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Research Article

Knowledge, Attitude, And Practice Among Pharmacists of Dakshina Kannada Towards Artificial Intelligence

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Abstract

The swift advancement of artificial intelligence (AI) has sparked significant interest in its potential applications in the healthcare domain, particularly in pharmacy. Understanding the knowledge, attitudes, and practices (KAP) of pharmacists towards AI is essential for its successful integration. This study sought to assess the KAP of pharmacists in Dakshina Kannada, India, concerning AI in pharmacy practice. A descriptive cross-sectional study was conducted with 201 licensed pharmacists in Dakshina Kannada. A mixed-methods approach was employed, combining quantitative data from structured questionnaires and qualitative insights from open-ended queries. The evaluation covered demographic information, AI awareness, attitudes, current practices, as well as perceived challenges and benefits. The survey showed that 89.6% of pharmacists were acquainted with AI in healthcare. Regarding AI understanding, 5% lacked comprehension, 19.9% had basic knowledge, 39.8% had intermediate understanding, and 35.3% exhibited advanced comprehension. Despite 79.6% expressing interest in AI training, significant barriers included concerns about infrastructure (24.9%), data privacy (29.9%), and costs (14.9%). Only 15% reported using AI tools currently, primarily due to limited expertise and technical obstacles. This study provides insights into the readiness of pharmacists in Dakshina Kannada towards AI integration in pharmacy practice. High awareness and interest in AI training were observed, but significant barriers such as infrastructure, data privacy, and costs need to be addressed. Tailored strategies are necessary to overcome these challenges and maximize the benefits of AI in enhancing pharmacy services.

INTRODUCTION

The rapid progressions in artificial intelligence (AI) have substantially altered various industries, particularly within the realm of healthcare [1-3]. In the expansive domain of healthcare, pharmacy emerges as a sector poised for technological advancement, with the potential to transform drug development, patient care, and operational efficiency [2,4,5]. In the context of Dakshina Kannada, an area renowned for its robust healthcare infrastructure and innovative medical approaches, the incorporation of AI into pharmacy presents a duality of opportunities and obstacles.

Pharmacists play an important role in the healthcare framework, acting as a crucial link between patients and their prescribed medications. Their duties encompass a wide spectrum, from dispensing medications to offering crucial health guidance, ensuring medication safety, and overseeing patient well-being [6-9]. As AI innovations start to infiltrate the pharmaceutical sector, it becomes imperative to grasp the knowledge, attitudes, and practices (KAP) of pharmacists towards these advancements. This comprehension is essential for pinpointing deficiencies, promoting positive outlooks, and devising effective training schemes customized to local requirements [4,5,10].

This research endeavor seeks to investigate the KAP among pharmacists in Dakshina Kannada with regards to AI. Through evaluating their current knowledge levels, assessing their attitudes, and scrutinizing their practical involvement with AI technologies, we can enhance our understanding of the preparedness and likely hindrances to AI integration in this crucial healthcare domain. Such discernments are paramount for various stakeholders, such as policymakers, educators, and healthcare managers, to facilitate a seamless transition and leverage the complete potential of AI in pharmacy.

METHODOLOGY

Methodology

To assess the knowledge, attitudes, and practices (KAP) of pharmacists in Dakshina Kannada towards artificial intelligence (AI), a structured methodology is essential. The study will employ a mixed-methods approach, combining quantitative and qualitative data collection to provide a comprehensive understanding of the subject.

Study Design

- **Research Type:** Cross-sectional descriptive study.
- **Population:** Registered pharmacists in Dakshina Kannada.
- **Sample Size:** Total population size of 201 pharmacists.

Sampling Technique

- **Sampling Method:** Given the manageable population size of 201, a census approach will be employed where every registered

pharmacist in the region will be invited to participate.

- **Inclusion Criteria:** Pharmacists currently practicing in Dakshina Kannada. Willingness to participate in the study.
- **Exclusion Criteria:** Pharmacists not currently practicing. Refusal to consent to participate.

Data Collection Methods

Questionnaire Development:

Sections: The questionnaire will be divided into three main sections: Knowledge, Attitudes, and Practices.

Format: A combination of multiple-choice questions, Likert scale items, and open-ended questions.

Validation: Pre-testing the questionnaire with a small group of pharmacists (10-15) to ensure clarity and relevance.

Distribution and Collection:

Mode: Both online (via email or survey platforms) and offline (paper-based) methods will be used to maximize response rates.

Duration: Data collection will span four weeks to allow adequate time for responses.

RESULT

Table 1, as presented within this investigation, provides a detailed overview of the demographic characteristics of pharmacists in Dakshina Kannada who participated in the study. The distribution of age demonstrates a significant representation across various age groups, with the highest proportion observed in the 25-34 age bracket, accounting for 24.9% of the sample. Participants below 25 years old and those between 35-44 years each contribute 19.9%, while pharmacists aged 45-54 represent 14.9%, and individuals aged 55 and above constitute 20.4%. In terms of gender distribution, the majority of the cohort consists of male participants, making up 69.7% of the total, whereas females account for 29.9%, and a small percentage of 0.5% identify with a different gender category. Regarding professional experience, pharmacists with 0-5 years of tenure form the largest group at 24.9%, followed by those with more than 21 years of experience at 22.9%. Other noteworthy categories include individuals with 6-10 years (19.9%), 11-15 years (17.4%), and 16-20 years (14.9%) of experience.

With regard to the practice settings, nearly half of the participants (44.8%) are employed in community pharmacies, which represent the primary practice environment. Hospital pharmacies hire 24.9% of the pharmacists, while clinical pharmacies accommodate 12.4% of the sample. Industrial pharmacy settings involve 9.9% of the participants, whereas academic and research positions are held by 8% of the individuals who took part in the study.

Table 1: Demographic Data of Pharmacists in Dakshina Kannada.

Question Number	Question	Response Options	Number of Respondents (n)	Percentage (%)
1	Age	Under 25	40	19.9%
		25-34	50	24.9%
		35-44	40	19.9%

		45-54	30	14.9%
		55 and above	41	20.4%
2	Gender	Male	140	69.7%
		Female	60	29.9%
		Other	1	0.5%
3	Years of Experience	0-5 years	50	24.9%
		6-10 years	40	19.9%
		11-15 years	35	17.4%
		16-20 years	30	14.9%
		21 years and above	46	22.9%
4	Type of Practice	Community Pharmacy	90	44.8%
		Hospital Pharmacy	50	24.9%
		Clinical Pharmacy	25	12.4%
		Industrial Pharmacy	20	9.9%
		Academic/Research	16	8%

Table 2 provides a comprehensive overview of the knowledge, attitudes, and practices of pharmacists in Dakshina Kannada regarding artificial intelligence (AI) in pharmacy. A significant majority (89.6%) have heard of AI in healthcare, while 10.4% have not. The levels of understanding vary, with 5% having no understanding, 19.9% having basic understanding, 39.8% having intermediate understanding, and 35.3% having advanced understanding. Pharmacists are aware of various AI applications, such as drug discovery and development (19.9%), personalized medicine (14.9%), medication management (24.9%), clinical decision support (19.9%), inventory management (12.4%), and patient adherence monitoring (8%). Learning sources for AI in pharmacy include academic courses (19.9%), professional training (24.9%), online resources (29.9%), conferences and seminars (14.9%), colleagues (5.5%), and media (5%).

Beliefs about AI benefits are varied, with 5% strongly disagreeing, 9.9% disagreeing, 14.9% neutral, 44.8% agreeing, and 25.4% strongly agreeing. Comfort levels with integrating AI into practice also vary, with 2.5% very uncomfortable, 9.9% uncomfortable, 19.9% neutral, 44.8% comfortable, and 22.9% very comfortable. Key concerns include lack of infrastructure (24.9%), resistance to change (19.9%), data privacy concerns (29.9%), cost of implementation (14.9%), and lack of AI expertise (10.4%). Opinions on including AI in the pharmacy curriculum are diverse, with 5% strongly disagreeing, 14.9% disagreeing, 19.9% neutral, 40.3% agreeing, and 19.9% strongly agreeing. Fifteen percent of pharmacists currently use AI tools, while 85% do not. The tools in use include drug interaction checkers (24.9%), automated dispensing systems (19.9%), electronic health records with AI features (17.4%), predictive analytics for inventory management (19.9%), and AI-driven patient consultation systems (17.9%). Usage frequency varies, with 2.5% using AI tools daily, 5% weekly, 7.5% monthly, 34.8% rarely,

and 50.2% never. Barriers to implementing AI include lack of infrastructure (24.9%), resistance to change (19.9%), data privacy concerns (29.9%), cost of implementation (14.9%), and lack of AI expertise (10.4%). A substantial majority (79.6%) are interested in AI training, while 20.4% are not. Preferred training methods include online courses (24.9%), workshops and seminars (29.9%), on-the-job training (24.9%), and formal education programs (20.4%). AI is perceived to improve efficiency (34.8%), enhance accuracy in dispensing (29.9%), improve patient outcomes (24.9%), and reduce costs (10.4%). Challenges in integrating AI include high initial costs (29.9%), lack of knowledge and training (24.9%), technical issues (19.9%), resistance to change (14.9%), and data privacy concerns (10.4%). This table provides detailed insights into the pharmacists' knowledge, attitudes, and practices regarding AI, highlighting widespread awareness, varied levels of understanding, significant interest in AI training, and multiple perceived benefits and challenges associated with AI integration in pharmacy practice. This information is critical for developing strategies to enhance AI adoption and training in the pharmacy sector.

Table 2: Knowledge, Attitude, and Practice (KAP) Data of Pharmacists in Dakshina Kannada Towards Artificial Intelligence.

Question Number	Question	Response Options	Number of Respondents (n)	Percentage (%)
5	Heard of AI in healthcare?	Yes	180	89.6%
		No	21	10.4%
6	Understanding of AI in pharmacy	No understanding	10	5%
		Basic understanding	40	19.9%
		Intermediate understanding	80	39.8%
		Advanced understanding	71	35.3%
7	AI applications awareness	Drug discovery and development	40	19.9%
		Personalized medicine	30	14.9%
		Medication management	50	24.9%
		Clinical decision support	40	19.9%
		Inventory management	25	12.4%

		Patient adherence monitoring	16	8%
8	Learning sources for AI in pharmacy	Academic courses	40	19.9%
		Professional training	50	24.9%
		Online resources	60	29.9%
		Conferences and seminars	30	14.9%
		Colleagues	11	5.5%
		Media (articles, news, etc.)	10	5%
9	Belief in AI benefits for pharmacy	Strongly disagree	10	5%
		Disagree	20	9.9%
		Neutral	30	14.9%
		Agree	90	44.8%
		Strongly agree	51	25.4%
10	Comfort with integrating AI into practice	Very uncomfortable	5	2.5%
		Uncomfortable	20	9.9%
		Neutral	40	19.9%
		Comfortable	90	44.8%
		Very comfortable	46	22.9%
11	Main concerns about AI in pharmacy	Lack of infrastructure	50	24.9%
		Resistance to change	40	19.9%
		Data privacy concerns	60	29.9%
		Cost of implementation	30	14.9%
		Lack of AI expertise	21	10.4%
12	Opinion on AI inclusion in pharmacy curriculum	Strongly disagree	10	5%
		Disagree	30	14.9%
		Neutral	40	19.9%

		Agree	81	40.3%
		Strongly agree	40	19.9%
13	Current use of AI tools in practice	Yes	30	15%
		No	171	85%
14	AI applications currently used	Drug interaction checkers	50	24.9%
		Automated dispensing systems	40	19.9%
		Electronic health records (EHR) with AI features	35	17.4%
		Predictive analytics for inventory management	40	19.9%
		AI-driven patient consultation systems	36	17.9%
15	Frequency of AI tool usage	Daily	5	2.5%
		Weekly	10	5%
		Monthly	15	7.5%
		Rarely	70	34.8%
		Never	101	50.2%
16	Barriers in implementing AI in practice	Lack of infrastructure	50	24.9%
		Resistance to change	40	19.9%
		Data privacy concerns	60	29.9%
		Cost of implementation	30	14.9%
		Lack of AI expertise	21	10.4%
17	Interest in receiving AI training	Yes	160	79.6%
		No	41	20.4%
18	Preferred types of AI training	Online courses	50	24.9%
		Workshops and	60	29.9%

		seminars		
		On-the-job training	50	24.9%
		Formal education programs	41	20.4%
19	Ways AI can improve pharmacy practice	Improved efficiency	70	34.8%
		Enhanced accuracy in dispensing	60	29.9%
		Better patient outcomes	50	24.9%
		Cost reduction	21	10.4%
20	Challenges in integrating AI into practice	High initial costs	60	29.9%
		Lack of knowledge and training	50	24.9%
		Technical issues	40	19.9%
		Resistance to change	30	14.9%
		Data privacy concerns	21	10

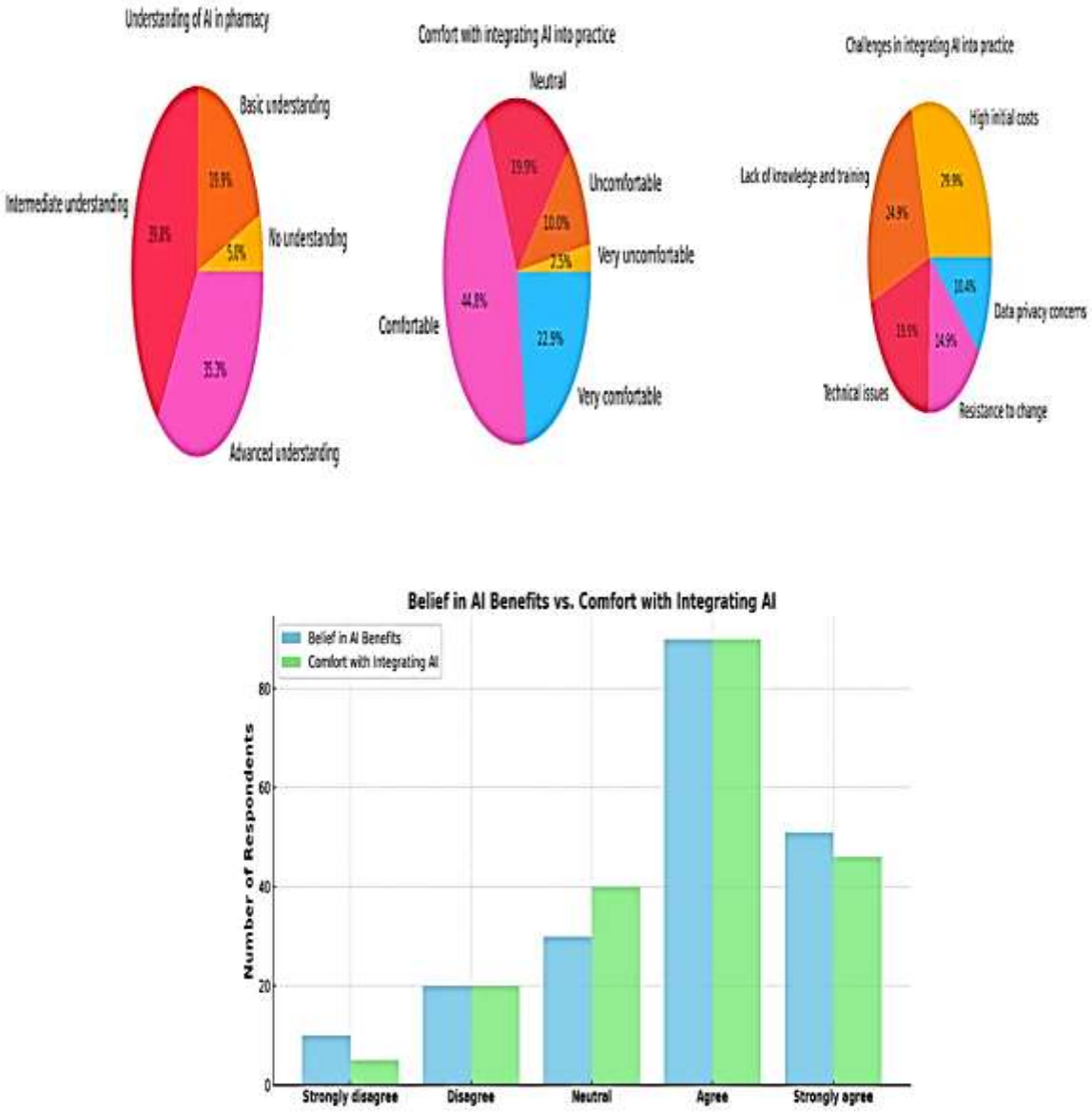

Figure 1: Survey on AI Awareness, Benefits, and Concerns in Pharmacy Practice.

DISCUSSION

AI in health refers to the use of artificial intelligence technologies to improve healthcare outcomes through applications such as diagnostics, treatment planning, patient monitoring, and healthcare management [11]. The present research delves into the understanding, viewpoints, and behaviors of pharmacists in Dakshina Kannada, India, concerning artificial intelligence (AI) within the pharmacy domain. The study uncovers a notable level of awareness among pharmacists regarding AI, accompanied by a generally optimistic stance towards its capacity to enhance pharmacy operations. Of particular note are apprehensions revolving around expenses, infrastructure, and data protection, pinpointing critical areas necessitating focus for the successful incorporation of AI into the pharmaceutical landscape in India. This scholarly research contributes invaluable perspectives on the specific obstacles and prospects associated with the adoption of AI within the Indian setting, offering a localized viewpoint on a global phenomenon.

In a contrasting approach, Hasan et al. (2024) carried out a cross-national investigation spanning multiple nations, highlighting the favorable predisposition towards AI within pharmacy across diverse cultural and geographical contexts. While their results align with the current study regarding the potential advantages of AI, Hasan et al.'s research did not delve into the precise levels of comprehension among pharmacists. Nonetheless, it emphasized universal themes concerning AI's role in improving medication adherence and clinical decision-making, presenting a comprehensive outlook on global trends related to the integration of AI in pharmacy practices [12].

Conversely, Al Subeh et al. (2017) directed their attention to pharmacy education in Jordan, scrutinizing the viewpoints of pharmacy students, faculty members, and preceptors regarding AI-driven medical applications. Their results echoed the favorable attitudes observed in the current study, signifying a willingness among stakeholders in the Jordanian pharmacy community to embrace advancements in AI technology. Despite geographical disparities, the work of Al Subeh et al. resonates with the broader worldwide narrative of optimism towards the integration of AI in pharmacy education and practice [13].

Furthermore, Mousavi Baigi et al. (2023) undertook a study encompassing healthcare students globally, among whom were pharmacy students, to assess perceptions of AI. Their findings complement the current study by reaffirming the increasing interest and positive perception of AI among future healthcare practitioners. While not explicitly tailored to pharmacy practice, the research by Mousavi Baigi et al. underscores the overarching trend of AI's growing relevance across various healthcare disciplines, thereby providing additional context to the results of the current study within a broader educational framework [14].

While the current study furnishes a localized view on AI adoption in the Indian context, comparative studies by Hasan et al. (2024), Al Subeh et al. (2017), and Mousavi Baigi et al. (2023) present more expansive global outlooks, collectively enriching our comprehension of the multifaceted dynamics that influence the integration of AI in pharmacy education and practice.

CONCLUSION

The swift progress of artificial intelligence (AI) is transforming different sectors, including healthcare, where pharmacy is seen as a promising area for technological incorporation. In Dakshina Kannada, known for its strong healthcare system, the introduction of AI in pharmacy brings forth both opportunities and challenges. Pharmacists, who have a vital role in patient care, must adapt to AI progress by comprehending their knowledge, attitudes, and practices (KAP) towards AI. This study employs a mixed-methods approach to explore these aspects among pharmacists in Dakshina Kannada, shedding light on their readiness and potential obstacles to AI integration. Results indicate a high level of AI awareness among pharmacists, along with optimism about its advantages, yet tempered by concerns like costs and data privacy. A comparison with global research studies reveals both specific local variations and common trends, emphasizing the need for tailored strategies for AI implementation in pharmacy practice. This research offers valuable insights for stakeholders looking to maximize the benefits of AI in enhancing pharmacy services.

Conflict of Interest: None.

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