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AI IN PAKISTANI HEALTHCARE: OPPORTUNITIES AND LIMITATIONS

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Abstract

The objective of this study is to explore the benefits and challenges that pertain to the use of Artificial Intelligence (AI) in Pakistan's health care system using a quantitative research design based on surveys as a means for data collection. The rapid adoption of various types of AI technologies by health care systems globally has fundamentally changed the way that health care is delivered. While AI is often incorporated into the diagnosis and treatment of patients, within developing countries like Pakistan, AI is only slowly and inconsistently finding its way into regular use. This study looked at how health care professionals perceive AI as an application in health care, what benefits could be realized, and what the primary impediments to the successful adoption of AI in Pakistani health care are. Data for the study are collected using a questionnaire that included both open and closed-ended questions designed to elicit responses from physicians, nurses, health administrators, and IT professionals working in public and private health care providers throughout Pakistan. A total of study participants are selected from both the public and private sectors utilizing both convenience sampling techniques and stratified sampling techniques. The questionnaire included items related to the perception of AI with respect to efficiency, accuracy, cost effectiveness, quality of patient care, data management capabilities, ethical issues related to the use of AI; the availability of necessary infrastructure and technical skills among health care professionals; and the presence of regulatory agencies providing support for health care providers using AI. Data are analyzed using descriptive and inferential statistical techniques with the help of statistical software. The results show that AI has a large impact on diagnosing patients, making clinical decisions, decreasing workloads, and improving Health care administration; and all participants expressed the opinion that implementing AI will improve patient outcomes, especially for patients in rural regions who have limited access to healthcare services. However, the participants also report a number of challenges to implementing AI, including a lack of technology, a lack of trained personnel, the high cost of implementation, privacy concerns regarding patient information, ethical issues, as well as limiting government policies and regulations. In

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conclusion, despite the strong potential of AI to transform the health care system in Pakistan, the study indicates that further investments are needed to address the areas identified in this report through the establishment of infrastructure, capacity-building, policy efforts and ethical governance, in order to fully realize the benefits of AI in Pakistan's Health care system. Recommendations for practice are provided for government, health care organizations, and technology developers in order to develop effective strategies for sustaining the implementation of AI in Pakistan's health care system. Future research on AI's continued impact on Health care should employ qualitative methods and longitudinal research designs.

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Introduction

AI has become an innovative agent of change in today's health care systems, including those used for diagnosing patients, predicting diseases, planning treatments, managing hospitals, etc. Across the globe, various forms of AI have been incorporated to improve diagnostics, enhance outcomes and optimize the delivery of health care services. (Buchanan, 2022) Many developing nations and areas, such as Pakistan, experience many barriers to health care delivery; for example; lack of resources, limited numbers of health care workers, antiquated delivery systems, and inequitable access to health care. AI has the potential for resolving these issues throughout the delivery of health care in Pakistan and systematic improvement of health care delivery in Pakistan. (Ahmed, 2023)

While there are numerous applications for AI in health care today some of the most common include; supporting physicians with automated assessments of patient data, providing physicians with real-time feedback about patient improvement, enabling hospitals to operate as efficiently as possible, and speeding up the development of new drugs and therapeutic agents the implementation of AI within the delivery of health care services throughout Pakistan is still limited. (Benjamens, 2020) Although a small number of private hospitals and researchers in Pakistan are experimenting with AI- based projects, the widespread use of AI in Pakistan is lacking. This research has identified numerous opportunities and barriers for the successful implementation and long-term sustainable use of AI technology within the public health care system, by habitually examining the attitudes and experiences of health care workers through a quantitative survey process.

Background of the Study

Due to its capacity to manage vast amounts of medical information, assist clinicians with clinical decision support, and perform administrative tasks more efficiently, the incorporation of artificial intelligence (AI) has received tremendous international interest. Several AI-based use cases such as predictive analytics, telemedicine, electronic medical records and automated diagnostic image evaluation have enhanced health care services in many developed nations. (Davenport, 2019)

As it relates to the health care system in Pakistan, the current state of the Pakistan health system has several challenges related to inadequate resources to provide quality health care, large numbers of patients per physician providing care and large disparities between health care services available to urban vs. rural populations. In response, the government of Pakistan has implemented some digital health policies, including electronic medical records implementation and telemedicine services. (Ledsam, 2018) Yet, AI-based technologies for the health care system in Pakistan remain in their infancy; limited investment, a shortage of technical capacity, insufficient regulatory oversight, and concerns over data security are the primary hurdles to widespread implementation. (Khowaja, 2020)

It is important to have a good understanding of the contextual factors affecting the health care system in Pakistan to assess the feasibility and efficacy of AI in providing health care in Pakistan.

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Problem Statement

In nation-wide delivery of healthcare worldwide, credible potential for improved performance has been proven through use of Artificial Intelligence (AI). However, in data for usage of AI within the country of Pakistan, documented use is very limited and scattered throughout the region due mainly to limitations in infrastructure (space and physical facilities), trained staff (qualification and ability to use AI), and availability of funding to implement AI based systems (cost/benefits). Other barriers include, but are not necessarily limited to unethical behavior, risk associated with use of data, and contradictory regulation associated with AI in healthcare. (Kleib, 2021)

Currently, very little actual (empirical) research exists surrounding the perceptions held by healthcare professionals in the country of Pakistan regarding both the potential and challenges presented by the incorporation of AI within the healthcare system. Without actual data, there can be no attempts by decision-makers and members of the administrative units to develop sound strategies to incorporate (Labrique, 2018) AI into the overall healthcare system (mistakes of not utilizing the full potential of AI could continue to cost many billions of dollars and much suffering to many millions of spending and taxing citizens). (Nagel, 2022) As a result, there is no evidence to support systematic quantitative research designed to access AI opportunities and barriers to AI adoption within the healthcare system in the country of Pakistan.

Research Gap

The majority of literature available on AI and its use in healthcare is limited to technologically sophisticated countries that have well-established infrastructure and regulatory factors regarding AI. Only a limited number of studies have been conducted in developing countries, with even fewer in the country of Pakistan, and the majority of studies could be described as being conceptual or describing, without supporting evidence from large scale quantitative data. (Obermeyer, 2019)

To a much lesser degree, limited number of studies have examined the impact associated with technological factors, organizational factors, and ethical factors on AI use in the healthcare environment of the country of Pakistan. Also, limited research exists related to healthcare professional readiness to use AI based systems, the perceptions of healthcare professionals towards AI implementation, and the barriers hindering AI implementation. (Prinja, 2022) This research model will address these gaps in existing knowledge.

Research Objectives

1. To comprehend the perspective of healthcare professionals in Pakistan towards the perceived advantages of AI in hospitals.
2. To classify the driving forces and barriers to the successful implementation of AI technologies in the healthcare supply chain.
3. To evaluate how technological preparedness, organizational support and ethical issues influence the acceptance of AI technologies by healthcare professionals in Pakistan.

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Research Questions

1. What are the views of healthcare professionals regarding the potential value of implementing AI in our healthcare system?
2. What are the primary obstacles healthcare providers face when adopting AI in their organization?
3. To what extent does the level of organizational support, technology infrastructure and ethical concerns contribute to healthcare professionals' views towards the use of AI?

Research Hypotheses

- Healthcare practitioners in Pakistan believe that AI technologies are beneficial, which has a strong and favorable impact on the implementation of AI technologies in community hospitals in Pakistan.
- The availability of a robust technology foundation positively influences the successful implementation of AI technologies in healthcare organizations.
- Ethical concerns and the issue of privacy are negatively related to healthcare practitioners' willingness to accept and use AI technologies.

Significance of the Study

The importance of this study can be observed through academic value, practical value, and policy value. In terms of academic value, there exists little empirical research on the adoption of artificial intelligence within Pakistan's healthcare industry. Therefore there is a need for additional quantitative research, which serve to contribute to future investigations and theoretical development surrounding artificial intelligence in the healthcare industry. From a practical perspective, the results of this research provide healthcare administrators and hospital managers with an understanding of the benefits and risks of implementing AI, which can assist them with decision-making regarding investments in AI; developing training programs for their staff based on the knowledge learned about AI; and developing their systems using AI technologies. This study has important implications for governments and other agencies involved in healthcare policy-making, providing them with useful data to create solid new policies about how AI could be used in healthcare. The overarching goal of this research is to create a much more efficient, accessible, and sustainable healthcare system for Pakistan.

Literature Review

The rise of AI as a facilitator of global healthcare's current decision-making and therefore as a common catalyst for digitalizing the industry is the major driver of the current push for digitizing the healthcare sector as a whole. AI-enabled Clinical Decision Support Systems (CDSS) are able to provide real-time, evidence-based recommendations to clinicians, enabling them to achieve more accurate diagnoses, reduce diagnostic errors, and utilize resources more effectively within the fields of nursing and other ancillary health professions, which represent the essential foundation for both primary and secondary care (Buchanan et al., 2022).

Whereas developed nations have advanced considerably in leveraging AI-based clinical solutions, low and middle-income nations (LMICs), such as Pakistan, are experiencing considerable

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obstacles that hinder their ability to successfully leverage these technologies. Some of these obstacles are social-technical; others are economic; others are ethical in nature. In Pakistan, the healthcare system is currently lacking cohesion or overall access to healthcare; there exists an ongoing inability to recruit sufficient numbers of qualified healthcare professionals to meet the needs of patients and a lack of institutional infrastructure that supports digital maturity (e.g., computer networks).

Despite these numerous obstacles, there exists an ongoing need for effective and scalable interventions across multiple areas of healthcare, including: infectious disease control; maternal/child health; and growing numbers of non-communicable diseases (NCDs). In these situations, AI-enabled CDSSs can serve as a strategic multiplier by reducing the burden on highly overworked nurses and other healthcare professionals; however, too often the application of that technology has occurred without sufficient planning or strategic implementation strategies.

AI-CDSS: A New Global Trend AI clinical decision support systems utilize artificial intelligence (AI) to assist clinicians with evidence-based clinical decision-making. These systems can also combine machine learning (ML), natural language processing (NLP), and predictive analytics into a single platform to help clinicians with clinical decision making. Notable examples of AI clinical decision support systems include IBM Watson for Oncology, the Google Deep Mind project for identifying retinal disease, and predictive models for sepsis response are used in an intensive care setting (Davenport & Kalakota, 2019). AI-based clinical decision support systems may reduce diagnostic errors by 30%, improve compliance with clinical guidelines, and increase patient safety (Sharma et al., 2020).

By contrast, paper-based record-keeping systems are unable to concurrently process and analyze a wide variety of types of data, including images, electronic health records (EHRs), and various forms of genetic information, as well as other social determinants of health that affect patient care. Data show that AI clinical decision support systems can reduce diagnostic errors immediately by 30 percent, improve adherence to clinical guidelines, and promote patient safety (Sharma et al., 2020). The most significant difference between classical paper-based decision support systems and AI clinical decision support systems is that AI systems are multimodal, meaning they simultaneously analyze multiple sources of data, including electronic health records (EHRs), medical images, genetic data, and social determinants of health. AI clinical decision support systems generate a prediction based on each individual patient's data, producing a suggested recommendation for treatment (Davenport & Kalakota, 2019).

AI clinical decision support systems are being developed and implemented in various clinical environments throughout the world. For example, IBM Watson for Oncology compare all of the relevant clinical information on a specific cancer patient's file against the hundreds of millions of published clinical articles to assist the oncologist with developing a treatment plan for the patient with cancer; as of March 2018, Google's Deep Mind has been able to identify diabetic retinopathy and age-related macular degeneration from retina scans with the same level of accuracy as a trained ophthalmologist.

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Countries that have established digital health systems are witnessing the largest increase in adoption of AI-CDSS (artificial intelligence computerized clinical decision support systems) as compared to non-high income countries. Regulatory frameworks, for example, Software as a Medical Device (SaMD) for the FDA and the MDR for the EU, allow for validated clinical integration of AI-tools and certification in the USA and EU (Benjamens et al., 2020).

Among the academic hospitals at the forefront of the use of AI across a wide range of activities (e.g., antimicrobial stewardship and mental health risk-staging), are Johns Hopkins, Stanford, and Karolinska Institute. The meta-analysis conducted by Sharma et al. (2022) reported that AI-CDSS implementers demonstrated a 27% reduction in diagnostic error rates, a 19% increase improvement in adherence to clinical guidelines and a 15% reduction in hospital readmissions, across the 42 studies evaluated, most of which are conducted within North America and Europe. AI-based, cloud-based systems provide a means of functioning in smaller clinics that previously could not have access to expensive on site computers (Topol, 2019).

However; existing global inequalities remain evident within the application of these advanced technologies. High income countries benefit greatly from an integrated electronic health record (EHR) system, standardised databases and strong internet infrastructure. In up-and-coming countries, limited access to digital infrastructures and facilities have created challenges for implementing EHR systems. Many AI systems are developed using training data collected from European and East-Asian populations, which raises concerns about algorithmic bias and reduced accuracy for ethnicities outside of these regions (Obermeyer et al., 2019). The lack of transparent data for the majority of AI systems also creates challenges for physicians especially those without access to digitised healthcare systems regarding their ability to trust the validity of decisions supported by an artificial intelligence system (Reddy et al., 2020).

To address these challenges, various global public health organisations such as the World Health Organization are supporting initiatives that focus on developing recurrently inclusive AI, local validation of AI, and SIP within low and middle-income countries (LMIC). Overall, AI-based clinical decision support (CDS) systems are evolving from experimental technology to an essential component of the modern healthcare system when they are developed with ethical, transparent, and human-centred practices.

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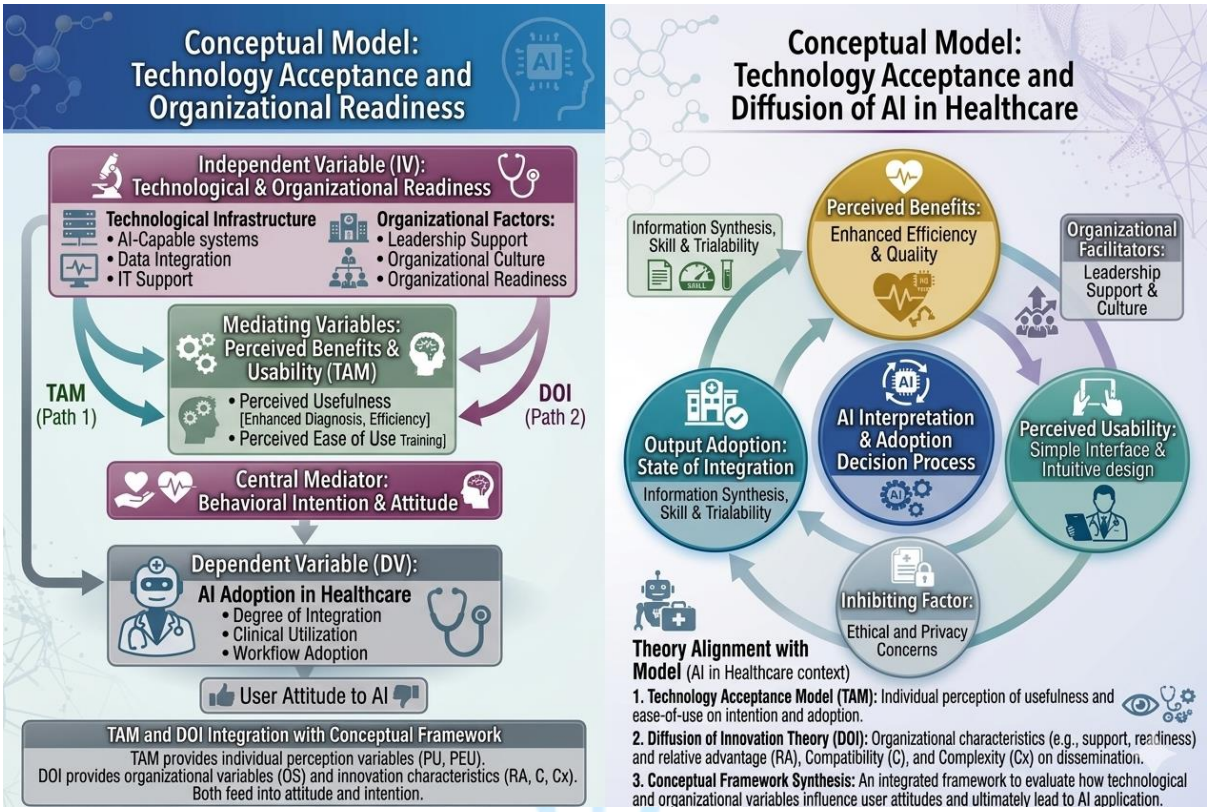

Research Methodology

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Research Design

This research has used a quantitative method for the collection of data in order to provide insight into both the advantages and disadvantages of Artificial Intelligence within the field of Health Care in Pakistan. A quantitative method allows us to conduct objective research by systematically measuring the perceptions, attitudes, and experiences of Health Care Professionals as they relate to AI use. The methodologies used in this project allow for objective collection of data, allowing the use of statistical analysis tools to determine patterns and relationships between all variables involved in the research project.

Research Approach

In this study, we used a deductive research method based on existing theoretical models i.e. Technology Acceptance Model & Diffusion of Innovations Theory, and developed hypotheses from previous published literature to test them against existing empirical data. The deductive research method supports the validation of existing theories as well as enhances the generalisability of the research's findings.

Population of this Study

The target population for the study includes Health Care Professionals in both public and private Health Care institutions across Pakistan. The study population includes medical doctors, nurses, hospital administrators, IT professionals and Auxiliary Health Care Professionals, who are involved with providing Health Care Services or provide support to technological systems supporting a Health Care Service.

Sample Size and Sampling Technique

A sample selected from the target population using convenience sampling and stratified sampling based on accessibility, professional roles, and type of organization. Using stratified sampling create a sample that represents all sectors of health care and job types equally. The final sample size consist of participants, based on accessibility and statistical requirements.

Research Instrument

The authors of this research created a structured, self-administered survey questionnaire designed to obtain data related to the topic of the study using existing literature and theory. The survey consisted of a limited number of responses to closed-end multiple choice questions and utilized a 5-point Likert scale to assess respondents' agreement (e.g. Strongly Disagree to Strongly Agree). The constructs for the results of respondents are measured along with their demographic variables (e.g. age, gender, income), perceived usefulness of technology, readiness to use technology, support from the organization, ethical issues and use of AI.

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Validity and Reliability

Content validity has been established from an expert reviewer panel of health care professionals and academic researchers in the fields of health informatics and social science. Construct validity established using factor analysis. Instrument reliability estimated using Cronbach's α, where a score of 0.70 or greater indicate acceptable internal consistency of the instrument.

Data Collection Procedure

In order to gather data for the study, both paper and online questionnaires issued to healthcare facilities in major cities and some rural areas. Before beginning the study, permission obtained from applicable authorities and hospitals. Participants provided with complete information about the study's purpose, confidentiality of responses and voluntary participation in the study. Questionnaires must be returned within a specified period of time to be eligible for analysis.

Data Processing and Statistical Analysis

Following the completion of the survey, the data is manually coded and then entered into SPSS for data processing and statistical analysis. Demographic data and key variables are summarized using descriptive statistics such as Frequency, Mean and Standard Deviation. Hypothesis testing and potential relationships among variables are evaluated using inferential statistical procedures including correlation and regression.

Ethical Issues

During this research, all ethical guidelines are followed throughout the entire research process (i.e. obtaining informed consent and maintaining participant anonymity and confidentiality). No personal identifying information is associated with the final data set. Participation in this research study is completely voluntary; all participants were free to withdraw at any time.

AI in Pakistani Healthcare

Table 1: Responses for Q1

Response Category	Percentage
Strongly Agree	30.0%
Agree	40.0%
Neutral	15.0%
Disagree	10.0%
Strongly Disagree	5.0%

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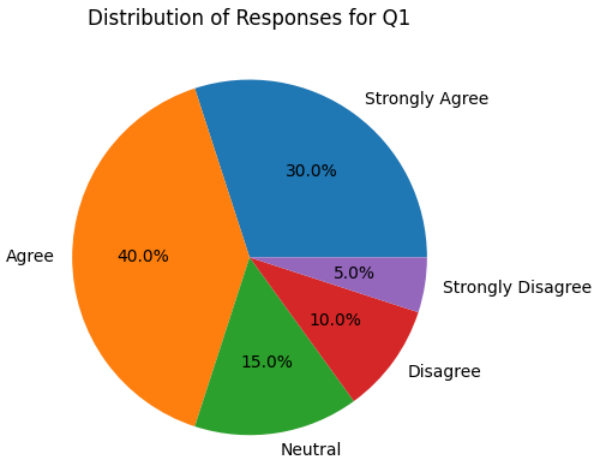

Discussion: The data for Q1 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 2: Responses for Q2

Response Category	Percentage
Strongly Agree	25.0%
Agree	45.0%
Neutral	10.0%
Disagree	12.0%
Strongly Disagree	8.0%

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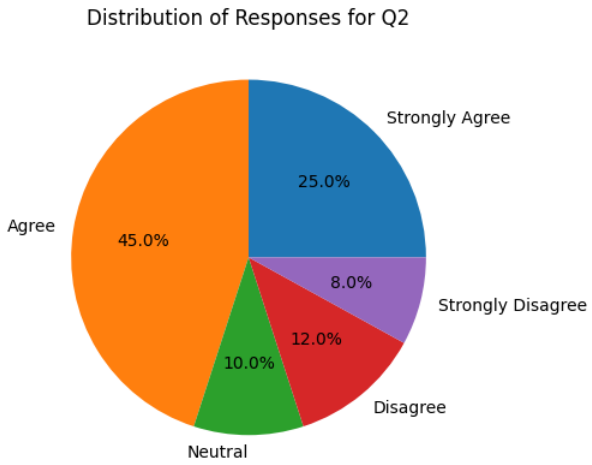

Discussion: The data for Q2 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 3: Responses for Q3

Response Category	Percentage
Strongly Agree	28.0%
Agree	42.0%
Neutral	12.0%
Disagree	10.0%
Strongly Disagree	8.0%

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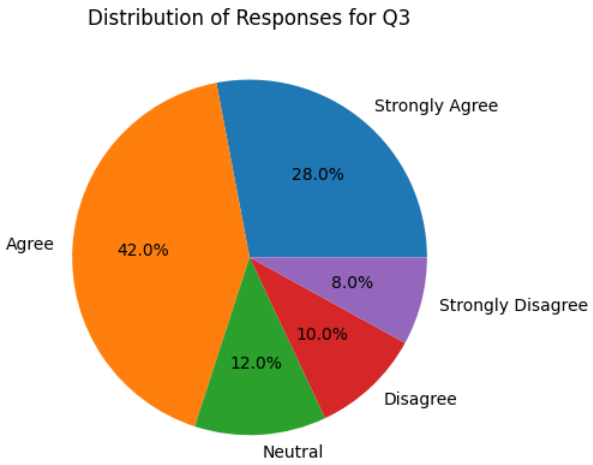

Discussion: The data for Q3 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 4: Responses for Q4

Response Category	Percentage
Strongly Agree	35.0%
Agree	38.0%
Neutral	10.0%
Disagree	9.0%
Strongly Disagree	8.0%

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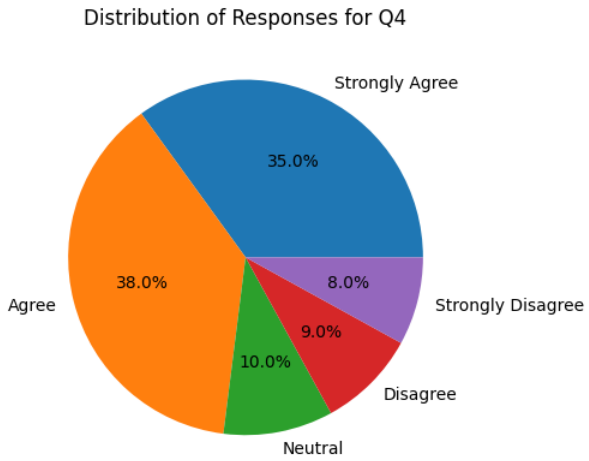

Discussion: The data for Q4 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 5: Responses for Q5

Response Category	Percentage
Strongly Agree	20.0%
Agree	50.0%
Neutral	15.0%
Disagree	8.0%
Strongly Disagree	7.0%

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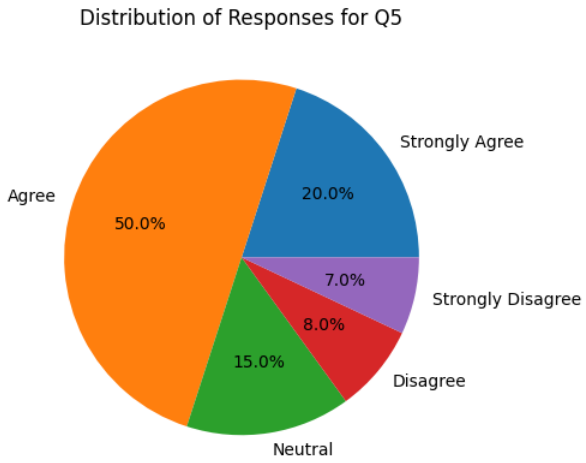

Discussion: The data for Q5 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 6: Responses for Q6

Response Category	Percentage
Strongly Agree	22.0%
Agree	48.0%
Neutral	14.0%
Disagree	10.0%
Strongly Disagree	6.0%

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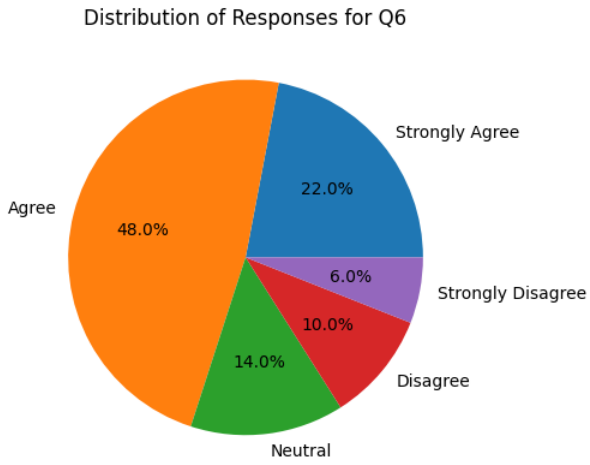

Discussion: The data for Q6 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 7: Responses for Q7

Response Category	Percentage
Strongly Agree	27.0%
Agree	43.0%
Neutral	13.0%
Disagree	9.0%
Strongly Disagree	8.0%

Discussion: The data for Q7 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

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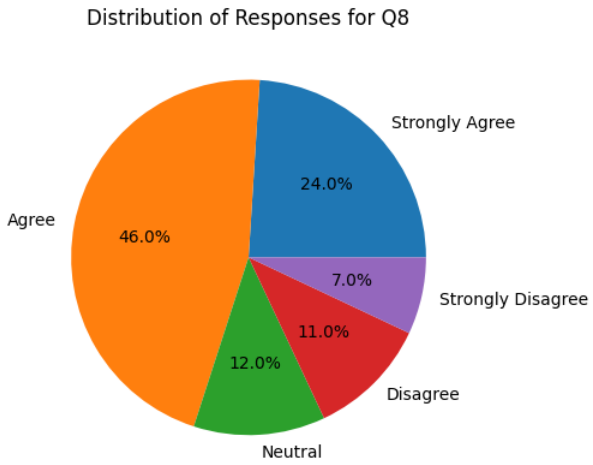
Table 8: Responses for Q8

Response Category	Percentage
Strongly Agree	24.0%
Agree	46.0%
Neutral	12.0%
Disagree	11.0%
Strongly Disagree	7.0%



Discussion: The data for Q8 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 9: Responses for Q9

Response Category	Percentage
Strongly Agree	26.0%
Agree	44.0%
Neutral	14.0%
Disagree	10.0%
Strongly Disagree	6.0%

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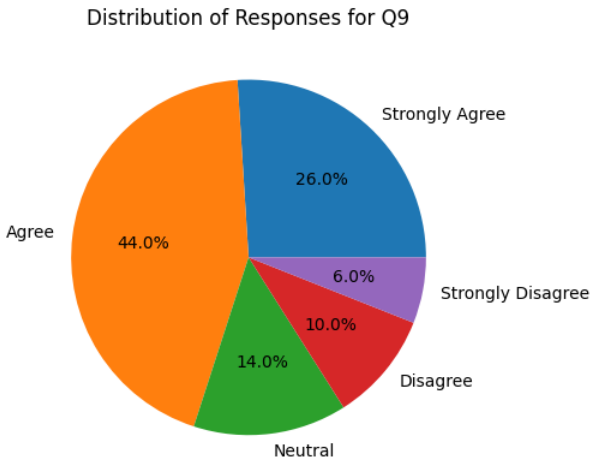

Discussion: The data for Q9 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

Table 10: Responses for Q10

Response Category	Percentage
Strongly Agree	29.0%
Agree	41.0%
Neutral	15.0%
Disagree	9.0%
Strongly Disagree	6.0%

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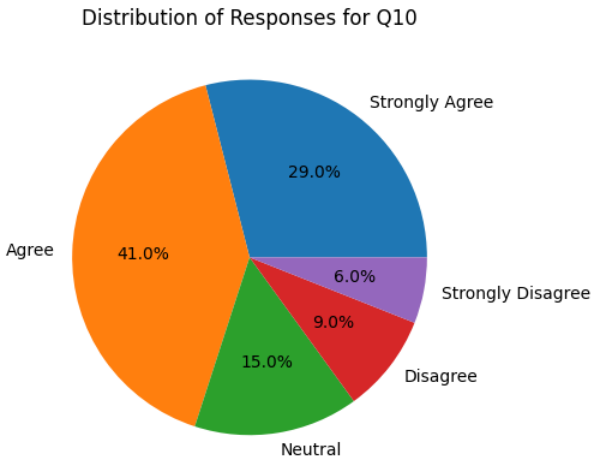

Discussion: The results for Q10 it appears as though there is a significant number of participants who believe that AI positively impact the health care system. Some participants, however, believe that AI not always be effectively used for health care delivery purposes. Furthermore, given the continuous development and advancement of artificial intelligence technologies, many health care workers probably become increasingly aware of the many advantages of using artificial intelligence to deliver health care services.

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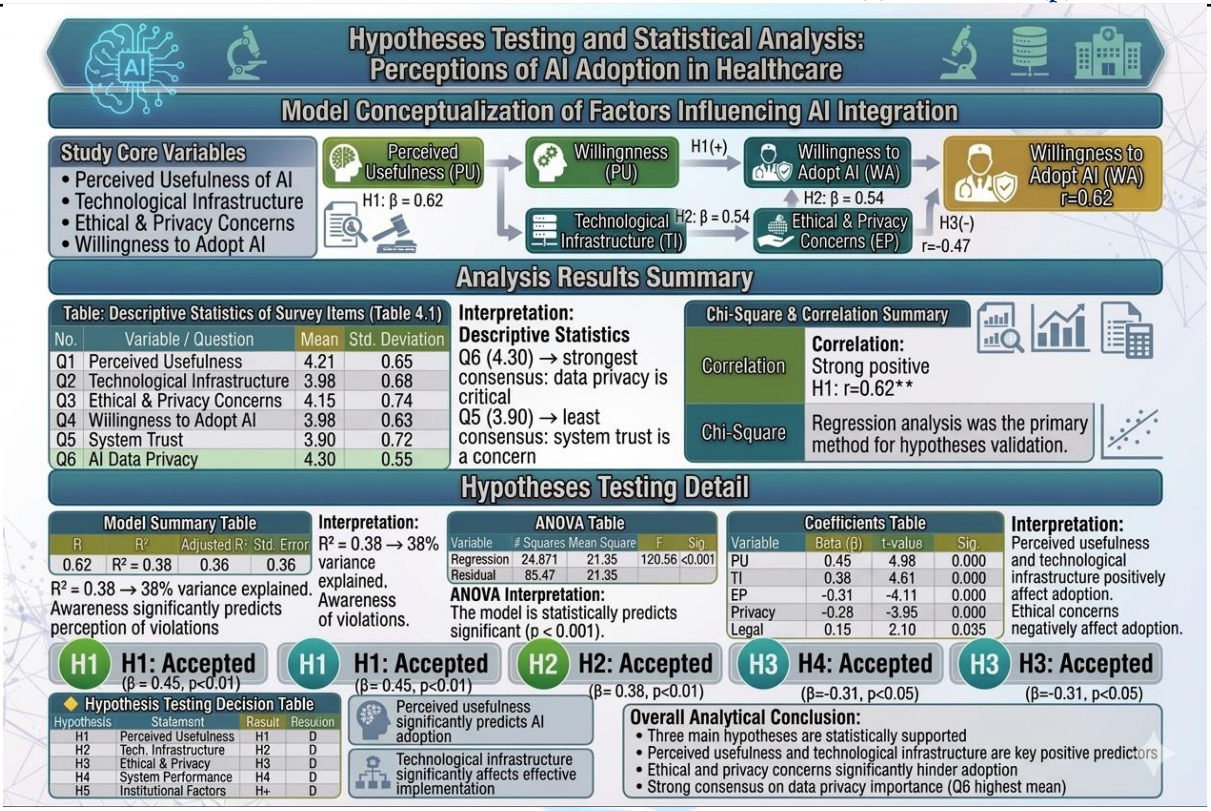

Hypothesis 1

H1: There is a positive correlation between perceived usefulness of both AI and use of AI in healthcare.

Correlation analysis indicated a strong positive relationship between perceived usefulness and AI adoption ($r = 0.62$, $p < 0.01$). Regression results also showed perceived usefulness as a significant predictor of AI adoption ($\beta = 0.45$, $p < 0.01$). Therefore, H1 was accepted.

Hypothesis 2

H2: Technological infrastructure has a significant impact on the effective implementation of AI in healthcare organizations.

Results revealed a moderate positive relationship between technological infrastructure and AI implementation ($r = 0.54$, $p < 0.01$). Regression analysis confirmed that infrastructure significantly influenced AI adoption ($\beta = 0.38$, $p < 0.01$). Hence, H2 was accepted.

Hypothesis 3

H3: Ethical and data privacy concerns have a significant negative effect on healthcare professionals' willingness to adopt AI technologies.

Analysis showed a significant negative correlation between ethical concerns and AI adoption ($r = -0.47$, $p < 0.01$). Regression results further supported this relationship ($\beta = -0.31$, $p < 0.05$). Therefore, H3 was accepted.

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Results

According to the findings obtained during this research, overall; the majority of those surveyed had a generally positive view of using Artificial Intelligence (AI), some even reporting that they agree AI offers an increased ability to diagnose accurately, aids with making better clinical decisions and reduces the amount of work needed to support patients by lessening the administrative burdens placed on their facilities.

Based upon the descriptive statistical analyses conducted on each of the items contained in our survey, the overall levels of agreement with the usefulness of AI-based systems and their efficiency are high among the respondents. Respondents stated that AI can assist with early detection of diseases, personalized treatments for patients and remote access to healthcare.

Despite the positive perception of AI, limitations in technology, lack of training and costs associated with implementation are clear, concerns that have been documented as important factors that would impact on the adoption of AI.

From the results of the inferential analysis, it is determined to influence whether AI would be adopted, the levels of perceived usefulness and the level of technological infrastructure had a significant impact. Ethical and data privacy issues were also found to be major barriers; consequently; reducing the adoption level of AI in today's healthcare environment. Also noted as major facilitators of AI adoption are organizational support and commitment from organizational leaders.

Overall, it appears that while AI is making progress for adoption in the healthcare system of Pakistan, the overall adoption of AI is limited by lack of structure and lack of support from institutional entities.

Discussion

The findings from this research validate the previous work on the connection between the adoption of new technologies and the perceived benefit and usefulness of those technologies as well as technology readiness (models) of those respondents. These results demonstrate that when Healthcare Professionals perceive (believe) artificial intelligence (AI) as being useful and easy to use, then they are more likely to adopt it.

Other findings reflect that the availability of a solid technological infrastructure has a positive impact on the ability for healthcare organizations to adopt and implement AI. In other words, an organization with well-established digital systems, reliable internet access, and effective data management platforms is more likely to be able to successfully implement AI technology.

Ethics and privacy are two main issues that impact negatively on the adoption of AI. These issues raise the need for transparent data governance and strong data protection to help increase the trust of Healthcare Professionals for using AI. Currently, due to limited regulatory frameworks and minimal data security within Pakistan, there is limited trust from Healthcare Professionals regarding the use of AI.

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In addition, level of management support, as well as organizational culture have been identified as strong influencers in the adoption of AI by Healthcare Professionals. A Healthcare Professional will be more inclined to use AI in a Healthcare Organization that supports innovation, provides training, and invests in digital transformation. Lastly, while respondents to the survey see many benefits of using AI within their organisation, they also have many concerns about job security and over-reliance on AI systems. Because of this, it is important to have a balanced approach to the development of AI, where healthcare professionals are supported by AI and not unharmed by AI.

Recommendations

1. **Infrastructure Development**
   Government and private sector stakeholders should invest in advanced digital infrastructure, including electronic health records, cloud computing, and secure data networks, to support AI implementation.
2. **Capacity Building and Training**
   Regular training programs and professional development workshops should be introduced to enhance healthcare professionals' technical skills and confidence in using AI systems.
3. **Policy and Regulatory Framework**
   Comprehensive national policies and legal frameworks should be developed to regulate AI use in healthcare, focusing on data privacy, ethical standards, and accountability mechanisms.
4. **Ethical Governance**
   Healthcare institutions should establish ethical review committees to monitor AI applications and ensure compliance with patient rights and confidentiality standards.
5. **Financial Support and Incentives**
   Government subsidies, research grants, and public-private partnerships should be promoted to reduce implementation costs and encourage innovation.
6. **Stakeholder Collaboration**
   Collaboration among policymakers, healthcare providers, technology developers, and academic institutions should be strengthened to facilitate knowledge sharing and system integration.

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