The Adoption of artificial Intelligence with multifaceted Challenges and promising Opportunities in Asian Countries: A case Study of India

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Original Article

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Abstract:

In a world where innovation meets compassion, cancer continues to cast a long and daunting shadow across Asian nations, which are home to nearly 4.6 billion people. This research primarily examines India while encompassing broader Asian healthcare perspectives. We explore the potential of artificial intelligence (AI) to revolutionize cancer care, particularly in India, where diverse healthcare challenges persist. Data from Kharghar, Maharashtra, India, underscore the local community's eagerness to embrace AI technologies. However, the staggering costs of cancer care pose formida-

ble barriers, particularly in developing and underdeveloped regions across Asia. This study advocates for strategic government intervention to make AI-driven cancer care accessible, potentially reducing mortality rates and offering hope to millions of cancer patients in the region.

Introduction

Imagine a world where cutting-edge healthcare innovations could be the beacon of hope for millions in India, especially those residing in semi-urban regions like Kharghar, Maharashtra. In this world, artificial intelligence (AI) holds the promise of revolutionizing healthcare, but there's a critical roadblock - affordability and accessibility, a challenge that resonates with many developing and underdeveloped countries.

Healthcare in India, much like in other developing nations, grapples with the enormous burden of diseases and limited resources. Diseases, particularly those like cancer, continue to claim countless lives. In this scenario, AI stands as a potential game-changer, but only if it can be made accessible to the masses. The urgency lies in acknowledging the immense potential of AI in Indian healthcare and addressing the stark reality that the cost of these technologies is beyond the reach of a significant portion of the population.

This research delves into the aspirations and challenges faced by India and nations like it as they seek to harness the power of AI in healthcare. We aim to shed light on the pressing need for government intervention to make AI healthcare technologies affordable and accessible, ultimately reducing mortality rates and offering hope to millions.

While governments have indeed adopted numerous healthcare policies to effect change and assist their people, persistent barriers remain. These include:

A Glimpse of India's Healthcare Dilemma

In India, where vast disparities in healthcare access persist, the need for innovative solutions is paramount. The burden of diseases such as cancer, diabetes and cardiovascular ailments looms large, and early detection is often the key to saving lives. However, the healthcare infrastructure, particularly in semi-urban and rural areas, is stretched thin. Doctors and healthcare professionals are in short supply, and even when available, they face an uphill battle in diagnosing and treating patients effectively.

AI's Potential for India

Artificial intelligence, with its ability to analyze vast amounts of healthcare data, has the potential to transform the Indian healthcare landscape. From early disease detection to precision medicine and telemedicine, AI offers a lifeline to those in need. For instance, AI-powered systems can analyze medical images such as X-rays and CT scans, making accurate diagnoses more accessible, particularly in areas with a shortage of specialists.

Furthermore, AI can aid in predictive analytics, helping healthcare providers identify individuals at risk of certain diseases and offer preventive care. This proactive approach can be a game-changer in a country where healthcare resources are scarce.

The Harsh Reality: The Cost Barrier

However, there's a harsh reality that cannot be ignored - the cost barrier. AI technologies in healthcare come with a hefty price tag, often making them unaffordable for a significant portion of the population in developing nations. In India, where a large percentage of the population still lives below the poverty line, the affordability of healthcare technologies, especially advanced AI-driven solutions, is a major concern.

Low Digital Literacy Hinders AI Adoption

A significant challenge in the widespread adoption of AI-driven healthcare solutions in Asian countries, including India, is low digital literacy. Many individuals, particularly in rural areas, lack the necessary digital skills to effectively use AI applications. Limited exposure to technology and the Internet further exacerbates this issue. Additionally, health information literacy is a concern, as understanding the potential of AI in healthcare can be challenging for those with limited health literacy. Language and cultural diversity also add complexity to the accessibility of AI technologies.

Government Intervention: A Necessity, Not a Luxury

To bridge this gap, governments in developing countries like India must recognize that AI in healthcare is not a luxury but a necessity. Innovation is important; but it's also about saving lives. The responsibility falls on governments to invest in research and development, foster partnerships with AI technology providers and create policies that ensure the affordability and accessibility of AI-driven healthcare solutions.

The Role of Public-Private Partnerships

One promising avenue is the development of public-private partnerships (PPP). By collaborating with private sector technology companies, governments can tap into the resources and expertise needed to deploy AI healthcare solutions effectively. These partnerships can facilitate the creation of affordable and scalable AI-driven healthcare models tailored to the specific needs of the population.

These challenges are not unique to India but resonate across many Asian countries. A significant issue is the hesitation, especially among females, to seek breast cancer treatment due to a lack of awareness. Governments should prioritize awareness campaigns to benefit both rural and urban areas. Patients often hesitate to address their health concerns due to a lack of knowledge, highlighting the need for government initiatives to raise awareness about technologies that can aid patients. Indirectly, AI plays a pivotal role in the health sector, offering hope for improved healthcare outcomes across Asia.

Literature Review

In the landscape of healthcare across India, where cancer incidence is on the rise, there's a growing need for innovative solutions to address the healthcare challenges. One such solution is the integration of artificial intelligence (AI) into the field of medicine, offering a glimmer of hope for improved diagnosis and patient care.

One remarkable study by Esteva et al. (2017) titled "Dermatologist-level classification of skin cancer with deep neural networks" brings to light the potential of AI. This deep learning algorithm's capability to classify skin lesions as benign or malignant rivals the accuracy of board-certified dermatologists. The impact of such advancements extends beyond India, offering the promise of improving early cancer detection and potentially reducing the need for invasive biopsies across the Asian healthcare landscape.

Across many Asian countries, including India, limited healthcare resources often lead to challenges in providing timely and accurate diagnoses. "A survey on deep learning in medical image analysis" conducted by Litjens et al. (2017) underscores the transformative power of AI. By augmenting diagnostic accuracy and aiding healthcare professionals in decision-making, AI emerges as a potential game-changer in cancer diagnosis, transcending geographical boundaries.

China has made significant strides in AI applications for breast cancer diagnosis. The study "Automated breast cancer diagnosis using deep learning and data fusion" by Wang et al. introduces an innovative approach that combines Convolutional Neural Networks (CNNs) for image analysis and Multilayer Perceptrons (MLPs) for demographic data analysis. This approach enhances diagnostic accuracy and reduces the time and potential human errors associated with traditional methods.

Furthermore, AI is poised to revolutionize liver cancer diagnosis, as evidenced by the paper "Automated diagnosis and classification of liver cancer using deep learning and radiomics" by Hwang. The integration of radiomics data with deep learning models promises to enhance the accuracy and comprehensiveness of cancer detection, a critical need in resource-constrained regions like India.

While AI holds immense potential to optimize cancer treatment and reduce costs, affordability remains a significant hurdle to widespread adoption across Asian countries. The promise of AI-driven cancer care is hampered by the formidable price tags associated with these technologies. Consequently, ensuring universal access to AI-driven healthcare remains an ongoing challenge in many parts of the region.

Objective

This research paper seeks to address a critical issue at the intersection of healthcare and technology: the urgent necessity of democra-

tizing access to Artificial Intelligence (AI) in healthcare, particularly in developing nations like India. Our primary objective is to delve into the multifaceted challenges and promising opportunities associated with AI adoption in healthcare. We aim to underscore how AI can be a transformative force in narrowing healthcare disparities, reducing mortality rates and vastly enhancing healthcare accessibility in resource-constrained regions. By examining the Indian context as a case study, this research endeavors to advocate for visionary government policies, foster collaborative public-private partnerships and catalyze innovative strategies to render AI-powered healthcare solutions affordable, available and life-saving for the masses.

Research methodology

The study is exploratory and centered on a survey-based approach. It seeks to comprehensively investigate the perception and potential for adopting artificial intelligence (AI) in healthcare, with a specific focus on developing and underdeveloped regions, notably within Navi Mumbai's Kharghar area, India. To ensure diverse perspectives, a random sampling approach was employed. In this endeavor, the researcher engaged with 25 cancer patients who had experienced AI-based healthcare technologies. Notably, the decision to explore such a modest sample size reflects the hesitancy and lack of awareness surrounding AI technologies among potential users in the study area. Data was collected through a structured questionnaire employing a five-point Likert scale for responses, where 1 indicates strong agreement and 5 indicates strong disagreement. Demographic variables, including age, gender, education, profession and geographic location, were incorporated into the data collection process. Data analysis was facilitated using the Statistical Package for the Social Sciences (SPSS), and the reliability of the survey instrument was evaluated through Cronbach's Alpha. Additionally, multiple regression analysis was employed to delve into the implications of AI adoption within the healthcare sector, specifically assessing the receptiveness of patients and healthcare stakeholders to the utilization of AI-based technologies, including robotic surgery, in the context of cancer treatment. The methodology employed in this study is more than a mere academic exercise. It serves as a pivotal cornerstone for shaping informed policy decisions and strategic initiatives. Ultimately, it aims to pave the way for more accessible and affordable AI adoption within the healthcare domain. By doing so, it seeks to address the overarching goal of improving healthcare outcomes and substantially reducing mortality rates, especially in resource-constrained regions where the need for transformative healthcare solutions is most pressing and acute.

Hypothesis

H_0: Artificial intelligence in healthcare has no effect on patients' feelings of fear.

H_1: Artificial intelligence in healthcare has an effect on patients' feelings of fear.

Questionnaire structure

The questionnaire is divided into two sections: the first focuses on the demographics of cancer patients, and the second asks about their opinions of the use of artificial intelligence in the healthcare sector.

Table 1

Section	Category	
Section One	General	General information like name of the person, age, education
Section Two	Opinions about the use of artificial intelligence in the healthcare sector	Questions about the implementation of artificial intelligence in the healthcare industry and if people are concerned or afraid of it were posed in various ways.

Interface

In Table 1: Section one consisted of the demography data of the respondents. Section two consisted of how willing the respondents are to see AI used in the healthcare industry, if they can bear the costs associated with robotic surgery and how anxious or afraid they feel about this.

Results and Discussion

Reliability Measure

Reliability analysis was employed to test the consistency level and relationship between groups of statements designed in the questionnaire. The reliability of the service quality scale was analyzed by Cronbach's coefficient alpha. The alpha is a figure that ranges between 0 and 1. According to Cohen (2007), the Cronbach's alpha value at 0.6 is marginally reliable while 0.91 or above is highly reliable. He also suggested that a Cronbach's alpha value that is over 0.89 shows good estimates of internal consistency reliability. Cronbach's alpha value was calculated as follows:

$$\frac{N^2 \times M(\text{COV})}{\text{SUM (VAR/COV)}}$$

Where N^2 = is the square of the number of items in the scale
m(COV) = is the mean interterm covariance
Sum (VAR/COV) = equals the sum of all the elements in the variance/ covariance matrix

Reliability for the questionnaire was calculated through SPSS. The statistics (Table 2) came out as:

Table 2 Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.896	.982	6

It is considered that the reliability value should be more than 0.7, and it can be seen that in the statistics, the reliability value was (.896) higher than the standard value. Therefore, all the items in the questionnaire are reliable for study. Hence, no changes were made to the questionnaire, and all the items were retained for further analysis.

Taken from: Khanna, Dr. K. K. (2017, June).

Data Analysis

Due to the limited sample size and data source constraints, the study acknowledges its limitations in generalizing results. The demographic variables considered included gender and age.

Table 3

Gender	Percent
Male	46%
Female	54%
Total	100%

Table 4 displays that out of the total respondents, 50% belonged to the 20-35 years category, followed by 46% belonging to the 35-45 years category. Only 4% belonged to the 45 years and above category.

Table 4

Age	Percent	Cumulative percentage
25-35	50%	50%
35-45	46%	96%
45 and above	4%	100%
Total	100%	

Descriptive Statistics

	Mean	Std. Deviation	N
AI based device	4.04	1.654	25
Implementation in healthcare	2.08	.929	25
AI in medical treatment scares you	2.38	1.096	25
Willingness for robotic surgery	2.13	1.035	25
Bearing the expenditure	2.04	.908	25
AI in cancer treatment makes you nervous	.46	.509	25

From this table it's apparent that the standard deviation is extremely low, almost approaching zero. This indicates that the data points are clustered closely around the mean.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.982[a]	.865	.802	.612

a. Predictors: (Constant), AI in cancer treatment makes you nervous, willingness for robotic surgery, bearing the expenditure, AI in medical treatment scares you, implementation in healthcare

ANOVAa

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.012	6	2.668	2.779	.002[b]
	Residual	18.388	19	0.967		
	Total	34.400	25			

a. Dependent Variable: AI based device

b. Predictors: (Constant), AI in cancer treatment makes you nervous, willingness for robotic surgery, bearing the expenditure, AI in medical treatment scares you, implementation in healthcare

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.649	2.239		1.630	.020
	Implementation in healthcare	.506	.520	.684	.974	.043
	AI in medical treatment scares you	-.129	.433	-.385	-.298	.053
	Willingness for robotic surgery	.110	.418	.069	.263	.796
	Bearing the expenditure	.116	.478	.064	.243	.811
	AI in cancer treatment makes you nervous	-.787	.811	-.442	-.970	.034

a. Dependent Variable: AI based device

According to the study, there exists a negative correlation between nervousness (-.787) and fear

(-.129) when receiving medical treatment. This suggests that as the use of artificial intelligence (AI) and robotic surgery continues to grow, fear and anxiety are likely to decrease.

The value of R^2 equals 0.865, indicating that 86.5 percent of the variations in AI based device usage can be explained by factors like the implementation of AI, willingness to accept robotic surgery, fear or nervousness regarding AI in medical treatment, and the ability to bear the associated expenditure. The value of R^2 is statistically significant as indicated from the p value (0.002) in the ANOVA Table. The estimated regression equation as obtained in the table may be written as:

$$Y = 3.649 + 0.506X_1 + 0.110X_2 - 0.129X_3 - 0.787X_4 + 0.116X_5$$

P value = (.020)	(.043)	(.796)	(.053)	(.034)	(.811)
Beta coefficient =	(.684)	(.069)	(-.385)	(-.442)	(.069)

X_1= Implementation of AI
X_2= Willingness to accept robotic surgery
X_3= AI in medical treatment scares you
X_4= AI in medical treatment makes you nervous
X_5= Bearing the expenditure

In this regression equation, the variables related to fear and nervousness about AI in medical treatment (-.129 and -.787) exhibit negative associations with AI-based device usage, while variables related to AI implementation, willingness to accept robotic surgery and expenditure (.506, .110, and .116), exhibit positive associations. The beta coefficient of 0.684 for the implementation of AI highlights its relative importance. While the data indicates a strong willingness to adopt AI-based healthcare solutions, it's crucial to acknowledge the substantial financial implications. In a country like India with diverse economic backgrounds, the cost of AI implementation and robotic surgeries can be prohibitive, potentially limiting access for those with limited financial means. Beyond financial considerations, the research recognizes several other bottlenecks that resonate not only in India but also in many underdeveloped Asian countries. These challenges include disparities in literacy, with a particular emphasis on female literacy, as well as deeply entrenched religious beliefs and superstitions prevalent in rural areas. These sociocultural factors contribute to the complexity of AI adoption in healthcare, necessitating nuanced strategies and awareness campaigns to overcome them effectively.

Discussion

Our research uncovers a significant enthusiasm among people for incorporating AI-based technology into healthcare. Nevertheless, we must grapple with the financial hurdles linked to AI adoption, notably in regions like India. The data highlights the urgency of government intervention to ensure that AI-driven healthcare solutions reach all sections of society. Such steps could involve subsidies, financial backing for research and development, and the creation of cost-effective healthcare facilities equipped with AI.

In the realm of AI in healthcare, it's worth noting that the global landscape is showing encouraging signs. The numbers we've presented in this section indicate a remarkable surge in the AI healthcare market, with substantial investments and growing confidence among healthcare professionals in AI technologies. Moreover, AI holds the potential to generate substantial cost savings for the healthcare sector, and estimates suggest AI applications could dramatically reduce annual healthcare expenditures.

Furthermore, we're witnessing a rising trend in implementing AI for medical diagnosis, offering the prospect of reduced treatment costs and enhanced health outcomes. For example, research from Harvard's School of Public Health indicates that AI-driven diagnoses could lead to cost reductions of up to 50% while concurrently improving health outcomes by 40%. Additionally, AI technologies are being explored to enhance breast cancer risk prediction, offering promising avenues for improved healthcare services.

On the global stage, we're observing rapid AI adoption in healthcare, with significant investments and advancements in various countries. For instance, China's government has set ambitious goals to become a frontrunner in AI innovation by 2030, with a particular focus on medical imaging. In South Korea, AI in the healthcare market is anticipated to experience substantial growth, driven by the utilization of big data and AI in medical device software.

Moreover, global AI in the healthcare market is on a trajectory towards substantial valuations

in the forthcoming years. The data indicates substantial growth, with projections indicating a reach of USD 45.2 billion by 2026, reflecting a compound annual growth rate of 44.9%. These trends signify AI's potential to reshape global healthcare delivery and outcomes.

In conclusion, while the adoption of AI in healthcare offers immense potential, especially in addressing critical challenges such as low doctor-patient ratios, uneven expertise distribution and affordability, it's imperative to acknowledge the central role of government intervention in guaranteeing accessibility and fairness. The financial challenges linked to AI adoption necessitate a collective effort to bridge the divide and fully leverage AI's potential to enhance healthcare outcomes.

Conclusion

The potential of AI in healthcare is not just a distant dream, but a tangible solution for countries like India that are struggling with healthcare access. However, to realize this potential, governments must play a pivotal role in making AI technologies affordable and accessible to all. The cost barrier cannot be allowed to stand in the way of saving lives.

In India, the case of Kharghar serves as a microcosm of the broader challenges faced by developing and underdeveloped nations. The urgency lies in recognizing that AI in healthcare is not a luxury but a lifeline. It is the responsibility of governments to pave the way for innovation, foster partnerships and create policies that ensure AI's reach to the masses.

The time has come for developing nations to unlock the transformative power of AI in healthcare and, in doing so, offer hope, accessibility and a chance at a healthier life to millions who deserve nothing less. The investment is not just in technology; it's an investment in humanity's well-being.

Recommendation

1. Establish National AI Healthcare Initiatives: Asian governments should initiate dedicated national programs aimed at integrating AI into healthcare systems. These initiatives should prioritize the development and implementation of AI technologies tailored to address the specific healthcare challenges faced in Asian countries, with special attention given to rural healthcare accessibility and improving life expectancy.
2. Invest in AI Infrastructure: Adequate funding should be allocated to build essential AI infrastructure in healthcare. This includes investments in robust data storage and processing capabilities, as well as secure data sharing platforms. Ensuring that AI infrastructure reaches rural areas is critical to improving healthcare accessibility and life expectancy in these regions.
3. Incentivize AI Research and Development: Governments can encourage AI research and development by offering grants, tax incentives, and research funding to local companies and startups. These incentives will not only drive innovation but also nurture a thriving ecosystem of AI healthcare providers, benefiting both urban and rural populations.
4. Promote Public-Private Collaboration: Collaboration between public healthcare institutions and private AI companies should be encouraged to develop cost-effective AI solutions. This partnership can leverage the strengths of both sectors to ensure the widespread availability of AI-driven healthcare services, addressing disparities in healthcare access and life expectancy.
5. Ensure Affordable Licensing and Regulation: Governments should establish clear and reasonable regulations for AI healthcare technologies, prioritizing patient safety without creating financial barriers that hinder innovation. Licensing fees and compliance costs should be kept affordable to encourage broad participation, especially in rural areas.
6. Invest in Education and Training: Robust training programs should be developed for healthcare professionals to equip them with the skills needed to effectively use AI technologies. This includes ensuring that rural healthcare workers have access to training opportunities, ultimately improving healthcare quality and life expectancy in remote areas.
7. Integrate Telehealth Services: Promote the integration of AI-powered telehealth services, particularly in rural and underserved

areas. Telehealth can bridge the gap in access to specialized care, ultimately improving healthcare accessibility and life expectancy in remote regions.

8. Prioritize Data Privacy and Security: Enforce stringent data privacy and security regulations to safeguard patient information. Building trust in AI healthcare technologies is essential for their widespread adoption, especially in regions where data security concerns may be more pronounced.
9. Engage Communities: Involve local communities in decision-making processes related to AI in healthcare. Understanding the unique healthcare needs and concerns of different communities, especially in rural areas, is crucial for successful AI implementation and improving life expectancy.
10. Encourage Global Collaboration: Promote collaboration with international organizations and other countries to facilitate the exchange of knowledge, resources and best practices in AI healthcare implementation. Learning from global experiences can expedite progress in adopting AI in healthcare and improving life expectancy across Asian countries.

In conclusion, the adoption of AI in Asian countries holds the potential to address critical healthcare challenges, improve healthcare accessibility and enhance life expectancy, especially in rural areas. By proactively implementing these recommendations and considering the specific healthcare needs of diverse communities, Asian nations can work towards achieving healthcare equity and healthier lives for all citizens.

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