Original Article

A Cross Sectional Study about the Perception and Practice of Health Information Technology (HIT) Interventions amongst the Healthcare Professionals Working in Intensive Care Units (ICU) of Multispeciality Hospitals in Kolkata

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Abstract

Background : Patient safety in the Intensive Care Unit (ICU) is a critical aspect of healthcare where the integration of advanced technology has revolutionized patient care; particularly in ICUs. From Electronic Health Records (EHRs) and smart monitoring systems to predictive analytics and telemedicine platforms, each tool offers unique advantages in enhancing diagnostic accuracy, treatment efficacy, and overall patient outcomes.

Aims and Objectives : To assess the Knowledge (K), Attitude (A), Practice (P) of ICU professionals about usage of Healthcare Information Technology (HIT) tools to augment Patient safety.

Results : A cross sectional pilot study was conducted in 7 hospitals of Kolkata, India through a validated structured questionnaire among ICU professionals to assess their acceptance of HIT tools. from April, 2024 to June, 2024. A total of 727 responses were obtained where 78.5% use HIT in work, 74% agreed that using HIT reduces medication errors, 79.1% agreed that it is an important patient safety tool, 77.2% agreed it improves adherence, medication ordering and vaccination process, 79.9% agreed it improves handover process, 77.3% agreed it reduces charting time, 70.7% agreed it helps achieve higher compliance.

Conclusion : The study's results clearly demonstrate a high level of agreement among healthcare professionals regarding the positive impact of HIT on reducing medication errors, improving process adherence, and enhancing clinical outcomes in a developing country like India.

Key words : Patient Safety, Health Information Technology, Intensive Care Unit.

In the fast-evolving landscape of healthcare, the integration of advanced technology has revolutionized patient care; particularly in Intensive Care Units (ICUs).[1] These critical settings demand precision, efficiency, and constant vigilance to ensure patient safety amidst complex medical conditions. Healthcare technology tools tailored for ICUs play a pivotal role in this endeavor, yet the extent to which Healthcare Professionals perceive and utilize these tools varies widely. Patient safety in the Intensive Care Unit (ICU) is a critical aspect of healthcare, where the complexity of cases and the severity of illnesses require highly coordinated and effective medical care. In recent years, healthcare technology tools have emerged as crucial allies in improving patient outcomes and ensuring safety.[2]

Editor's Comment :

- Healthcare Information Technology interventions to be integrated in ICUs for more accurate, efficient and safe patient care.
- These tools help in clinical decision making and improved workforce efficacy.

Healthcare Technology Tools in the ICU[2] includes Electronic Health Records (EHRs) which are digital versions of patients' paper charts and provide comprehensive, real-time patient data. They facilitate better coordination among healthcare providers and improve the accuracy of diagnoses and treatments.

Tele-ICU involves remote monitoring of ICU patients through video conferencing and real-time data transmission. It enables specialists to provide expert guidance and support to on-site clinicians, especially in resource-limited settings. Along with this the Automated Medication Dispensing Systems, help in reducing medication errors by ensuring accurate dispensing and administration of drugs. They are integrated with EHRs to provide alerts for potential drug interactions and allergies.

Healthcare Technology also involves Wearable Monitoring Devices to monitor vital signs continuously and transmit data to healthcare providers. They help in early detection of clinical deterioration, allowing timely interventions.

From Electronic Health Records (EHRs) and smart monitoring systems to predictive analytics and

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telemedicine platforms, each tool offers unique advantages in enhancing diagnostic accuracy, treatment efficacy and overall patient outcomes. However, the gap between technological advancement and practical implementation can present hurdles, influencing how these tools are perceived and utilized in real-world clinical scenarios.

Understanding the perspectives of Healthcare Professionals - ranging from nurses, doctors and intensivists - regarding healthcare technology tools in the ICU is crucial. Their insights not only highlight the current state of adoption and awareness but also provide invaluable feedback on efficacy and potential areas for improvement. Studies conducted Globally indicate varying levels of awareness and acceptance of healthcare technology tools among Healthcare Professionals. Factors influencing these variations include education, training, availability of resources, and institutional support[3-5].

This study delves into the intricate relationship between ICU patient safety and the technology that supports it, exploring both the challenges and opportunities faced by frontline healthcare providers. By examining the knowledge base, attitudes, and training needs of Healthcare Professionals, we can uncover critical insights into optimizing the integration of healthcare technology in ICUs. Moreover, addressing these insights can pave the way for more streamlined workflows, improved decision-making processes, and ultimately, enhanced patient safety.

Limited research work is available on the perception of Healthcare Workers in Indian ICUs about the utility of healthcare technology tools for enhancing patient safety. Hence, this capstone project was conducted in seven ICUs of multispecialty Hospitals in the City of Kolkata.

Aims and Objectives

To assess the Knowledge, Attitude and Practice of using Healthcare technology interventions among the Healthcare Professionals working in ICUs of 7 Hospitals in Kolkata through a validated structured objective questionnaire based survey.

Materials and Methods

It is a cross sectional study on the perception and practice of Health Information Technology among Healthcare Professionals working in ICUs. The study was conducted in 7 hospitals of Kolkata from April, 2024 to June, 2024. The participating Hospitals were Peerless Hospital, Manipal Hospital, Dhakuria, Manipal Hospital, Mukundapur, Desun Hospital, Joint and Bone Care Hospital, Saltlake, Joint and Bone Care Hospital, Sodepur & Institute of Child Health, Kolkata. The sample size was calculated to be 727 with a confidence interval of 95%.

All Doctors, Nurses and Healthcare Professionals working in the Intensive Care Units of the hospitals mentioned above and those who were willing to give informed consent were included in the study.

An online questionnaire through Google form were sent to all Physicians, Nurses, Healthcare Technicians through whatsapp and their email ids.

The validation of the questionnaire was done before distribution among 10 doctors and 20 Nurses working in Peerless Hospital, Kolkata and Manipal Hospital, Dhakuria, Kolkata. Two reminders were given to all the participants to complete the online. Proper written informed consent was taken before sharing of the questionnaire.

The study was initiated after Ethics Committee Approval (PHH& RCLCREC/4312/2024)

The data from participants were collected and descriptive analysis was done by using SPSS 31 software.

Percentage distribution, frequency distribution and educational pursuance were looked into. Categorical data was analysed using Chi square test. A p-value less than 0.05 was considered as statistically significant.

Results

This study was carried out in 7 ICUs of Multispecialty Hospitals in Kolkata.

Out of them, most number of responses ie, 342 responses (47.3%) came from the age group of 20-29 years and least ie, 29 responses (3,7%) came from the age group of 60-69 years (Table 1). Among them 204 were Male (29.1%) and 523 were Female (71.9%).

Out of 727 responses, 571 persons (78.5%) have used HIT in their workplace whereas 156 persons (21.5%) have never used any form of HIT (Table 2). In 36.3% of responses (264) were from Doctors, 57.8% (420) from Nurses and the rest were from Technicians.

Majority (74%) of the people agreed to the fact that HIT reduces medication error in ICU whereas 13.7% disagreed on the same.

Almost 77% responded positively to the fact that HIT brings in improvement in the process adherence, medication ordering, vaccination lab ordering and clinical outcomes whereas 1.8% strongly disagreed.

Out of the 727 responses analysed, 343 (47.2%) strongly agreed that HIT improves handover process and there are fewer omissions of critical patient information. A minor section (2.3%) strongly disagreed and 40 (5.5%) disagreed regarding the same.

37.7% strongly agreed that EMR can help to plan the care pathway and follow the trend of the physical condition of the patient while 3.2% strongly disagreed on the same.

A sizable population (32.9%) strongly agreed and (32%) agreed that HIT helps in reduction in smart pump programming errors whereas 5% strongly disagreed on this question.

Majority (40.6%) strongly agreed and agreed (36.7%) on the fact that HIT helps in reduction of charting time and increases the time spent on direct patient care, reducing the occurrence of error.

Out of the 727 responses analyzed, 255 participants strongly agreed that HIT helps in reduction in the rate of retained surgical items while the rest disagreed on this fact.

35.8% strongly agreed that HIT helps in achieving higher compliance to preventive medical services. 3.2% strongly disagreed and 7.4% disagreed on this question.

41.3% of the participants were of the opinion that HIT is an important tool of patient safety but 4% disagreed regarding the same (Table 3).

Discussion

Our findings align with existing literature, particularly regarding the positive perceptions of Healthcare Information Technology (HIT) interventions in Intensive Care Units (ICUs) concerning patient safety. A significant portion of the participants (78.5%)reported using healthcare technology interventions in the ICU, indicating widespread adoption and integration of these technologies. This is consistent with studies by Zhou, *et al* in 2019[6] and Carayon, *et al* in 2015[7], which highlight the increasing adoption of HIT in critical care settings due to its potential to enhance patient safety and care outcomes.

The study's results also demonstrate a high level of agreement among Healthcare Professionals regarding the positive impact of HIT on reducing medication errors, improving process adherence and enhancing clinical outcomes. A similar study was done by Bates, *et al* in 1998[8], who also observed a significant reduction in medication errors with the implementation of electronic prescribing and medication administration systems. Even Black, *et al* in 2011[9] reported similar benefits in clinical settings.

The results also revealed that 72.2% of the respondents believe that Electronic Medical Records (EMR) help in planning care pathways and monitoring patient conditions. This finding is consistent with the study by Jamoom, *et al* in 2014[10], which demonstrated that EMRs contribute to better care coordination and patient monitoring, ultimately leading to improved clinical outcomes. Additionally, the reduction in charting time, which allows more time for direct patient care , supports the findings of Jones, *et al* in 2014[11], who identified similar efficiencies resulting from HIT implementation.

Franklin, *et al* in 2011[12] found that HIT significantly improved handover processes in clinical settings which is similar to our findings in this study depicting the usefulness of HIT tools.

The perception of HIT as a tool for enhancing transparency and communication between healthcare providers and patients' families is another point of convergence with previous studies. A research done by Banger, *et al* in 2015[13] emphasized that HIT, particularly EMRs, facilitates better communication and engagement with patients and their families, leading to improved satisfaction and care outcomes.

Despite the overall positive perception of HIT, there are areas where this study's findings diverge from previous research. While majority of participants agreed in our study that HIT reduces the rate of retained surgical items, other studies have reported mixed or inconclusive results. A study by Greenberg, *et al* in 2016[14] noted that while technology can aid in reducing such incidents, the effectiveness often depends on factors such as staff training and the integration of technology into existing workflows. The relatively lower agreement in this area compared to other aspects of HIT might reflect ongoing challenges in fully integrating these technologies to achieve the desired outcomes.

Another point of divergence is related to the reduction in smart pump programming errors. While a vast majority of respondents agreed to this fact, studies by Vanderveen, *et al* in 2018[15] and Ruppel, *et al* in 2018[16] have reported varied success with smart pumps, highlighting that while they can reduce errors, their effectiveness is often compromised by user-related issues and the complexity of the devices. This discrepancy suggests that while the potential of smart pumps is recognized, there may still be significant barriers to their optimal use.

Table 1 — *Distribution of responses according to age group (n=727)*

Age	Frequency	Percentage
20-29	342	47.3
30-39	187	25.9
40-49	85	11.6
50-59	84	11.5
60-69	29	3.7
Total	727	100.0

Table 2 — *Shows the result of healthcare technology intervention in ICU*

		Profession			Total	p Value	Significance
		Doctor	Nurse	Technicians			
Have you used any Healthcare technology intervention in ICU?	NO	26(9.85)	119(28.33)	11(25.58)	156(21.46)	<0.001	Significant
	YES	238(90.15)	301(71.67)	32(74.42)	571(78.54)		
Total		264(100)	420(100)	43(100)	727(100)		

Table 3 — *Perception of HIT as tools for patient safety*

		Profession			Total	p Value	Significance
		Doctor	Nurse	Technicians			
Please rate your overall perception of HIT as tools to patient safety	Strongly Disagree	7(2.65)	8(1.9)	0(0)	15(2.06)	0.021	Significant
	Disagree	12(4.55)	17(4.05)	0(0)	29(3.99)		
	Neutral	49(18.56)	52(12.38)	7(16.28)	108(14.86)		
	Agree	109(41.29)	146(34.76)	20(46.51)	275(37.83)		
	Strongly Agree	87(32.95)	197(46.9)	16(37.21)	300(41.27)		
Total		264(100)	420(100)	43(100)	727(100)		

Strengths of the our Project :

One of the main strengths of this study is the large and diverse sample size. This broad representation across different professions (Doctors, Nurses and Technicians) provides a comprehensive view of the perceptions and practices related to HIT in ICUs. The study's focus on a specific and critical setting, the ICU, adds to its relevance, as this is an area where patient safety is of utmost importance, and where HIT interventions can have a significant impact.

Another strength is the detailed analysis of different types of HIT interventions, such as smart pumps, EMRs, and telemedicine tools. By examining various technologies, the study offers a nuanced understanding of how different tools are perceived and their impact on patient safety.

Limitations of our Project :

Despite its strengths, this project has several limitations. One of the primary limitations is its reliance on self-reported data, which may be subject to response bias. Participants might overestimate the positive impact of HIT due to social desirability bias or might underreport negative experiences due to fear of repercussions. The cross-sectional nature of the study also limits the ability to draw causal inferences; the study captures perceptions at a single point in time, which may not fully reflect the dynamic and evolving nature of HIT implementation and its impact on patient safety.

Another limitation is the project's geographical focus on Kolkata, which may limit the generalizability of the findings to other regions or countries with different healthcare systems, technological infrastructures, or cultural attitudes towards technology. The specific context of multispecialty hospitals may also limit the applicability of the findings to other healthcare settings, such as primary care or single-specialty hospitals.

Furthermore, the study did not explore the specific barriers and facilitators to HIT adoption and effective use, which could have provided deeper insights into the reasons behind the varied perceptions and outcomes associated with different HIT tools. Additionally, the study did not assess the actual outcomes of HIT implementation, such as changes in patient safety metrics or clinical outcomes, relying instead on Healthcare Professionals' perceptions, which may not always align with objective measures of impact.

Conclusion

Overall, the study underscores the critical role of HIT in modern ICU settings, particularly in enhancing medication safety, communication, and care coordination. Continued investment in training, infrastructure and system integration is recommended to fully realize the potential benefits of HIT and ensure consistent, evidence-based improvements in patient outcomes across all areas of critical care.

Future research should explore the specific barriers and facilitators to HIT adoption and effective use, including factors such as staff training, technological infrastructure, and organizational culture, to identify strategies for optimizing HIT implementation.

Conflict of Interest : None

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