventions and structured support.

Importantly, the strong correlations between perceived benefits, personal readiness, and organizational support suggest that effective AI implementation requires a balanced combination of technological training, leadership engagement, and transparent ethical governance. These factors collectively form the foundation for responsible and sustainable integration of AI into primary healthcare workflows.

DISCUSSION

This study explored primary healthcare professionals' perceptions, readiness, and ethical attitudes toward artificial intelligence (AI), revealing generally positive views accompanied by notable disparities across professions, age groups, and levels of experience. The findings confirm that while enthusiasm for AI integration is widespread, effective implementation depends on institutional readiness, targeted education, and ethical transparency.

The overall positive orientation toward AI among primary healthcare workers aligns with previous research emphasizing optimism about digital transformation in healthcare (Lee et al., 2024; Rahman & Hossain, 2022; Alami et al., 2023; Lee & Kim, 2023; Ahmed et al., 2024). High scores for perceived benefits and personal readiness indicate that respondents recognize AI's potential to enhance diagnostic accuracy, clinical decision support, and administrative efficiency. In line with the Technology Acceptance Model (TAM), these findings correspond to the constructs of perceived usefulness and perceived ease of use, which jointly predict behavioral intention to adopt new technologies (Davis, 1989).

Nevertheless, the limited level of practical experience identified in this study suggests that AI remains largely theoretical for many practitioners. This gap between awareness and application is consistent with findings reported by Kim et al. (2023) and Kraus et al. (2023), who observed that healthcare professionals frequently endorse AI conceptually but lack structured opportunities for hands-on engagement. These results highlight a persistent "knowledge–practice divide," indicating that attitudinal readiness alone is insufficient to ensure effective AI use without adequate organizational and educational support mechanisms.

The negative association between ethical concerns and personal readiness underscores the role of moral and legal apprehensions in moderating technology acceptance. Respondents who expressed stronger concerns related to data protection and decision accountability were less willing to engage with AI systems. This finding aligns with research by McBride et al. (2022) and London (2023), as well as broader European policy discussions emphasizing that perceived ethical risk can function as a psychological barrier even among technologically competent professionals. These results reinforce the importance of integrating ethical literacy, transparency, and data governance into AI training and implementation strategies.

Differences observed among professional groups—particularly higher perceived benefits among physicians and stronger ethical concerns among nurses—mirror patterns identified in previous comparative studies (McBride et al., 2022; London, 2023). Physicians, as primary clinical decision-makers, may focus more on AI's diagnostic and efficiency-related advantages, whereas nurses, who are often more directly involved in patient communication and data handling, may be more sensitive to ethical, relational, and accountability-related implications. This division reflects the influence of professional identity on risk perception and moral responsibility within healthcare hierarchies.

Age- and experience-related trends identified in this study are consistent with the Diffusion of Innovations Theory, which posits that younger professionals often act as early adopters of new technologies due to greater openness and adaptability (Rogers, 2003). In contrast, older and more experienced practitioners may adopt a more cautious stance, emphasizing reliability, professional autonomy, and ethical safeguards. These patterns confirm that technology acceptance in healthcare is shaped not only by individual cognition but also by generational and experiential learning contexts.

The empirical results correspond directly with findings reported by Lee and Kim (2023), who demonstrated that generational and experiential factors significantly influence healthcare professionals' readiness for AI adoption. However, existing literature also suggests that these differences are not immutable. For example, Park et al. (2024) found that older physicians who received structured AI training exhibited acceptance levels comparable to their younger counterparts. This highlights the potential of targeted education and mentorship to bridge generational divides and underscores the central role of organizational readiness.

The significant correlations between organizational support, perceived benefits, and personal readiness further confirm that supportive institutional environments are essential for successful AI adoption. These findings align with organizational and implementation theories that identify leadership engagement, resource allocation, and effective communication as critical mediators of innovation uptake (Greenhalgh et al., 2023; Nilsen & Bernhardsson, 2023). Organizations that invest in technical infrastructure, continuous learning opportunities, and open dialogue about ethical implications tend to foster more confident and engaged professionals.

These results extend the conclusions of Vila-Corcoles et al. (2024), who demonstrated that staff engagement and perceived managerial encouragement are stronger predictors of digital adoption than technological capacity alone. In this context, organizational readiness functions both as a prerequisite for and an outcome of AI integration. Institutions that actively promote participatory learning and interdisciplinary collaboration create what Greenhalgh et al. (2023) describe as "innovation-conducive microclimates," in which ethical and professional anxieties are mitigated through shared competence rather than isolated individual adaptation.

Ethical concerns surrounding AI—particularly regarding patient data security, accountability for automated decisions, and potential professional devaluation—remain central to contemporary debates. The present findings suggest that such concerns, although moderate

in intensity, exert a measurable influence on professionals' willingness to adopt AI tools. Consistent with McBride et al. (2022), ethical tension often arises from uncertainty regarding legal responsibility and transparency in algorithmic decision-making. Importantly, ethical resistance should not be interpreted solely as opposition to innovation but rather as an expression of professional responsibility and patient advocacy (London, 2023).

The study also indicates that ethical caution may serve a protective function, ensuring that technological enthusiasm does not override critical reflection. Therefore, ethical concerns should be regarded as integral to sustainable digital transformation rather than as barriers to progress. Incorporating structured ethical reflection, peer dialogue, and multidisciplinary ethics committees into AI implementation processes may strengthen moral confidence and facilitate responsible adoption.

From a theoretical perspective, the results extend established acceptance models by demonstrating how professional, organizational, and ethical factors interact in shaping AI acceptance. While the Technology Acceptance Model effectively explains the relationship between perceived benefits and readiness, the inclusion of ethical and institutional dimensions offers a more comprehensive framework consistent with the Diffusion of Innovations Theory. Together, these models support conceptualizing AI adoption in healthcare as a multilevel process in which individual perceptions, professional culture, and organizational climate converge to shape trust and readiness.

Several limitations should be acknowledged. First, reliance on self-reported data may have led to an overestimation of positive attitudes due to social desirability bias. Second, the cross-sectional design limits causal inference, as attitudes and readiness may evolve with increased exposure to AI technologies. Third, the exclusively quantitative approach precluded in-depth exploration of emotional and contextual factors that could be captured through qualitative methods.

Future research should therefore employ mixed-method designs combining surveys with interviews or focus groups to better understand how ethical reflection, teamwork, and leadership influence sustained AI engagement. Longitudinal studies could further assess how readiness translates into actual implementation over time. Comparative research across different healthcare systems, particularly in low-resource or rural contexts, would also enhance understanding of how institutional capacity shapes AI adoption trajectories.

The findings carry important practical implications. Training initiatives should extend beyond technical instruction to include ethical reasoning, interdisciplinary dialogue, and communication skills. Healthcare leaders should develop AI implementation frameworks that emphasize fairness, transparency, and data protection while actively involving clinicians in system design and evaluation. Although younger professionals may act as digital change agents, successful AI integration ultimately depends on inclusive strategies that engage experienced staff and preserve professional identity.

By embedding AI adoption within a culture of shared accountability and continuous learning, primary healthcare institutions can strengthen both technological innovation and human-centered care.

CONCLUSIONS

1. The findings confirmed that primary healthcare workers generally hold positive attitudes toward AI, supporting the study's objective to assess overall perceptions and readiness. Respondents recognized AI's potential to improve diagnostic precision, streamline administrative processes, and enhance efficiency, consistent with the Technology Acceptance Model (TAM). High internal consistency within the perceived

benefits and personal readiness domains indicates prevailing technological optimism in the sector.

2. The objective of identifying professional and demographic differences was also achieved. Variations across professional roles, age groups, and experience levels revealed that readiness for AI adoption is unevenly distributed. Physicians demonstrated greater confidence in AI's benefits, while nurses expressed stronger ethical caution. Younger and less experienced professionals reported higher motivation and readiness, aligning with the Diffusion of Innovations theory and underscoring the need for differentiated implementation strategies.
3. The influence of organizational and ethical factors was clearly demonstrated. Strong positive associations between organizational support, readiness, and perceived benefits, alongside negative associations between ethical concerns and willingness to adopt AI, indicate that institutional trust, transparent communication, and structured training are central to sustainable AI integration. Ethical uncertainty, even among receptive professionals, may reduce motivation and engagement.
4. The study contributes to ongoing debates on the moral and professional implications of AI in healthcare. Ethical reflection among participants was grounded in practical concerns related to accountability, data security, and preservation of human judgment in clinical decision-making. These concerns should be understood not as resistance to innovation, but as expressions of professional responsibility and commitment to patient-centered care.
5. By integrating the Technology Acceptance Model and the Diffusion of Innovations theory, the study demonstrates that ethical readiness and organizational trust function as mediating variables extending beyond traditional acceptance models. AI adoption in healthcare should therefore be conceptualized as a relational and multilevel process shaped by professional culture and institutional ethics, rather than solely by individual cognition.

LITERATURE

1. Ahmed, S., Chan, Y. H., & Lim, W. S. (2024). Healthcare professionals' acceptance of AI-driven clinical decision tools in primary care: A multi-centre study. *International Journal of Medical Informatics, 179*, 105227.
2. Akhtar, F., Rees, G., & Menon, S. (2023). Artificial intelligence in primary care: Accountability dilemmas and ethical considerations. *Ethics and Information Technology in Health, 5*, 22–33.
3. Alami, H., et al. (2023). Artificial intelligence in healthcare: Challenges and opportunities. *npj Digital Medicine, 6*, 34.
4. Braga, L. F., Rodrigues, M., & Viegas, R. (2023). The ethics of AI in family medicine: A scoping review. *Family Practice, 40*(3), 356–362.
5. Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum.
6. Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage.
7. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.
8. Delaney, B. C., Curcin, V., Andreasson, A., Arvanitis, T. N., & Carinci, F. (2024). Trustworthy artificial intelligence for primary care: A call for action. *BMJ Health & Care Informatics, 31*, e100735.
9. DeVellis, R. F., & Thorpe, C. T. (2021). *Scale development: Theory and applications* (5th ed.). Sage.
10. Díaz-García, J., Ortega-Morán, J., & Martínez-Torres, M. R. (2023). Ethical concerns of healthcare professionals regarding artificial intelligence in primary care: A qualitative review. *AI in Healthcare, 5*, 100218.
11. Ellis, P. D. (2010). *The essential guide to effect sizes*. Cambridge University Press.
12. Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). Sage.

13. Fritz, C. O., Morris, P. E., & Richler, J. J. (2012). Effect size estimates: Current use, calculations, and interpretation. *Journal of Experimental Psychology: General, 141*(1), 2–18.
14. Greenhalgh, T., & Russell, J. (2023). Organizational readiness and adaptive learning in healthcare AI. *Journal of Evaluation in Clinical Practice, 29*(4), 620–628.
15. Greenhalgh, T., Wherton, J., & Papoutsi, C. (2023). The human infrastructure of AI adoption. *Social Science & Medicine, 317*, 115579.
16. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Pearson.
17. Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). Sage.
18. Johansson, A., Boström, M., & Jansson, M. (2023). Artificial intelligence implementation in small healthcare practices: Perceptions of general practitioners. *Scandinavian Journal of Primary Health Care, 41*(2), 123–131.
19. Kim, J., Lee, S. Y., & Oh, H. (2023). Physicians' perceived risks and benefits of AI in clinical practice: A cross-sectional survey in primary care settings. *BMC Primary Care, 24*, 96.
20. Kraus, S., Schiavone, F., Pluzhnikova, A., & Invernizzi, A. C. (2023). Artificial intelligence in healthcare: Insights into adoption and implementation in primary care. *Journal of Medical Systems, 47*(1), 12.
21. Kwok, H., Hildt, E., & Stahl, B. C. (2023). Explainability and transparency in healthcare AI: Balancing innovation and responsibility. *AI & Society, 38*(1), 211–225.
22. Lee, D., & Kim, J. (2023). Healthcare professionals' readiness for artificial intelligence: A cross-national comparison. *BMC Health Services Research, 23*, 1023.
23. Lee, M. J., Lee, H., & Choi, B. (2024). Factors influencing healthcare workers' attitudes toward artificial intelligence: A systematic review. *Nursing Outlook, 72*, 101984.
24. Li, Y., Zhang, J., Huang, J., & Chen, L. (2023). Natural language processing in primary care: Current applications and future directions. *Health Informatics Journal, 29*(1), 1–15.
25. Lin, C., Wang, S., & Tsai, C. (2023). Understanding primary care providers' perspectives on artificial intelligence: A qualitative exploration. *Journal of General Internal Medicine, 38*(5), 1230–1237.
26. London, A. J. (2023). Artificial intelligence and professional ethics in medicine. *Hastings Center Report, 53*(1), 7–15.
27. López-Pineda, A., Núñez-Benjumea, F. J., & Sánchez, M. (2023). Clinical decision support systems in primary care: Impact on provider satisfaction and practice. *Health Informatics Journal, 29*(1), 1–13.
28. McBride, B., et al. (2022). Moral stress and professional integrity in AI adoption. *Nursing Ethics, 29*(5), 1203–1216.
29. Meier, H., Jørgensen, J., & Klein, K. (2024). Organizational readiness for artificial intelligence in general practice: A mixed-method study. *Primary Health Care Research & Development, 25*, e9.
30. Moore, S. F., Patel, R., & Sood, H. (2023). Organisational readiness for AI adoption in healthcare: A national survey. *Health Policy and Technology, 12*, 100738.
31. Nguyen, A., Park, Y. R., & Lim, J. (2023). Artificial intelligence in primary care: Perceptions, applications, and future needs. *Journal of Medical Systems, 47*(1), 41.
32. Nilsen, P., & Bernhardsson, S. (2023). Implementation frameworks in healthcare innovation. *Implementation Science, 18*, 27.
33. Park, M., Jung, H., & Kwon, Y. (2024). Human–AI collaboration in general practice: What are clinicians really afraid of? *Journal of Health Organization and Management, 38*(1), 13–27.
34. Polit, D. F., & Beck, C. T. (2021). *Nursing research: Generating and assessing evidence for nursing practice* (11th ed.). Wolters Kluwer.
35. Rahman, M., & Hossain, A. (2022). Perceptions of AI in clinical decision-making: A global survey. *Frontiers in Digital Health, 4*, 925611.
36. Rimmer, A., Williams, C., & Davison, M. (2023). Data privacy and digital trust in AI healthcare applications: Perspectives from front-line staff. *Digital Health, 9*, 1–12.
37. Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.
38. Streiner, D. L., Norman, G. R., & Cairney, J. (2015). *Health measurement scales: A practical guide to their development and use* (5th ed.). Oxford University Press.
39. Tang, K., Lim, J., & Wong, A. (2024). Digital stress and adaptation among healthcare professionals during AI integration: A mixed-methods approach. *Journal of Medical Internet Research, 26*, e52418.
40. Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2*, 53–55.
41. Turner, A. M., Benton, J. L., & Zhang, Y. (2023). Trust in AI among primary care providers: Development of a conceptual framework. *Health Informatics Journal, 29*(1), 1–15.
42. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478.

43. Vila-Corcoles, A., Hernandez, N., & Rius, C. (2024). AI implementation in community-based healthcare: The role of staff engagement and trust. *Primary Health Care Research & Development, 25*, e8.
44. von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2008). The STROBE statement: Guidelines for reporting observational studies. *PLoS Medicine, 5*(10), e297.
45. Wang, L., & Li, J. (2024). Organizational strategies for supporting AI adoption in healthcare settings. *Journal of Health Management, 26*(1), 15–28.
46. Zhou, Y., Patel, V., & Singh, S. (2023). Empathy versus efficiency: Ethical tensions in the use of artificial intelligence in primary healthcare. *AI in Healthcare, 6*, 100234.