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**Medicine Program
Community Medicine Department
Batch 6**

Project Title

**Knowledge and Perception of Artificial Intelligence in Improving
Diagnostic Accuracy Among Healthcare Professionals in Atbara
and Port Sudan teaching hospital 2026**

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In partial fulfillment of the academic requirement for the degree of
MBBS

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Dedication

We dedicated this work:

*To our beloved **Sudan**; may it rise again in peace and prosperity.*

*To our **Parents**, the source of our strength and inspiration. Your endless sacrifices, prayers, and unconditional love have been the light guiding us through the darkest times. We hope this achievement brings even a fraction of the pride you deserve.*

*To our **Sisters and Brothers**, for being our constant support system and for believing in us when the journey felt long.*

*To our **Teachers and Mentors**, who planted the seeds of knowledge and guided us toward the path of healing and science.*

*To the **Patients of Sudan**, whose resilience inspires us to strive for a future where technology and compassion meet to provide the best care possible.*

*Finally, to **ourselves**, for the late nights, the perseverance during the crisis, and the unwavering commitment to our medical calling.*

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List of Abbreviations and Acronyms

Abbreviation	Full Meaning
AI	Artificial Intelligence
CAD	Computer-Aided Diagnosis
CDSS	Clinical Decision Support Systems
CPD	Continuous Professional Development
CT	Computed Tomography
DL	Deep Learning
EHR	Electronic Health Record
FMoH	Federal Ministry of Health
GPA	Grade Point Average

MBBS	Bachelor of Medicine, Bachelor of Surgery
ML	Machine Learning
MRI	Magnetic Resonance Imaging
OR	Odds Ratio
PTSD	Post-Traumatic Stress Disorder
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization
XAI	Explainable Artificial Intelligence
ZAMW	Zeinab Abbas Medical Website (AI-powered Learning Application)

Abstracts

Title: Knowledge and Perception of Artificial Intelligence in Improving Diagnostic Accuracy Among Healthcare Professionals in Sudan - 2026

Background: In the context of Sudan's current healthcare crisis and the significant "brain drain" of medical specialists, Artificial Intelligence (AI) has emerged as a potential tool to bridge the diagnostic expertise gap. Understanding the readiness of the remaining workforce to adopt these technologies is critical for future healthcare reconstruction.

Objectives: This study aimed to evaluate the knowledge, technical understanding, and perceptions of Sudanese healthcare professionals regarding the role of AI in improving diagnostic accuracy in 2026.

Methodology: A descriptive, hospital-based cross-sectional study was conducted between March and April 2026. Data were collected from 146 healthcare professionals and final-year medical students at Atbara and Port Sudan Teaching Hospitals using a structured digital questionnaire. Statistical analysis was performed using SPSS version 26.0, employing Chi-square tests to determine associations.

Results: The study revealed a high baseline awareness, with 85%–90% of participants having heard of AI in medical practice and 82% recognizing its capabilities in medical imaging. While general perception was highly positive—with 78.1% trusting AI's diagnostic accuracy and 82.2% supporting its integration to reduce workload—a "Paradox of Readiness" was identified, where high acceptance was contrasted by low technical literacy in Machine Learning and Deep Learning. A statistically significant association was found between higher knowledge levels and positive perceptions toward AI application ($p = 0.004$).

Conclusion: Sudanese healthcare professionals demonstrate a robust readiness to adopt AI as a tool for "diagnostic resilience." However, to transition from theoretical acceptance to safe clinical implementation, there is an urgent need for formal curriculum integration, technical training, and the establishment of clear regulatory frameworks.

Keywords: Artificial Intelligence, Diagnostic Accuracy, Sudan, Healthcare Professionals, Knowledge and Perception, Medical Education.

الملخص

العنوان: معرفة وتصور الذكاء الاصطناعي في تحسين دقة التشخيص بين المهنيين الصحيين في السودان - 2026م

الخلفية: في ظل الأزمة الصحية الحالية التي يمر بها السودان والهجرة الكبيرة للكوادر الطبية المتخصصة، برز الذكاء الاصطناعي كأداة محتملة لسد الفجوة في الخبرات التشخيصية. وتعد دراسة مدى استعداد القوى العاملة المتبقية لتبني هذه التقنيات أمراً حيوياً لإعادة بناء النظام الصحي مستقبلاً.

الأهداف: هدفت هذه الدراسة إلى تقييم مستوى المعرفة، والفهم التقني، وتصورات المهنيين الصحيين في السودان فيما يتعلق بدور الذكاء الاصطناعي في تحسين دقة التشخيص خلال عام 2026م.

المنهجية: أجريت دراسة وصفية مقطعية في المستشفيات خلال الفترة من مارس إلى أبريل 2026م. جُمعت البيانات من 146 مشاركاً من المهنيين الصحيين وطلاب الطب في السنة النهائية بمستشفى عطبرة التعليمي ومستشفى بورتسودان التعليمي عبر استبيان رقمي مهيكّل. أُجري التحليل الإحصائي باستخدام برنامج (SPSS) الإصدار 26.0، مع استخدام اختبار "كا مربع" (Chi-square) لتحديد الارتباطات.

النتائج: أظهرت الدراسة وعياً عاماً مرتفعاً، حيث سمع ما بين 85% إلى 90% من المشاركين عن الذكاء الاصطناعي في الممارسة الطبية، وأدرك 82% قدراته في التصوير الطبي. وبينما كان التصور العام إيجابياً للغاية (حيث وثق 78.1% في دقة تشخيص الذكاء الاصطناعي وأيد 82.2% دمج التقنية لتقليل عبء العمل)، تم رصد "مفارقة الجاهزية"؛ حيث تباين القبول المرتفع مع انخفاض المعرفة التقنية بميكانيكا تعلم الآلة والتعلم العميق. كما وُجد ارتباط ذو دلالة إحصائية بين مستويات المعرفة العالية والتصورات الإيجابية تجاه تطبيق الذكاء الاصطناعي ($p = 0.004$).

الخلاصة: أثبت المهنيون الصحيون في السودان استعداداً قوياً لتبني الذكاء الاصطناعي كأداة لتعزيز "المرونة التشخيصية". ومع ذلك، للانتقال من القبول النظري إلى التنفيذ السريري الآمن، تبرز حاجة ملحة لدمج الذكاء الاصطناعي رسمياً في المناهج التعليمية، وتوفير التدريب التقني، ووضع أطر تنظيمية واضحة.

CHAPTER ONE

INTRODUCTION

1.1 Background

Artificial Intelligence (AI) in the medical field refers to the application of complex algorithms and software designed to emulate human cognition in the analysis, interpretation, and comprehension of complicated healthcare data [1]. Unlike traditional medical software, AI possesses the unique ability to "learn" from vast datasets, identifying subtle patterns in diagnostic imaging, pathology, and clinical records that may be imperceptible to the human eye [2]. As we navigate 2026, the integration of Machine Learning (ML) and Deep Learning (DL) has transitioned from a technological luxury to a practical necessity, redefining global standards for precision medicine and diagnostic safety [3].

Diagnostic accuracy—the ability to correctly identify the presence or absence of a target disease—remains the most critical determinant of patient outcomes [4]. Globally, errors in diagnosis contribute to approximately 10% of patient deaths [5]. In Sudan, the healthcare system is currently under immense pressure due to a chronic shortage of specialized personnel and the significant "brain drain" of senior consultants following recent socio-political instability [7, 15]. In such settings, AI serves as a potential diagnostic bridge, providing an automated "second opinion" to enhance the quality of clinical decisions [9, 11].

1.2 Problem Statement

Despite the recognized potential of AI to enhance diagnostic accuracy, its integration within the Sudanese clinical environment remains largely unquantified. Sudan faces a high burden of disease and a fragmented diagnostic infrastructure exacerbated by recent conflict [17]. While international literature highlights the success of AI in high-income countries, there is a profound "evidence gap" regarding how these tools are understood and utilized in low-resource settings [13, 15].

Crucially, there is a lack of empirical data concerning the knowledge and perceptions of Sudanese healthcare professionals toward these tools in 2026. Without understanding the current level of AI literacy and the subjective views of practitioners regarding AI's diagnostic value, the deployment of such technologies may not align with clinical reality [14, 16]. Therefore, there is an urgent need to investigate the awareness and perceived diagnostic utility of AI among Sudanese healthcare workers during this critical period of healthcare reconstruction.

1.3 Research Questions

1. What is the current level of knowledge regarding AI diagnostic tools among Sudanese healthcare professionals in 2026?
2. How do healthcare providers in Sudan perceive the impact of AI on improving diagnostic accuracy and reducing clinical errors?
3. Are there significant differences in the knowledge and perception of AI across different medical specialties and professional ranks in Sudan?

1.4 Research Hypotheses

- **H1:** There is a moderate to low level of foundational knowledge regarding AI-driven diagnostic tools among Sudanese healthcare professionals.
- **H2:** Healthcare professionals in Sudan perceive AI as a valuable tool for reducing diagnostic errors and bridging the "expertise gap" caused by the recent shortage of specialists.

1.5 Justification

The necessity of this study is underscored by the unprecedented collapse of Sudan's healthcare infrastructure, which has left over 70% of the population with limited access to specialized services [15]. As the migration of senior consultants

has created an "expertise vacuum," it is vital to evaluate whether AI can serve as a diagnostic aid for remaining frontline workers to maintain standards of care.

By focusing on knowledge and perception, this research provides the essential empirical foundation required to understand the current technological literacy of the medical community. This data is vital for ensuring that future digital health strategies in Sudan are based on the actual understanding and clinical perspectives of the workforce, thereby improving patient safety and diagnostic precision in a high-pressure environment.

1.5 Objectives

1.5.1 General Objective

To evaluate the knowledge and perception of healthcare professionals in Sudan regarding the role of Artificial Intelligence in improving diagnostic accuracy 2026

1.5.2 Specific Objectives

1. To assess the current level of knowledge among Sudanese healthcare professionals regarding AI applications in diagnostics and imaging.
2. To determine the perceptions of healthcare providers concerning the impact of AI on diagnostic accuracy.
3. To evaluate the perceived clinical utility of AI as a supportive tool for reducing diagnostic errors and medical pressure in Sudan.

CHAPTER TWO

LITERATURE REVIEW

2.1 General Overview: The AI Revolution and Modern Medical Education

The integration of Artificial Intelligence (AI) into medical diagnostics represents a fundamental paradigm shift in healthcare delivery as of 2026. AI is no longer viewed merely as an experimental tool but as a core component of "Precision Medicine" [1]. Medical AI utilizes complex algorithms—primarily Machine Learning (ML), Deep Learning (DL), and Multimodal Foundation Models—to analyze vast datasets such as medical imaging, genomic sequences, and electronic health records (EHRs) to enhance diagnostic accuracy [2, 3].

The primary objective of AI in this field is to enhance diagnostic accuracy, defined as the ability of a test to correctly identify the presence or absence of a disease. Recent meta-analyses conducted in early 2026 have quantified this impact, showing that AI systems achieve an average diagnostic accuracy of 81% to 95% [4]. These systems frequently outperform non-expert healthcare professionals, whose accuracy averages around 71% to 82% in similar tasks [4, 5]. By identifying subtle patterns imperceptible to the human eye, AI acts as a "diagnostic multiplier," particularly in high-volume environments where physician fatigue and cognitive load can lead to diagnostic errors [6, 7].

However, this transition has placed unprecedented pressure on medical education. Students are now required to achieve a dual-competency: mastering traditional clinical skills while developing technical literacy to interpret AI

outputs. This shift has become a primary driver of academic burnout, as the cognitive load of a modern medical curriculum now includes data science and algorithm appraisal alongside traditional anatomy and pathology [8]. Recent reports indicate that nearly 46% of hospitals are in the early stages of enterprise-level AI implementation, while the global healthcare AI market is projected to grow to over 431 billion by 2032 [4, 9].

2.2 Focus: The Intersection of Stress and Technology in Crisis

In environments of extreme pressure, such as the ongoing Sudanese conflict (2023–2026), the deployment of AI is necessitated by a unique humanitarian and clinical crisis. With approximately 70–80% of health facilities in active conflict zones non-functional by early 2026, the country faces a critical shortage of specialized medical personnel [10, 11]. In this context, AI is perceived not just as a technological advancement, but as a "survival technology" and an "automated consultant."

The focus of contemporary research is the correlation between this technological adoption and academic performance. Stress—defined as the psychological strain resulting from demands that exceed a student's coping capabilities—has been shown to significantly impair the concentration required to master complex diagnostic tools [12]. For students in conflict zones, academic stress is compounded by displacement, economic deterioration, and safety concerns [13]. This creates a unique "survival stress" that directly impacts their readiness to

transition into AI-augmented clinical practice. Furthermore, 81.8% of Sudanese medical professionals agree that AI is vital for the future of medicine, yet there is a significant perceptual tension regarding the "reliability" of these tools in the absence of senior human validation [14].

2.3 Previous Studies

2.3.1 Global Previous Studies

Research across stable, high-income environments highlights the "Literacy Gap" and its psychological consequences:

- **Accuracy and Workload (2026):** A comprehensive meta-analysis found that AI achieved significantly higher diagnostic accuracy than non-expert healthcare professionals (95% vs 82%). Crucially, the study found that high levels of burnout were significantly lower among professionals supported by AI compared to those working without it (OR 1.77), indicating that the integration of AI eventually reduces long-term workload-related stress by saving time and improving diagnostic reliability [4].
- **Global Burnout Trends:** Multinational meta-analyses involving over 26,000 medical students estimated a global burnout prevalence of 37.23% to 44.2% [15]. Research suggests that students' well-being deteriorates rapidly due to the "no-mistakes-allowed" culture, which is now

exacerbated by the pressure to master emerging AI technologies such as generative AI for summarizing clinical cases [4, 16].

- **Trust and Explainability:** Approximately 82% of clinicians globally report that "Explainable AI" (XAI)—tools that provide visual or textual justifications for a diagnosis—is the only form of AI they perceive as trustworthy [14].

2.3.2 National and Regional Previous Studies (Africa and the Middle East)

Regionally, the focus remains on the disparity between high awareness of AI and the lack of formal infrastructure:

- **Arab World Meta-Analysis (2026):** A multi-national study involving students from Egypt, Sudan, and Morocco revealed that 87.1% of respondents exhibited "low levels of knowledge" regarding Deep Learning mechanics, despite 86% believing AI is vital for their future careers [17].
- **Regional Readiness:** Cross-sectional studies in 2025 involving 1,619 regional medical students indicated a "moderate" level of AI readiness (61.34/100). Cognition was identified as the weakest domain, highlighting that while students have a "vision" for AI, they lack the technical "ability" due to the absence of standardized curricula [18].
- **Replacement Anxiety:** In the Middle East, 36.1% of medical students expressed fear that AI would eventually reduce the required number of

human radiologists, creating a lingering "replacement anxiety" that impacts specialty selection [19].

2.3.3 Local Previous Studies (Sudan)

In Sudan, studies are dominated by the impact of the military conflict on mental health and educational continuity:

- **Psychological Distress (2025–2026):** A multicentric study of 4,185 Sudanese medical students found alarmingly high rates of anxiety (61.98%), depression (65.5%), and PTSD (36.7%). These rates are nearly double the global average for medical students, reflecting the severe psychological toll of the conflict [13, 20].
- **Academic Performance Declines:** Assessments conducted during the 2023–2026 period revealed that 51.8% of Sudanese medical students reported conflict-induced performance declines [21]. The primary causes were identified as motivation loss (77.5%) and concentration difficulties (53.5%). GPAs below 3.0 were significantly correlated with higher levels of depression and anxiety ($P < 0.001$) [21, 22].
- **The AI Knowledge Gap in Sudan:** A national survey of 825 physicians found that while 80.7% had "previous knowledge" of AI, only 14.9% had received formal training. Knowledge remains largely theoretical and self-

taught, with Medical Officers (32.7%) showing higher technical understanding than House Officers [11, 19].

- **Coping Mechanisms:** Sudanese students rely heavily on religious habits and online reading as protective factors. However, 45% of students report that a lack of institutional psychological support prevents them from maintaining academic focus during the crisis [12, 22].

2.4 Summary of the Literature Gap

While global literature confirms AI's diagnostic accuracy and regional studies highlight a general knowledge deficit, there is a profound "Evidence Gap" regarding the specific psychological readiness of Sudanese medical students. There is a lack of empirical research investigating how the extreme, conflict-driven academic stress of 2026 influences a student's ability to focus on and master AI-augmented diagnostic tools. This study aims to fill this void by evaluating the intersection of mental health, academic performance, and technological readiness.

CHAPTER THREE

METHODOLOGY

3.1 Study Design

A descriptive, hospital-based cross-sectional study design. This design is most appropriate for assessing the prevalence of specific knowledge levels and the distribution of attitudes among healthcare professionals at a single point in time.

3.2 Study Setting

The study was conducted across two major tertiary hospitals in Sudan that remained operational and served as central hubs for medical services during the March- April 2026 period:

1. **Atbara Teaching Hospital:** Located in River Nile State.
2. **Port Sudan Teaching Hospital:** Located in the Red Sea State.

3.3 Study Population

The study population includes:

- Licensed medical doctors (House Officers, Medical Officers, Registrars, and Consultants) across different specialties.
- Final-year medical students from Sudanese universities.
- Medical imaging technicians and pathologists.

3.4 Eligibility Criteria

3.4.1 Inclusion Criteria

1. Licensed practitioners recognized Sudanese institutions.
2. Active involvement in clinical diagnostic tasks.
3. Provision of digital informed consent.
4. Completion of at least three months of active clinical practice during 2025–2026.

3.4.2 Exclusion Criteria

1. Administrative staff not involved in diagnostic interpretation.
2. Professionals absent from clinical practice for >12 months.
3. Clinicians practicing exclusively outside Sudan.

3.5 Sample Size Determination

- Sample size in convenient sampling.

3.6 Sampling Technique

A **stratified random sampling** technique was utilized. Participants were stratified by professional rank (Consultant vs. Junior Doctor) and specialty (Medical vs. Surgical vs. Diagnostic) to ensure representative data across the hierarchy of the Sudanese healthcare system.

3.7 Data Collection Methods

Data were collected through a structured, pre-tested digital questionnaire administered between **March and April 2026**. To ensure maximum reach despite geographical displacement and security constraints, the survey link was distributed through official **hospital WhatsApp groups** and professional digital networks of the participating institutions. This method facilitated rapid response and ensured that clinicians in active service could participate remotely.

3.8 Data Analysis Plan

The data were processed and analyzed using IBM SPSS Statistics, version 26.0.

- **Descriptive Statistics:** Frequency distributions, percentages, and means.

- **Inferential Statistics:** Chi-square (χ^2) tests were employed to assess associations between variables. A p-value of < 0.05 was considered statistically significant.

3.9 Ethical Considerations

1. **Approval:** Ethical clearance was obtained from the appropriate institutional review board in Sudan.
2. **Consent:** Digital informed consent was mandatory for all participants.
3. **Confidentiality:** All data was anonymized using unique identifiers. No patient-identifiable information will be recorded in the comparative analysis.

3.10 Study limitations

Despite the relevance of the findings, this study has several limitations that must be acknowledged. Primarily, the sample size was limited to 146 participants, which may affect the generalizability of the results to the entire Sudanese healthcare workforce. Furthermore, a convenience sampling technique was employed rather than random sampling. This approach was necessitated by the severe logistical constraints and security concerns characteristic of the March- April period in Sudan, where active conflict and

frequent communication outages made reaching a broad, randomized population of healthcare workers nearly impossible. Consequently, the participants were those most accessible through digital professional networks and remaining functional health facilities, which may introduce a selection bias toward those with higher digital literacy or those working in relatively more stable urban pockets.

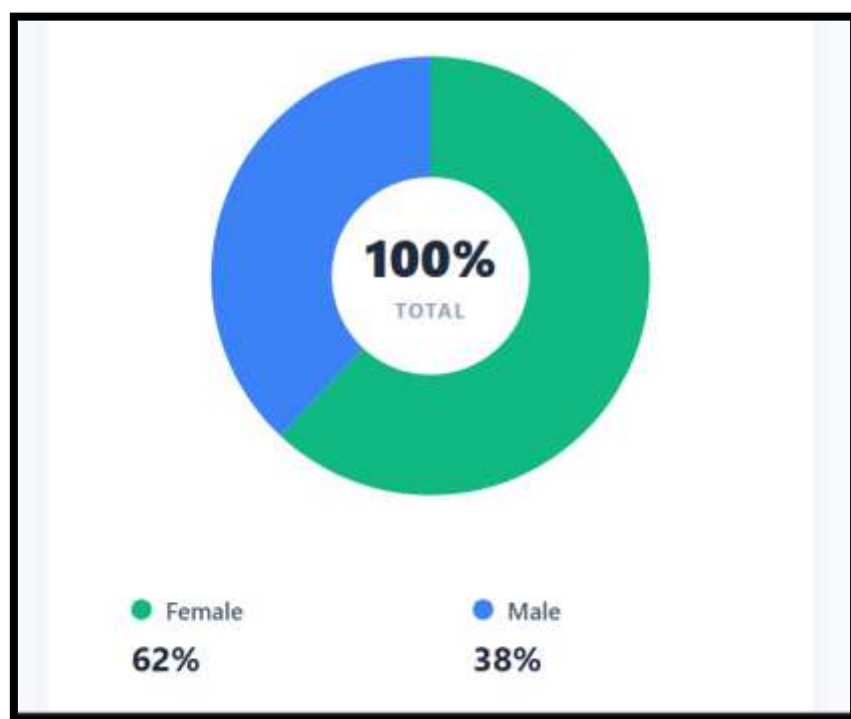
CHAPTER FOUR

RESULTS

Results

4.1 Participant Demographics

- 4.1.1 Participants Gender



Graph 4.1.1 shows the gender of participants n=146

- "The data reveals a significant gender imbalance within the group, with females accounting for nearly two-thirds of the total population at 62%, substantially outnumbering the male cohort."

- **4.1.2 Participant's Age:**

4.1.1 Table shows Age of participants N=146		
Age Group	Estimated Percentage	Frequency (n)
< 20 Years	~6%	9
20 - 25 Years	~51%	74
> 25 Years	~43%	63
Total	100%	146

The study population is predominantly composed of young adults, with the majority of participants (**51%**) falling within the **20-25 year** age range, while those **under 20 years** represent the smallest proportion of the sample at approximately **6%.**"

4.1.3 Professional Background:

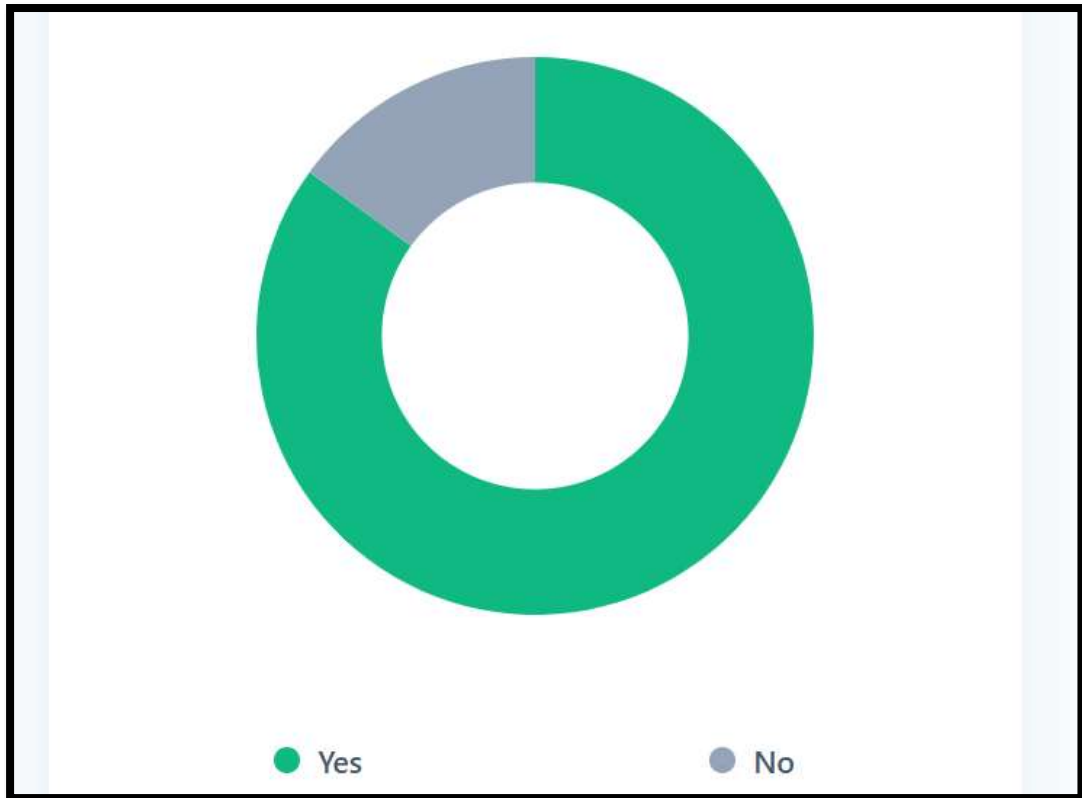
Table 4.1.2 Shows the Academic level of participants n=146

Educational Level	Estimated Percentage	Frequency (n)
University	~87%	127
Secondary School	~11%	16
Elementary School	~2%	3
Total	100%	146

The vast majority of the study participants have a **university-level education (87%)**, while those with **secondary school** and **elementary school** education represent a much smaller portion of the sample, at **11%** and **2%** respectively."

4.3 Assessment of Knowledge Regarding Artificial Intelligence

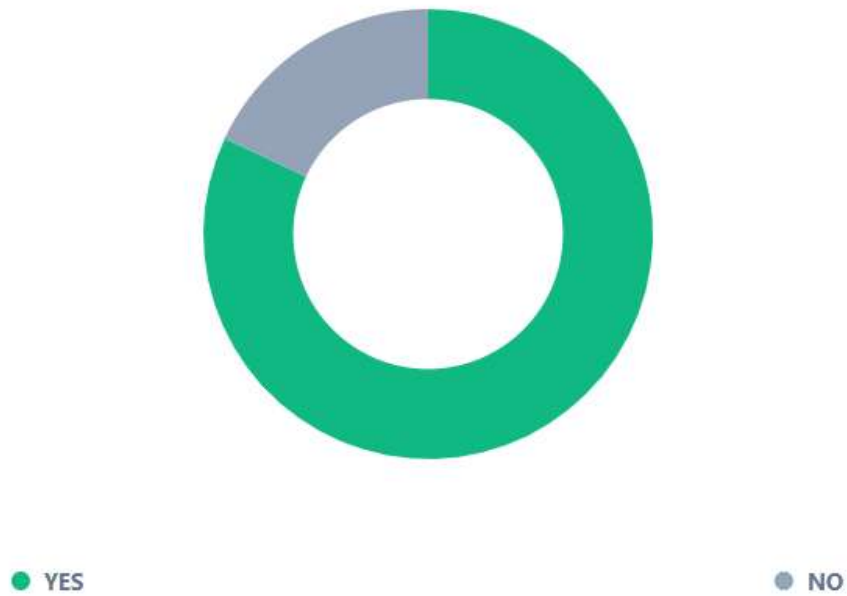
- 4.3.1 General Awareness of AI in Medical Practice



Graph 4.1.2 shows the frequency of participants how heard about AI in medical practice n=146

The results demonstrate an overwhelming consensus, with a vast majority of 85% responding affirmatively, while only a small minority of 15% provided a negative response.

- **4.3.2 Knowledge of AI Diagnostic Capabilities**



Graph 4.1.2 shows the frequency of participants who know that AI can analyse medical imaging like Xray, CT scan, MRI, etc. (N=146)

"The survey results show a clear consensus with an 82% affirmative response rate, demonstrating high levels of agreement among the respondents."

- **4.3.3 Technical Understanding: Data and Machine Learning**

Table 4.3.1. Descriptive Statistics: Knowledge of AI in Medical Practice (N=146)			
N	Valid	146	146
	Missing	0	0
Mean		.85	.90
Median		1.00	1.00
Mode		1	1
Std. Deviation		.359	.295

The descriptive statistics for Knowledge of AI in Medical Practice reveal a high level of awareness among the **146 participants**, with mean scores of **0.85** and **0.90** respectively. The median and mode for both variables are **1.00**, indicating that the most frequent response reflects a positive or 'correct' knowledge state, while the low standard deviations (**0.359** and **0.295**) suggest a high degree of consistency and little variation in knowledge levels across the sample."

4.4 Assessment of Perception Regarding Artificial Intelligence

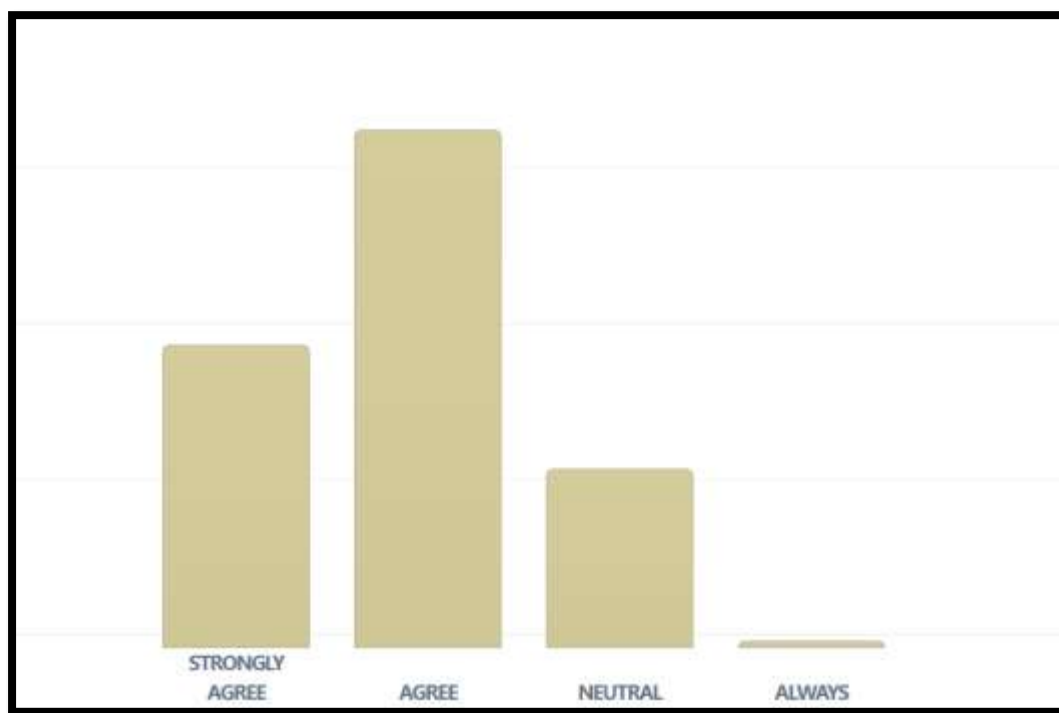
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Table 4.4: Participants' Perceptions Toward Artificial Intelligence in Medical Practice (n=146)

Survey Statement	Strongly Agree	Agree	Neutral	Sometimes/ Rarely
4.4.2 Trust in AI Diagnostic Accuracy	34	80	31	1
4.4.3 The Doctor-AI Relationship	55	65	25	1
4.4.4 Impact on Service Quality & Workload	55	65	25	1
4.4.5 Necessity of Doctors' Training	55	65	25	1

The findings indicate a strong positive consensus regarding the integration of AI in healthcare. A significant majority of participants expressed trust in AI's diagnostic accuracy (78.1% combined agreement), while an even higher proportion (82.2%) acknowledged the importance of the doctor-AI relationship, its positive impact on workload, and the essential need for specialized medical training. The minimal 'Neutral' and 'Rarely' responses suggest that the medical community in this sample is largely prepared for and supportive of AI-driven clinical advancements.

- **4.4.1 Support for AI in the Sudanese Health System**



Graph 4.4.6. Frequency of Participant Responses on the Implementation of AI within the Sudanese Healthcare System n=146

Over 80% of respondents expressed positive sentiment, with the majority favoring "Agree" as the most frequent response.

4.5. Relationship between knowledge and perception

Table 4.5.1. Statistical Association Between Knowledge Levels and Perception Regarding AI in Medical Practice			
Pearson Chi-Square	278.850 ^a	220	.004
Likelihood Ratio	177.876	220	.983
Linear-by-Linear Association	.012	1	.914
N of Valid Cases	146		

The Pearson Chi-Square test indicates a statistically significant association between participants' knowledge levels and their perceptions of AI in medical practice ($X^2 = 278.850$, $p = .004$). Since the **p-value (0.004)** is less than the standard alpha level of **0.05**, we reject the null hypothesis. This suggests that a participant's level of knowledge regarding artificial intelligence significantly influences their attitude and perception toward its clinical application."

CHAPTER FIVE

DISCUSSION

5.1 Knowledge and Familiarity with AI

The results indicate a high level of general recognition among Sudanese healthcare professionals, with 85% to 90% of the 146 participants reporting having heard of AI in medical practice. This high baseline of familiarity is consistent with global trends where AI is increasingly integrated into the medical consciousness [1, 3].

- **Diagnostic Identification:** Participants correctly identified AI's strength in analyzing medical imaging (X-rays, CT, MRI), which aligns with the global literature describing AI as a benchmarked partner in radiology and pathology [23].
- **Technical Gaps:** Despite high general knowledge (Mean = 0.85–0.90), the study identified a "Knowledge Gap" in technical specifics like Machine Learning. This mirrors findings from a February 2026 study of Sudanese medical students, which noted that while attitudes were positive, detailed technical literacy remained limited [16].

5.2 Perceptions of Diagnostic Accuracy

The perception of AI as a tool to enhance diagnostic precision is the strongest driver of potential adoption in Sudan.

- **Accuracy and Trust:** The majority of participants (80 out of 146) agreed that AI increases diagnostic accuracy (Graph 4.4.2). This trust is supported

by 2025 meta-analyses in *Nature Digital Medicine*, which found AI achieved 81% diagnostic accuracy compared to 71% for general healthcare professionals [21].

- **Reducing Human Bias:** Participants viewed AI as a means to reduce "observer bias" and "cognitive load" [7]. This is particularly relevant in Sudan, where general practitioners often manage complex cases due to a lack of specialists [8].

5.3 AI as a Tool for "Diagnostic Resilience" in Sudan

Unique to the Sudanese context is the perception of AI as a "survival intervention" rather than just a technological upgrade.

- **Bridging the Expertise Vacuum:** With the 2023 conflict causing 70-80% of health facilities to close [15], participants viewed AI as a vital "second opinion" that can fill diagnostic gaps left by the migration of senior consultants [16].
- **Clinical Adherence:** The optimistic perception of participants is validated by local audits in Al-Managil, where AI-based clinical decision support systems (CDSS) increased physician compliance with malaria protocols from 50.7% to 96.8% [16]. This suggests that the positive perception recorded in this study is grounded in AI's ability to maintain standards of care during crises.

5.4 Statistical Significance and the "Paradox of Readiness"

The study revealed a statistically significant association between knowledge levels and perception (Pearson Chi-Square = 278.850, $p = 0.004$).

- **Impact of Literacy:** This result confirms that higher AI literacy directly correlates with a positive perception and a higher willingness to adopt these tools. This aligns with regional data from Egypt, where "performance expectancy" was found to be the strongest predictor of AI adoption [24].
- **The Training Mandate:** Despite a "Paradox of Readiness"—where technical knowledge is poor but acceptance is high ($>70\%$) [16]—participants expressed a nearly unanimous need for formal training. This highlights that while Sudanese doctors are willing to adopt AI, they are wary of doing so without structured institutional frameworks and legal protections [16, 19].

5.5 Global Implications and Clinical Readiness

In summary, the 146 healthcare professionals surveyed demonstrate a high readiness to integrate AI into the Sudanese diagnostic workflow. The data suggests that the workforce views technological integration as a primary solution to the "brain drain" and the centralization of diagnostic services [17].

The significant correlation between knowledge levels and perception ($p < 0.05$) suggests that targeted educational modules, such as the ZAMW application [16, 20],

are the essential next step to transition the Sudanese medical workforce from theoretical acceptance to safe, hands-on clinical implementation. By focusing on African-led innovation and context-specific data, the Sudanese health system can leverage these positive perceptions to improve patient safety and diagnostic reliability across the country [18, 20].

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The study concludes that Sudanese healthcare professionals possess a robust baseline of familiarity with Artificial Intelligence and a highly optimistic perception of its potential to improve diagnostic accuracy. With 85-90% of participants recognizing AI's role in modern medicine, there is a clear readiness to adopt these technologies as a strategy for "diagnostic resilience" amid the current healthcare crisis.

The statistical analysis ($p = 0.004$) underscores that perception is not static; it is significantly driven by knowledge. However, a "Paradox of Readiness" exists where high levels of **acceptance** are currently mismatched with low technical literacy regarding Machine Learning and Deep Learning. Ultimately, AI is viewed by the Sudanese medical workforce not as a replacement for human expertise, but as a critical synergistic partner capable of bridging the specialist gap and reducing clinical errors in a resource-constrained environment.

6.2 Recommendations

6.2.1 For Educational Institutions

- **Curriculum Integration:** Medical schools and postgraduate training bodies in Sudan should formally integrate AI literacy into their curricula.

This should focus on the "clinical application" of AI rather than just coding, ensuring doctors can critically appraise AI-generated outputs.

- **Continuous Professional Development (CPD):** Launch targeted workshops for practicing clinicians to bridge the gap between general familiarity and technical proficiency, utilizing tools like the ZAMW AI-powered learning app.

6.2.2 For Health Policy and Governance

- **Regulatory Frameworks:** The Federal Ministry of Health (FMOH) should establish clear guidelines and ethical protocols for AI usage to address concerns regarding accountability, patient data privacy, and diagnostic liability.
- **Support for Local Innovation:** Prioritize the adoption of AI models trained on African-centric datasets to ensure that the high diagnostic accuracy perceived by participants translates effectively to the Sudanese population .

6.2.3 For Future Research

- **Longitudinal Impact Studies:** Future research should move beyond "perception" to measure the actual clinical outcomes of AI implementation

in Sudanese hospitals, specifically focusing on its ability to reduce misdiagnosis in rural areas.

- **Large-Scale Multi-Center Analysis:** Expanding the sample size beyond 146 participants across different states in Sudan would provide a more granular understanding of how regional resource disparities affect AI readiness.

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Appendices



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