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TECH-DRIVEN TRANSFORMATION OF PARAMEDICAL ROLES: EMERGING SKILL SETS AND CHALLENGES

Reshmi R [1] , Anitha S [2]
[1] Research scholar, [2] Professor & Research Supervisor
Research & PG Department of Commerce
Government College Attingal, University Of Kerala, Thiruvananthapuram

ABSTRACT

The role of paramedical professionals has drastically altered due to the increasing use of digital technologies in the healthcare settings. The workforce, who were only limited to assisting in medical roles, termed as paramedical professionals, are now expected to contribute as technologically competent members of modern healthcare systems. Besides presenting an overview of the new competencies expected of them, as well as the challenges faced in the process, this paper seeks to discuss the effects of digital technologies on the roles of paramedical professionals. The premise of this study is an overview of the existing research on workforce evolution and digital transformation in healthcare. According to the study, technologies such as telemedicine, artificial intelligence, the Internet of Things(IoT), and data-based healthcare systems are drastically altering role, functions and expectations, thus requiring skill development. Some of the challenges, however, include a lack of training opportunities, resistance to new technologies, and infrastructure challenges. The paper ends with an overview of how to improve the digital preparedness of paramedical professionals.

KEYWORDS *Paramedical Professionals, Digital Transformation, Healthcare Systems, Skill Development, Workforce Evolution*

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1. INTRODUCTION

The rapid development of digital technology is having a marked impact on the development of healthcare services. For para medical professionals, this is creating a new and exciting environment in which they are no longer simply supporting staff in medicine and nursing. Rather, they are becoming integral parts of the healthcare system that is becoming increasingly sophisticated and digital. Digital technologies such as electronic health records, telemedicine, AI, Automated medicine dispensing and mobile health are no longer simply changing the way that healthcare services are provided. Rather, they are creating new possibilities for paramedics and similar professionals. In this increasingly digital healthcare system, it is now important for paramedical professionals to be skilled in digital technologies.

This is because there is now a shift towards patient-centred care that is data-based and technology-enabled.

However, this transformation is not without challenges. Many paramedical workers face difficulties in adapting to rapidly changing technologies due to limited training opportunities, lack of infrastructure, and resistance to change. Additionally, issues such as increased workload, data privacy concerns, and the need for continuous upskilling further complicate this transition.

In this context, the present study aims to examine the role of rapid technological changes in transforming the role of paramedical staff and also attempts to identify the skill sets required in the modern digital age and the challenges faced by professionals in adapting to the changing scenario. Thus it is believed that the present study would help in further understanding of the changing workforce in the healthcare sector.

2. STATEMENT OF THE PROBLEM

The rapid integration of digital technologies in healthcare has created a strong need to understand how these advancements are transforming the roles of paramedical professionals. As tools such as electronic health records, telemedicine, and artificial intelligence become more common, paramedical staff are expected to adapt to new responsibilities that go beyond traditional clinical support. Additionally, the study is important to explore the challenges faced by paramedical professionals during this transition, including lack of training, resistance to change, infrastructure limitations, and data security concerns. By analyzing these issues, the study provides valuable insights for healthcare institutions, educators, and policymakers to develop appropriate training programs, improve digital infrastructure, and support workforce readiness. This is particularly relevant in ensuring that the benefits of digital transformation are effectively realized in healthcare delivery.

3. OBJECTIVES OF THE STUDY

1. To analyse the impact of technology on paramedical roles
2. To identify emerging skill requirements in the digital healthcare environment
3. To examine challenges faced by paramedical professionals

4. REVIEW OF LITERATURE

- According to de Almeida et al. (2023), healthcare is undergoing a “profound change” driven by technologies such as artificial intelligence (AI), big data, and advanced computing, which are reshaping traditional healthcare models and improving efficiency and outcomes . Similarly, Hameed et al. (2024) emphasize that digital transformation is central to achieving sustainable healthcare systems, particularly in improving accessibility and quality of care. These technological advancements have accelerated the shift toward patient-centered and data-driven healthcare.
- Stoumpos et al. (2023) found that technologies such as telemedicine, Internet of Things (IoT), and mobile health applications enhance healthcare delivery by improving patient engagement and enabling real-time monitoring. Additionally, recent reviews indicate that digital tools streamline workflows, reduce manual errors, and improve decision-making processes, thereby increasing efficiency and productivity in healthcare organizations . These benefits have significantly contributed to the modernization of healthcare systems globally.
- A study by Kljucnikov et al. (2023) notes that technological advancements have redefined job roles, requiring healthcare professionals to adapt to new systems and workflows . Paramedical professionals are increasingly involved in managing digital records, operating advanced diagnostic tools, and supporting telehealth services, indicating a significant expansion of their roles.

- Mauro et al. (2024) highlight that employees' skills and competencies are critical determinants of successful digital transformation, particularly in areas such as data management and digital literacy
- Afridi and Khan (2024) further categorize these competencies into technical, cognitive, and interpersonal skills, emphasizing the importance of critical thinking, communication, and interdisciplinary collaboration in healthcare settings . Continuous learning and professional development are therefore essential for paramedical professionals to remain effective in a rapidly changing environment.
- Wieslander et al. (2024) also highlight that limited participation of healthcare professionals in decision-making processes can negatively impact the success of digital initiatives. Furthermore, concerns related to data privacy, cybersecurity, and the digital divide continue to pose significant challenges, particularly in developing region**s.**

5. HYPOTHESIS OF THE STUDY

- H_{01}: Technology adoption has no significant impact on work efficiency
- H_1: Technology adoption has a significant impact on work efficiency
- H_0**:** Technology has no significant relationship with challenges
- H_2: Technology has significant relationship with challenges
- H_0: There is no relationship between gender and attitude towards adoption of technology
- H_3**:** There is a relationship between gender and attitude towards adoption of technology

6. RESEARCH GAP

Although a substantial body of literature exists on digital transformation in healthcare, most studies focus on physicians, nurses, or overall organizational performance, with limited attention given specifically to paramedical professionals. Therefore, this study aims to bridge this gap by providing a focused, region-specific analysis of the evolving paramedical roles in a technology-driven healthcare environment

7. METHODOLOGY

The study adopts a descriptive research design, to examine the impact of technology on paramedical role. The research is based on primary data collected through a structured questionnaire distributed among 200 paramedical professionals from the southern district (Thiruvananthapuram, Kollam, Pathanamthitta, and Alappuzha) in Kerala. All the data required for this analytical study has been obtained mainly from primary source. A stratified random sampling method was adopted to ensure accurate representation. Respondents were randomly selected from each district. Google forms were used for collecting data electronically. Statistical tools such as Likert scale, mean score analysis, ANOVA (F-test), and Chi-square test were applied for analysis. Relevant literature was collected from databases such as PubMed, Scopus, google scholar and science direct.

8. DATA ANALYSIS AND DISCUSSION OF RESULTS

Table 1- Level of Technology Adoption

Level of technology adoption	frequency	percentage
High	120	60
Moderate	50	25
low	30	15
total	200	100

Source: primary data

Interpretation: The table 1 shows that a majority of respondents (60%) fall under high level of technology adoption, indicating that most paramedical professionals are actively using and integrating digital technologies in their work. A further 25% exhibit a moderate level of adoption, suggesting partial utilization of technological tools, while only 15% remain at a low level, possibly due to lack of training, limited access, or resistance to change. Overall, the distribution reflects a strong inclination toward technology adoption in the healthcare sector.

Table 2- Impact of technology on work efficiency

Statement	Frequency	Percentage
Highly improved	80	40
Improved	70	35
No change	30	15
Decreased	20	10
Total	200	100

Source: primary data

Interpretation: Table 2 shows the impact of technology on work efficiency that explain majority of respondents (75%) experienced improvement on paramedical role due to technology, with 40 per cent reporting highly improved efficiency while only 20 per cent indicated no change or decreased efficiency. This suggests a strong positive influence of technology on paramedical work performance. For hypothesis testing, using the Chi-square method, the calculated value ($\chi^2 = 52$) is greater than the table value (7.815) at the 5% significance level with 3 degrees of freedom. Therefore, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted, indicating that technology adoption has a statistically significant impact on work efficiency.

Table 3- Emerging skill requirement

Skill area	Mean
Digital literacy	4.20
Technical skill	4.05
Data management	3.80
Analytical skill	3.60
Communication skill	3.50

Source: primary data

Interpretation: The table 3 highlights on emerging skill requirements, indicates that digital literacy (mean = 4.20) is the most important skill among paramedical professionals, followed closely by technical skills (mean = 4.05), highlighting the strong emphasis on technology-related competencies in modern healthcare. Data management (3.80) and analytical skills (3.60) also hold moderate importance, reflecting the growing need to handle and interpret medical data effectively. Overall, the results show a clear shift toward digital and technical proficiency as key skill requirements in the evolving healthcare environment.

Table 4- challenges in technological adoption

Factors	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)	TOTAL RESPONSE	MEAN SCORE
Lack of training programs limits my ability to effectively use technology	5	10	30	80	75	200	4.25
Frequent technical issues (system errors, downtime) affect my	6	15	40	80	59	200	4.05

work performance							
There is insufficient technical support available when problems arise	10	15	50	70	55	200	3.8
Fear of making errors while using technology affects my confidence	15	20	50	60	55	200	3.65
I feel resistance or hesitation when adapting to new technologies	8	12	40	70	70	200	4.05
Adoption of new technology increases my workload initially	5	12	45	60	78	200	4.05
Inadequate infrastructure (internet, devices) limits technology usage	4	8	40	70	78	200	4.3
Management support for technology adoption is insufficient	12	18	50	60	60	200	3.8
Technology reduces the level of direct patient interaction	20	25	60	50	45	200	3.35

Source: primary data

Interpretation: The overall analysis from table 4 highlight the analysis of challenges in technological adoption, which reveals paramedical professionals strongly agree that inadequate infrastructure (mean = 4.30) and lack of training (mean = 4.25) are the most significant barriers, indicating that both resource limitations and skill gaps critically affect effective technology use. Other major challenges include frequent technical issues, resistance to change, and increased workload during initial adoption (mean ≈ 4.05), suggesting that both technical and behavioral factors influence adoption. Additionally, fear of making errors (3.65) reflects confidence issues among users. The lowest mean score is for reduced patient interaction (3.35), indicating it is a comparatively lesser concern. Overall, the findings show that challenges are primarily infrastructural, training-related, and system-based, requiring institutional support and continuous skill development for effective technology adoption.

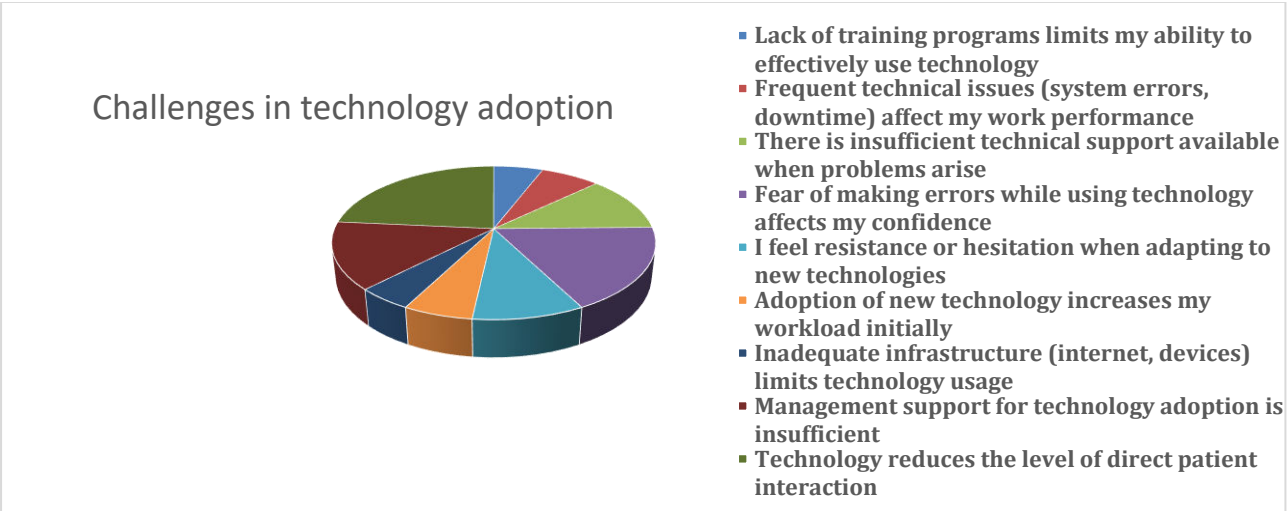

Figure 1 : Challenges in technology adoption

Table 5- Contingency table (combined with challenges and technology adoption)

Technology adoption	Low challenge	Moderate challenge	High challenge	Total
High (120)	10	40	70	120
Moderate (50)	8	20	22	50
Low (30)	4	7	19	30
Total	22	67	111	200

Source: primary data

Methodology:

The challenges were first categorized based on mean scores using standard criteria: mean values less than 3.5 were considered low challenges, values between 3.5 and 4.0 were considered moderate challenges, and values above 4.0 were considered high challenges. Based on this classification, five factors—lack of training, frequent technical issues, resistance to change, increased workload, and inadequate infrastructure—were identified as high challenges, three factors—technical support, fear of errors, and management support—were categorized as moderate challenges, and one factor—reduced patient interaction—was classified as a low challenge. Since each factor was measured across 200 respondents, the challenge categories were proportionally converted into respondent-level distribution, resulting in approximately 111 respondents under high challenges, 67 under moderate challenges, and 22 under low challenges. These values were then combined with the technology adoption levels (120 high, 50 moderate, and 30 low) to construct a contingency table. The final table showed the distribution of respondents across both variables, enabling further analysis of the relationship between technology adoption and challenges faced by paramedical professionals.

Interpretation: Table 6, combined contingency table explain the relationship of technology adoption and challenges faced by paramedical professionals The calculated Chi-square value ($\chi^2 = 5.31$) is less than the table value (9.488) at the 5% level of significance with 4 degrees of freedom. Therefore, the null hypothesis is accepted and the alternative hypothesis is rejected. This indicates that there is no significant relationship between technology adoption and challenges faced by paramedical professionals. Hence, challenges are independent of the level of technology adoption.

Table 6 - Gender and attitude towards technology adoption

Gender	Positive	Neutral	Negative	Total
Male	62	15	23	100
Female	58	20	22	100
Total	120	35	45	200

Source: primary data

Interpretation: Table 6 explain the relationship between gender and attitude towards technology adoption in paramedical field, of chi square at 0.05 level of significance with degree of freedom 2 is 5.99 and calculated value is 9. As calculated value is less than table value,we accept null hypothesis and hence there is no relationship between gender and attitude towards adoption of technology.

9. SUGGESTIONS

- Healthcare institutions should organize regular training and upskilling programs to enhance digital competencies among paramedical professionals.
- Strengthen digital infrastructure by including reliable internet connectivity, updated software systems, and advanced diagnostic equipment, is essential.
- Awareness programs and change management strategies should be implemented to reduce resistance to new technologies. Motivating professionals by highlighting the benefits of digital transformation can foster acceptance and engagement.

- Management should actively support digital transformation by involving paramedical staff in decision-making processes, providing necessary resources, and creating a supportive work environment.
- Management should establish strong technical support teams to handle system errors and downtime quickly

10. CONCLUSION

The rapid advancement of digital technologies has significantly transformed the healthcare sector, leading to a fundamental shift in the roles and responsibilities of paramedical professionals. No longer confined to traditional supportive functions, paramedical staffs are now expected to operate in a dynamic, technology-driven environment that demands both clinical expertise and digital competence. This transformation has enhanced the efficiency, accuracy, and accessibility of healthcare services, ultimately contributing to improved patient outcomes.

In conclusion, while digital transformation presents significant opportunities for enhancing healthcare delivery and expanding paramedical roles, its success depends on addressing the associated challenges through structured training programs, improved infrastructure, supportive policies, and effective change management strategies. A collaborative effort among healthcare institutions, policymakers, and educational bodies is essential to ensure that paramedical professionals are well-equipped to thrive in the digital era and contribute meaningfully to the future of healthcare.

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