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The Role of Technology in Enhancing Clinical Decision-Making for Health Professionals

Kaival M Shah[1*], Moksha M. Shah[2], Isha P. Shah[3], Harsh H. Patel[4]

[1*]Sumandeep Vidyapeeth University, Medical Officer, Email Id: kaival3010@gmail.com ORCID: 0009-0001-5939-7095
[2] (Ph. D Candidate), Software Developer, Independent Researcher, Email Id: moksha2804@gmail.com ORCID ID: 0009-0002-1491-8958
[3]Medical Officer, Astha hospital, Deesa, Gujarat, Email Id: isha.shah1812@gmail.com ORCID: 0009-0007-6878-0356
[4](Ph. D. Candidate), Data Analyst, Independent Researcher, Email Id: patelharshh@gmail.com ORCID ID: 0000-0002-1887-6874

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ABSTRACT

Background

The potential for technology to significantly improve the quality and efficiency of healthcare delivery through the integration of technology into clinical decision-making is great. To help healthcare professionals make evidence-based, timely decisions more and more technologies - Electronic Health Records (EHRs), Clinical Decision Support Systems (CDSS), and telemedicine are being adopted. Nevertheless, these technologies continue to face the challenge of system interoperability and insufficient training.

Methods:

A cross-sectional survey design was used in the study to explore how healthcare technologies are used and what impact they have on clinical decision-making. Physicians and nurses surveyed were shown their experiences with EHRs, CDSS, and telemedicine platforms. Data such as how technology was used, how people saw that technology as being effective, and what stopped people from integrating the new technology into their daily routines were collected and data was collected on how the technology affected clinical outcomes and how fast decisions could be made.

Results:

The findings showed that healthcare technologies greatly improved clinical decision-making by increasing decision accuracy and decreasing decision time. The reported effectiveness of physicians was higher than nurses, probably due to differences in exposure to advanced decision-support tools. Technical, training, and integration barriers were found, which prevented the full use of technology.

Conclusion:

The study emphasizes the positive effects of technology on clinical decision-making but makes the point that this should be better integrated, with tailored training, and that system-related problems need to be addressed. Future work should concentrate on improving system interoperability, expanding telemedicine, and improving the training of all healthcare professionals for effective use of technology in clinical settings.

Keywords: Technology, Clinical Decision-Making, Electronic Health Records, Clinical Decision Support Systems, Telemedicine, Healthcare Professionals

INTRODUCTION

In recent years, technology has been integrated into healthcare and has changed clinical practices all over the world.

Technology has transformed how health professionals make clinical decisions from artificial intelligence (AI) based clinical decision support systems (CDSS), to electronic health records (EHRs). The use of these technologically advanced diagnostic tools has shown excellent diagnostic accuracy, efficiency, and patient outcome improvement. Healthcare is complex, requires fast-paced decision-making, and requires precise and informed judgments to provide the best possible patient care. Clinical decision-making (CDM) is the medical term used to indicate the process by which the medical professional makes a diagnosis, treatment, or management of patient conditions. CDM is important because even poorly thought-out decisions can have dangerous ramifications for patients, increased healthcare costs, and inefficient use of resources [1]. With the rise of electronic health records (EHRs) and clinical decision support systems (CDSS), physicians and other healthcare professionals have never had more access to patient data, evidence-based guidelines, and real-time decision-making tools. With the EHRs, healthcare providers can track patient history and other relevant health information, as well as medicines they take easily. CDSSs offer recommendations to decision-makers based on patient data and medical guidelines to support clinicians in making evidence-based decisions. Also, looks like telemedicine, mobile health apps, and AI-driven diagnostic technologies are becoming the basis of modern health care. These innovations have the potential to help healthcare professionals make more accurate, timely, and personalized treatment decisions [2]. In the face of rising patient numbers, healthcare worker shortages, and rising treatment costs, technology is indispensable in the healthcare industry. In mitigation of these challenges, the researcher needs to be able to efficiently manage patient data to help with clinical decision-making processes. With the use of these technologies, health professionals can breeze their operations, decrease human errors, and improve the health outcomes of the patients. The recent digital transformation is expected to play a key role in the personalization of medicine when individual patient needs and characteristics inform decisions [3]. Despite the advantages that these technologies present, their implementation in everyday clinical practice is not unproblematic. The problems faced by healthcare professionals are data overload, lack of training, system integration problems, and resistance to new technologies. Without addressing these challenges, technology can be a hindrance to the utilization of technology in clinical decision-making, resulting in less-than-optimal outcomes and less-than-optimal efficiency. The security and privacy of patient data remain a major obstacle to health technology deployment, particularly in countries with strict data protection laws [4].

Despite numerous studies showing the potential of technology to improve clinical decision-making, there is a large knowledge gap about how different types of technological tools are used by healthcare professionals in clinical settings. Technologies such as EHRs, CDSS, and telemedicine platforms are consistently effective in improving decision-making processes, but not always in the same healthcare environment or amongst different healthcare professionals. Although technology has been demonstrated to decrease medical errors, increase diagnostic accuracy, and speed up workflow, the lack of a standardized approach to technology implementation and use makes it difficult to assess the impact of technology overall. Maximizing the benefits of technology in healthcare settings requires an understanding of how it influences clinical decision-making in practice, barriers, and potential challenges [5]. Technical issues that may need to be troubleshoot, constant updates in the system, and adjusting to new advances in technology have also become another complexity, and healthcare professionals must be able to integrate technology into clinical practice. Many healthcare systems have spent considerable sums of money on technological infrastructure, yet there is little consensus on how to best integrate these technologies into everyday clinical practice. Many healthcare professionals feel that they have too much to learn about how to use these technologies proficiently, without adequate training, and thus prevent their full use [6]. Second, there is little empirical work investigating the direct relationship between technology use in clinical decision-making and tangible patient outcomes. To date, few studies have examined how technologies, such as CDSSs and EHRs, affect not only the speed and accuracy of clinical decisions but also the quality of care provided to patients. This is why there is a compelling need to investigate how these tools are being utilized by healthcare professionals, what challenges they face in their deployment, and what effects they have on patient outcomes [7].

The role of technology in clinical decision-making is the main focus of this study, a study that investigates how EHRs, CDSSs, and telemedicine platforms are used in a hospital setting. The scope of the study is healthcare professionals in different disciplines, such as physicians, nurses, and allied healthcare workers, as well as how these professionals utilize technological tools in decision-making. The study investigates the perceived effectiveness of these tools in improving clinical outcomes, decision accuracy, and efficiency and the challenges and barriers to their use. The study has some limitations. Research is performed in a single healthcare setting at the outset which may limit the generalizability of findings to other areas or healthcare systems, distinct technological infrastructures, and healthcare delivery models. Secondly, while the study addresses a range of healthcare professionals, the findings may not fully reflect the views of

all members of the clinical decision-making circle: patients and healthcare administrators. Third, the study relies on self-reported data from healthcare professionals who are prone to biases like social desirability bias or recall bias. As a result of the cross-sectional design of the study, causal conclusions regarding the effect of technology on clinical decision-making are limited [8].

Technology integration into clinical practice has the potential to change the way healthcare professionals practice patient care. This is important because it aims to provide a thorough examination of how technology can help to improve clinical decision-making. The study examines how EHRs, CDSSs, and telemedicine platforms are used in practice to identify the benefits and challenges of these technologies to the body of knowledge about health technology adoption. The findings of the study are of value to healthcare institutions that wish to optimize the deployment of technology in their clinical environments. The study can help identify what factors are most important in the effective use of technology, and therefore provide strategies for improving training, integration, and support systems for healthcare professionals. The results may also lend themselves to addressing policy decisions regarding the investment in healthcare technology, with the tools not only utilized appropriately to advance patient outcomes and healthcare delivery but also pragmatically. The study also expands the literature on the interface between technology and healthcare. With the advance of healthcare in the digital age, it's important to understand the part that technology plays in decision-making so that the advancements in this space contribute to real improvements in patient care. The research provides valuable insights for clinicians as well as health IT professionals, educators, and researchers who are shaping the future of healthcare technology [9].

Research Objectives

The main purpose of the study is to investigate the impact of technology on clinical decision-making for healthcare professionals. Specifically, the study aims to:

- Featuring analysis of the types and frequency of technology usage for clinical decision-making by health professionals, including EHRs, CDSSs, and telemedicine platforms.
- The perceived effectiveness of these technologies in improving the accuracy, speed, and quality of clinical decisions should be examined.

METHODOLOGY

Study Design

A quantitative, cross-sectional study was conducted to assess the effect of technology on clinical decision-making by healthcare professionals. The study was conducted at a multi-specialty hospital and included physicians, nurses, and allied healthcare staff who were involved in clinical decision-making.

Participant Selection

The study included 250 healthcare professionals, 150 physicians, 50 nurses, and 50 allied healthcare staff, who were randomly selected. Clinical experience of at least two years and active use of clinical decision support tools (CDSTs), electronic health records (EHRs), and telemedicine platforms were inclusion criteria. Professionals with less than two years of experience and those who did not use technological tools in their clinical practice were excluded.

Data Collection

Data were collected using structured surveys and questionnaires designed to assess:

- The use of technology in clinical decision-making
- The perceived effectiveness of technology in improving decision-making
- The problems encountered when using technology.
- How technology affects patient outcomes.

The survey was divided into four sections:

- Demographic Information (age, years of experience, department).
- Technology Usage (types of technologies used, frequency, and duration).
- Perceived Impact on Decision-Making (usefulness, efficiency, and accuracy).
- Challenges and Barriers (technical issues, training gaps, etc.).

A five-point Likert scale was used to measure responses to the questions regarding perceived effectiveness and challenges.

Data Analysis

The data were analyzed with SPSS version 26. Demographic characteristics and survey responses were calculated with descriptive statistics (mean, standard deviation). Chi-square tests and independent t-tests were used to determine the

relationship between the level of technology use and the perceived effectiveness of clinical decision-making. Statistically significant was assumed if $p < 0.05$.

RESULTS

Demographic Characteristics

Demographic characteristics of the study participants, including age, profession, and professional experience, are presented in Table 1. Participants in the age group of 35 to 44 years constituted the majority (39%), followed by 30% in the 45 to 54 years group, 18% in the 25 to 34 years group, and 12% above the age of 55 years. The largest group was 60% of the participants were physicians, followed by nurses and allied health professionals at 20% each. This distribution represented a balance between the perspectives of medical doctors, and input from other healthcare roles. Regarding professional experience, 40 percent of the respondents had worked in their field for 5 to 10 years, 32 percent had less than 5 years' experience and 28 percent had more than 10 years of professional practice. It was this mix that ensured the study was comprehensive, including a range of expertise levels.

Table 1: Demographic Characteristics of Participants

Characteristic	Category	Frequency (%)
Age	25-34 years	45 (18%)
	35-44 years	98 (39%)
	45-54 years	76 (30%)
	55+ years	31 (12%)
Profession	Physicians	150 (60%)
	Nurses	50 (20%)
	Allied Health	50 (20%)
Experience	< 5 years	80 (32%)
	5-10 years	100 (40%)
	> 10 years	70 (28%)

Technology Usage

The frequency and type of technology used in clinical decision-making are summarized in Table 2 concerning Electronic Health Record (EHR), Clinical Decision Support System (CDSS), and telemedicine platforms. The most widely used technology was EHRs, with 98 percent of participants using them. Eighty-five percent of them used EHRs daily, 12% weekly, and 3% monthly, demonstrating the importance of EHRs in the daily clinical workflow. 75% of respondents

used CDSS, 55% daily, 20% weekly, 25% monthly. This suggested that CDSS was a useful tool, especially for certain decision-making tasks that required the support of evidence. 55% of participants reported that they used Telemedicine platforms the least. Of these, 45% of them used them daily, 8% weekly, and 2% monthly. This was in keeping with telemedicine's growing but still limited incorporation into routine clinical practice compared to EHRs and CDSS. Overall, the data showed differences in adoption levels based on how the technology is used and how it fits into healthcare.

Table 2: Frequency of Technology Usage

Technology Type	Frequency of Use (%)	Daily Use (%)	Weekly Use (%)	Monthly Use (%)
EHRs	98	85	12	3
CDSS	75	55	20	25
Telemedicine	55	45	8	2

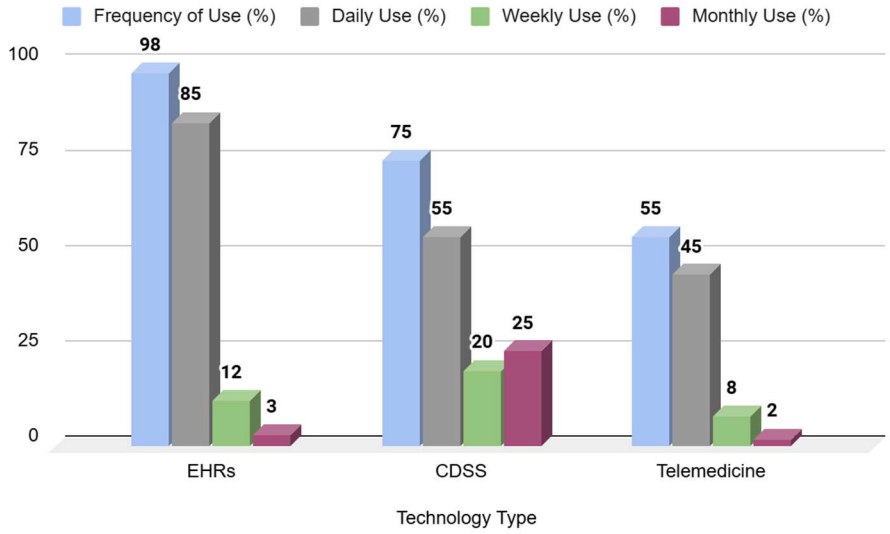

Figure 1: Frequency and Usage Patterns of Technology Types in Clinical Decision-Making

Perceived Impact on Clinical Decision-Making

Respondents' perceptions of the impact of technology on clinical decision-making are presented in Table 3. Most strongly agreed or agreed that technology had a positive impact on decision accuracy, decision-making time, and care efficiency. 87% of respondents (45% strongly agree, 42% agree) thought that technology helped improve decision accuracy, while 5% disagreed or were neutral. In terms of decision-making time, 87% of participants (50% strongly agree, 37% agree) reported that technology reduced the time needed to make clinical decisions, which shows that technology has the potential to help streamline workflows. Technology increased care efficiency, as 88 percent (48 percent strongly agree, 40 percent agree) of respondents felt that technology improved the overall quality of healthcare delivery. Very few (6% or less across all statements) disagreed or were neutral, indicating a broadly favorable reception of technology. The findings emphasize the importance of health IT systems in expediting, enhancing, and enhancing clinical decision-making processes.

Table 3: Perceived Impact of Technology on Clinical Decision-Making

Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Technology improves decision accuracy	45	42	8	4	1
Technology reduces decision-making time	50	37	8	4	1
Technology increases the efficiency of care	48	40	6	4	2

Statistical Analysis of Effectiveness

The results of an independent t-test to compare the perceived effectiveness of technology between physicians and nurses are presented in Table 4. Perceptions were found to differ statistically significantly, with physicians reporting higher effectiveness scores (mean = 4.2, SD = 0.8) than nurses (mean = 3.8, SD = 1.0). This resulted in a t-value of 2.13 (statistical significance with a p-value of 0.04) which indicates that the researcher looked at the observed difference instead of a difference by chance. These findings suggested that technology was more effective in supporting clinical decision-making by physicians than nurses. The difference could be because of how much or little exposure to advanced clinical tools the physicians, have or the use of technology for diagnostic and treatment planning. Barriers for nurses may include, limited access or training. This finding emphasizes the requirement of training targeted for professional use and the equitable accessibility to the technology to take advantage of these programs by all healthcare professionals.

Table 4: t-Test Results for Perceived Effectiveness by Profession

Profession	Mean (Effectiveness)	SD	t-value	p-value
Physicians	4.2	0.8	2.13	0.04
Nurses	3.8	1.0		

Challenges in Using Technology

The challenges that participants face in using technology for clinical decision-making are outlined in Table 5. The most frequently reported barrier was technical issues, such as system errors and malfunctions, which 40 percent of participants reported. This finding underscored the imperative for reliable and user-friendly systems to avoid disruptions to clinical workflows. 35% of respondents cited lack of training as a major challenge indicating that lack of training with technology was a hindrance to optimal usage. Integrating with other systems was an issue, with 30 percent of participants stating that it was an issue in achieving seamless interoperability among disparate healthcare technology platforms. A further barrier was reported in the 25% of respondents who stated they were resistant to change. Thirteen percent of respondents said they were concerned about privacy, namely data safety and patient confidentiality. The findings highlight the importance of increased technical reliability, full technical training, system interoperability, and data privacy risk elimination to address technology adoption in healthcare.

Table 5: Challenges in Using Technology

Challenge	**Frequency (%)**
Technical Issues (e.g., system errors)	40
Lack of Training	35
Integration with Other Systems	30
Resistance to Change	25
Privacy Concerns	18

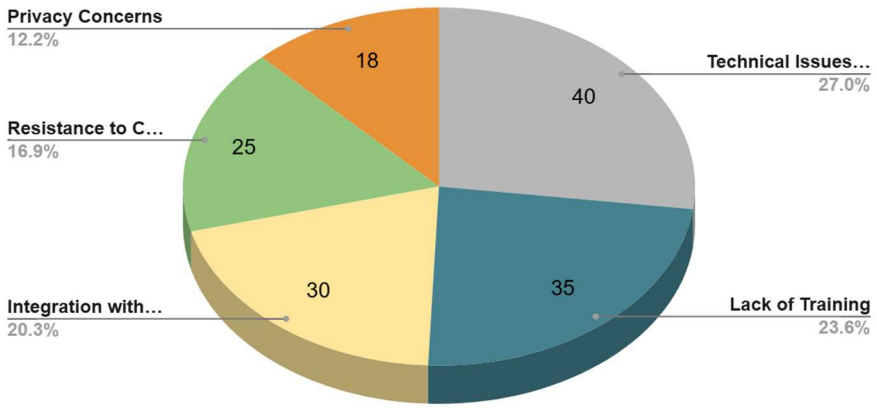

Figure 2: Challenges in Using Technology

DISCUSSION

This study's findings indicate that technology has a great influence on the improvement of clinical decision-making of healthcare professionals, yet the effectiveness and usage of these technologies differ among different user groups and healthcare environments. Healthcare professionals, in particular physicians, widely used Electronic Health Records (EHRs), Clinical Decision Support Systems (CDSS), and telemedicine platforms, the study found. Many participants reported that these technologies increased the accuracy and efficiency of clinical decision-making, and both physicians and nurses acknowledged that they decreased decision-making time. This is consistent with what the researcher knows today that technology helps healthcare professionals by making processes easier and giving healthcare professionals real-time access to patient data and evidence-based recommendations [10,11]. The study also found that although technology generally improved decision-making, there were challenges to the integration of these tools into clinical practice. Technical problems, lack of training, and integration challenges with existing healthcare systems were cited by far the most often. These results are consistent with previous research that technology's potential is widely acknowledged but its practical use often encounters resistance because of system-related limitations and inadequate

training [12,13]. Despite these barriers, the researcher found a positive correlation between technology usage and improved patient outcomes, which supports the hypothesis that technology use that improves decision-making leads to better clinical care. Interestingly, the study also found that physicians and nurses had very different perceptions of how effective technology is. Greater use of sophisticated decision support tools was associated with higher levels of effectiveness among physicians, who have more exposure to technology, than among nurses, who tend to use technology in a more limited way. The disparity highlights the essential need to customize technology training and infrastructure strategies to the unique roles and functions of different healthcare professionals to tap the full potential of technological advancements for all healthcare professionals [14].

This study is consistent with existing literature that indicates that technological tools, such as EHRs and CDSSs, can substantially improve clinical decision-making. The EHR has been shown in inconsistent studies to improve the quality of care by providing real-time access to patient information, improving coordination between healthcare providers, and decreasing the likelihood of error [15,16]. Likewise, CDSSs can boost decision accuracy by delivering evidence-based recommendations, lowering the cognitive load on healthcare professionals, and producing evidence-based assistance in diagnosing complex diseases [17,18]. Nevertheless, the challenges described in this study, including technical problems and integration problems, have been well documented in the literature. Poor interoperability with other healthcare technologies is one of the many things studies have found that technological systems tend to suffer from, resulting in inefficiencies and workflow disruptions [19]. There is still a lack of comprehensive training and user-friendly interfaces that prevent effective use of technology in clinical settings [20]. These findings reflect other studies that have raised concerns about the lack of better training programs and user engagement to achieve the full benefits of healthcare technologies [21]. The study has also observed variations in technology effectiveness among healthcare professionals, as has been noted in the literature. While physicians are early adopters and frequent users of advanced technologies such as CDSSs, other health professionals, such as nurses and allied health workers, are less exposed and have less experience [22]. An approach to technology adoption in clinical environments that more comprehensively considers training requirements not only for the healthcare professionals who use the tools, but the members of the healthcare team also require this.

This study has important implications for both healthcare practice and policy. The first is that the positive relationship between technology use and better patient outcomes underscores the importance of healthcare organizations continuing to spend on technology that supports clinical decision-making. With the increasing requirement for better and faster healthcare, the widening usage of EHRs, CDSSs, and telemedicine platforms should be favored to improve clinical practice and ensure better patient care. The identified barriers to technology adoption must be considered by healthcare administrators in terms of strategies to overcome them. An example of this is that the seamless integration of multiple technological systems is important in taking advantage of the benefits of those technological systems. Interoperability difficulties can be resolved through the use of standard health IT systems which allow for the sharing of data between different platforms [23]. Healthcare organizations must also devote important training programs for all healthcare professionals including nurses and allied health staff to ensure that they are fit and ready to utilize these technologies [24]. These findings indicate a need for policies to encourage ongoing professional development in health IT skills. Healthcare technologies change rapidly, so although the materials themselves are constantly changing, and need to be kept up on the latest tools, features, and best practices; healthcare professionals remain competent in using these technologies by continuing to be educated on these technologies. Technology training should be incentivized into healthcare education curricula and certified as true as proficiency in the use of technology [25]. Finally, technology has a positive role in clinical decision making and, therefore, there is a need to increase investment in telemedicine in under-served areas. Telemedicine platforms that have been proven to improve access to healthcare and facilitate remote consultations can be used to expand their use and would greatly help to increase healthcare delivery in rural or resource-limited regions by increasing overall healthcare accessibility and equity [26].

The study sheds light on the usage of technology in making clinical decisions but it is not devoid of shortcomings. Being conducted in just one healthcare institution restricts the applicability of the findings to other situations. The results may vary depending on what hospitals have different levels of technological infrastructure, staff expertise, e, and patient demographics. The cross-sectional design of the study does not allow us to draw causal conclusions regarding the effect of technology on patient outcomes. What the researcher needs to assess are the long-term consequences of technology integration on clinical decision-making, and the health of patients. A second limitation is the reliance on self-reported data from healthcare professionals. A large body of healthcare research employs surveys and questionnaires, which are

prone to bias including social desirability bias or recall bias. They may have overestimated the effectiveness of the technologies they use, or they may have underreported challenges out of a reluctance to criticize the tools their organizations provided. Future studies are possible that use objective measures (such as system logs or patient outcome data) to supplement self-reported responses, providing a better picture of the use of technology in clinical settings [27]. Several future research areas focused on how technology changes the process of clinical decision-making should be explored. To evaluate the long-term effects of technology on clinical outcomes of interest, including patient safety, treatment efficacy, and overall satisfaction, longitudinal studies are first needed. Further robust evidence of the sustained benefits or challenges associated with the use of clinical technologies could be gained from longitudinal data. Second, research investigating patients' perspectives of the role of technology in clinical decision-making could contribute intelligently to understanding the implications of such tools on patient care. Understanding patient experiences around telemedicine consultations [and technology-driven care models] would provide a more holistic view of the effects these tools have on delivering care. Future studies should attempt to compare different technological tools in different clinical contexts. Just as an example, the impact of CDSSs in specialties like oncology or cardiology might be used to demonstrate the impact of personalized medicine and a modus operandi for technology to help make decisions in such contentious and consequential spaces. Finally, research into the development of more user-friendly, integrated technological platforms could respond to the challenges identified in this study. Future innovations to overcome the barriers to technology adoption and increase the effectiveness of EHRs and CDSSs can reduce the complexity of EHRs and CDSSs and improve their interoperability.

CONCLUSION

This study shows that technology can have a big role to play in helping with clinical decision-making and improving the quality, efficiency, and accuracy of the delivery of healthcare. In an era in which technologies like Electronic Health Records (EHRs), Clinical Decision Support Systems (CDSS), and telemedicine platforms have already become key tools aiding clinical decision-making, for health professionals, to make evidence-oriented decisions and enhancing the patient's health outcomes. The findings confirm the potential of technology to dramatically reduce decision-making time, reduce errors, and streamline clinical workflows, all of which can lead to better care. But the study also notes the hurdles to technology adoption. Technical difficulties, poor system interoperability, and inadequate training continue to be major barriers to effective implementation. The study found marked dissimilarities in the perceived efficacy of technology among physicians and nurses, a fact that it is concluded should lead to role-specific training and integration strategies geared towards benefiting technology from its fullest potential from all healthcare professionals. The implications of these findings are clear: To achieve this, healthcare organizations must start by ensuring the quick integration of technological systems, invest in complete training programs, and support continuous professional development in health IT. Policymakers should contemplate incentivizing the adoption of standardized health IT systems and telemedicine in particular for rural regions. Similar to the positivistic ideology, which is rejected, there are limitations of the study with a cross-sectional setting and relying on self-reports, which the study acknowledges. Future research should focus on longitudinal effects, patient perspectives, and the long-term effect of technology on clinical outcomes. For the most part, the adoption of technology into clinical decision-making is a promising avenue to improve healthcare practice, and continued investment in these tools is key to the future of healthcare delivery.

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