The Bioscan AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES 20(1): 354-358, 2025 www.thebioscan.com

Needs Assessment and Training Methodologies for Medical Practitioners towards Emerging Digital Technology

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DOI: https://doi.org/10.63001/tbs.2025.v20.i01.pp354-358

Received on:

12-12-2024

Accepted on:

13-01-2025

Published on:

10-02-2025

ABSTRACT

Technological adoption in healthcare sector is critical in enhancing operational efficiency, improving patient outcomes and accelerating clinical research. In this case, it is important that medical practitioners have become skilled in the use of skills and tools for making appropriate decisions in the fast-paced environment that shifting in this case. This abstract examines the various training methods aimed at equipping medical staff with the ability to apply and comprehend digital technologies. Such methods involve the use of digital learning environments, simulation, and hands-on training as well as other mixed approaches whereby video technology is combined with conventional teaching that involves face to face content delivery. At the same time, talks and joint learning environments help to foster their exchanges and solving concrete tasks. This way, the realism of training opportunities is often the focus to make sure that medical professionals are able to work with these tools. Technologies including digital imaging technologies, telemedicine, electronic health records (EHR), and artificial intelligence (AI) in diagnoses are technologies that medical practitioners have to familiarize themselves with. Also addressed are range of training approaches that though can improve their technical capabilities, also concern the ethical, privacy, and security issues related to this.

INTRODUCTION

Training methodologies for medical practitioners in the context of emerging digital technologies are evolving to address the rapid advancements in healthcare. With the increasing integration of artificial intelligence (AI), telemedicine, electronic health records (EHR), and robotic surgery, it is crucial for medical professionals to stay updated on these innovations. Effective training methodologies must be dynamic, interactive, and hands-on to ensure physicians and healthcare workers can adapt to these new tools.

Traditional in-person workshops are being supplemented by online learning platforms, virtual simulations, and e-learning modules, allowing for flexible, self-paced learning. Interactive case studies, webinars, and collaborative online forums provide practitioners with real-time knowledge sharing and problem-solving. Virtual reality (VR) and augmented reality (AR) are being increasingly used for immersive training experiences, allowing practitioners to simulate procedures and treatments in a risk-free environment. Moreover, continuous professional development (CPD) programs are now incorporating digital technology training to ensure that healthcare workers can utilize the latest tools effectively and ethically. This approach not only enhances clinical skills but also improves decision-making and patient outcomes. Training in digital health technologies is essential to maintaining high standards of care, ensuring that medical professionals are equipped to meet the demands of modern healthcare systems.

II Emerging digital technologies in Healthcare that medical practitioner's should be aware

As the healthcare industry rapidly evolves, the integration of emerging digital technologies is transforming patient care, clinical practices, and operational efficiency. For medical staff, staying informed and skilled in these technologies is crucial to maintaining high standards of care. Fig [1] shows the several key digital technologies which are reshaping the landscape, and healthcare professionals must be aware of them to adapt effectively. [1]

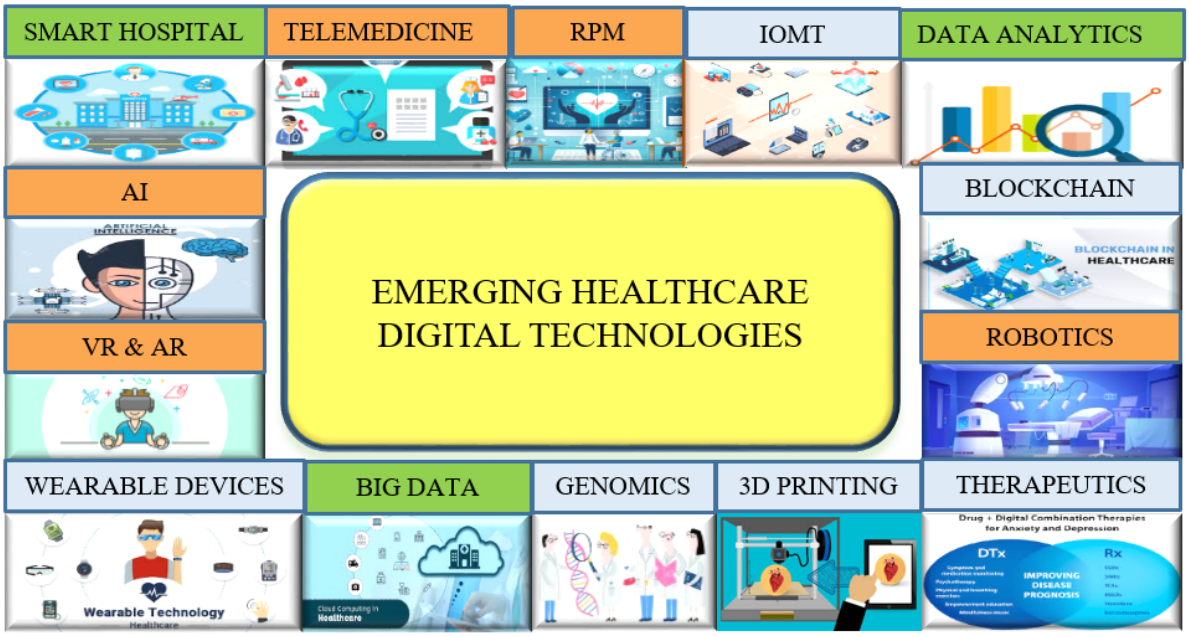

Fig 1: Emerging Healthcare digital technologies

III Level of understanding expected from Medical Practitioners about digital technologies

Degree of knowledge that is expected from medical staffs to use Emerging Digital Technologies. Table [1] shows the degree of knowledge that doctors should have for each of the technologies mentioned. [2]

Basic Knowledge: For technologies like **AI**, **blockchain**, **cloud computing**, and **IoMT**, doctors need foundational knowledge, particularly regarding how these technologies affect data management, patient care, and system integration.

Intermediate Knowledge: For technologies like **telemedicine**, **digital therapeutics**, and **genomics**, doctors need a deeper understanding to apply them in clinical settings and to improve patient care.

Collaboration Knowledge: Technologies like **robotic surgery**, **AR/VR**, and **3D printing** require an awareness of how to collaborate with specialized teams and use them effectively in practice.

Technology	Degree of Knowledge Needed
Artificial Intelligence (AI) and Machine Learning (ML)	Basic understanding of AI/ML applications in healthcare, especially for diagnostics and decision support.
Telemedicine and Telehealth	Intermediate knowledge of telemedicine platforms, remote consultations, and best practices for virtual care.
Remote Monitoring and Internet of Medical Things (IoMT)	Basic understanding of remote monitoring devices and how they integrate with healthcare systems.
Blockchain Technology	Basic knowledge of blockchain concepts and how they ensure secure, interoperable patient data management.
Cloud Computing	Basic understanding of cloud-based healthcare systems (EHRs, data storage) and security compliance (e.g., HIPAA).
Genomics and CRISPR Technology	Intermediate knowledge of genomics and CRISPR's potential for personalized medicine and genetic treatment.
Robotic Surgery	Basic knowledge of robotic-assisted surgeries, benefits, and how to collaborate with robotic systems.
Natural Language Processing (NLP)	Basic understanding of how NLP aids in documentation, transcription, and clinical decision support.
3D Printing	Basic knowledge of 3D printing applications for customized implants, prosthetics, and surgical planning.
Augmented Reality (AR) and Virtual Reality (VR)	Basic understanding of AR/VR in medical training, surgical planning, and patient rehabilitation.
Wearable Health Devices	Basic understanding of wearable health devices, their data collection, and how they support patient monitoring.
Big Data and Data Analytics	Basic knowledge of how big data and analytics improve patient care, predictive modeling, and health trends.
Digital Therapeutics	Intermediate knowledge of evidence-based software solutions for disease management and patient care.
Smart Hospitals and Healthcare Automation	Basic understanding of automated systems in hospitals for improving workflow, resource management, and patient safety.

Table 1: Various technologies and the degree of knowledge required by medical practitioners

IV Procedure for Needs assessment for the required training

Conducting a needs assessment for each emerging digital technology in healthcare involves evaluating the specific requirements and readiness of medical practitioners, institutions, and systems to effectively integrate and utilize the technology. A comprehensive needs assessment should identify gaps in knowledge, resources, and infrastructure that need to be

addressed. Here's a step-by-step approach to analyze the needs assessment for each technology. [3]

Identify the Technology's Impact on Clinical Practice

Understanding the practical application of technologies such as artificial intelligence (AI), telemedicine, and cloud computing in healthcare settings requires analyzing how these technologies will impact daily medical tasks, decision-making, and patient care. Through increased access to care, streamlined treatment plans, and improved diagnostic accuracy, these technologies have the potential to improve patient outcomes and operational efficiency. For example, by finding patterns in patient data, AI can assist doctors in making more precise diagnoses, which will improve the effectiveness of treatment. In a similar vein, telemedicine can facilitate patient access to medical care, especially in remote or underprivileged areas. Enhanced operational efficiency, decreased errors, and better diagnostics are some of the possible advantages. For instance, cloud computing systems can centralize patient data, lowering the possibility of data loss or miscommunication, while AI-driven tools can reduce human errors in diagnosis. In the end, examining these variables enables medical professionals to ascertain whether a given technology will close a particular practice gap, like expediting diagnostic procedures or improving remote consultations, guaranteeing that it will enhance clinical results and the general patient experience.

Evaluate the Current Level of Familiarity and Competency

Determining the medical staff's readiness for adoption of emerging technologies requires assessing their present level of competency and familiarity with them. This evaluation's first step is to determine whether medical staff members are already utilizing comparable technologies, like telemedicine platforms or electronic health record (EHR) systems. This aids in determining how at ease they are using digital tools and how well they can incorporate new technologies into their daily tasks. Assessing one's present proficiency with the technology in question—whether it be basic, intermediate, or advanced—is also crucial because it will affect the kind of training needed. Staff members who have previously used telemedicine platforms, for example, might only require a refresher or specialized training on new features, while those who have not may require introductory courses. Finding out what credentials or abilities employees already hold can also be helpful because they can be used to support learning. Employees with certifications in digital health or data management, for instance, might be able to expand on their prior knowledge more rapidly. Finding knowledge gaps and determining the proper training level—whether introductory, advanced, or specialized—are the results of this evaluation, which aims to guarantee the successful integration of new technologies into medical practice. [4]

Assess the Availability of Resources and Infrastructure

Examining the infrastructure and resource availability is crucial when thinking about introducing new technologies in healthcare environments. Assessing whether the healthcare facility has the required internet infrastructure, software, and hardware to support the technology is the first step. This involves determining whether the current systems—like cloud services or electronic health records, or EHRs—need to be updated or improved, or if they are compatible with the new technology. It's also critical to determine whether the organization has enough IT specialists or support personnel to manage the new technology's implementation, maintenance, and troubleshooting. The facility may need to hire more staff or make an investment in staff training if these resources are lacking. The evaluation's findings will assist in identifying resource gaps In these situations, healthcare institutions must decide whether infrastructure improvements or investments are necessary to guarantee seamless integration and effective technology use. Healthcare facilities can improve operational efficiency and patient care outcomes by filling these gaps and fostering an environment that is conducive to the adoption of technology. [5]

Assess Staff Readiness for Change

Determining how well new technology will be adopted in a healthcare setting requires assessing staff change readiness. The first step is to determine whether medical staff members are resistant to change or willing to learn and use new technologies. Effective adoption of new tools may be hampered by resistance stemming from worries about workload, unfamiliarity, or a fear of technology taking the place of human roles. It's also critical to assess whether employees have enough time for training, since their hectic schedules might necessitate setting aside funds for special training sessions. The company may need to modify work schedules or offer alternate training options, like e-learning or after-hours sessions, if time is of the essence. The degree of interest in the technology and its potential effects on clinical results and job satisfaction are also important factors. Employees are more likely to adopt technology if they can see how it can enhance their workflow and patient care. The assessment's findings will assist in identifying possible obstacles, like resistance or a lack of time, and enable healthcare organizations to create focused plans, like offering rewards, accommodating training schedules, or clearly outlining the advantages of the technology, to allay these worries and encourage successful adoption. [6]

Identify Training and Support Needs

To guarantee that medical professionals are proficient with new technologies, it is essential to determine their training and support requirements. The first step is to ascertain what kind of training—which could include online courses, practical workshops, or even certification programs—is required for staff members to become proficient with the technology. The kind of training needed will depend on how complex the technology is; more sophisticated tools may require specialized sessions. To guarantee that employees can troubleshoot problems and keep improving their skills, it's also critical to think about how continuing support will be offered. To keep employees informed about new features and best practices, this may entail setting up help desks, providing opportunities for peer learning, or providing continuous professional development (CPD). Frequent changes in digital health tools may necessitate regular briefings or newsletters to ensure practitioners are aware of any improvements or modifications. Therefore, it is equally important to keep staff members informed about technological advancements and updates. The assessment's results include the creation of a customized training program that addresses the various needs of medical personnel and the identification of continuing support systems, guaranteeing that the staff can operate the technology with assurance and keep up with its advancements. In the end, this strategy will improve the incorporation of digital technologies into clinical practice by creating a fruitful and encouraging learning environment. [7]

To successfully implement and adopt emerging digital technologies, a thorough needs assessment is essential. By evaluating factors such as clinical impact, staff readiness, infrastructure, and patient outcomes, healthcare organizations can ensure that the right technologies are selected and effectively integrated into practice. This assessment also helps identify gaps that need to be addressed through training, resources, and ongoing support.

Based on the needs assessment for emerging digital technologies in healthcare, training methodologies should be tailored to address the specific gaps identified in the areas of knowledge, resources, infrastructure, compliance, staff readiness, and integration with existing systems. Below are training methodologies that medical practitioners should adopt to equip themselves with the necessary skills and knowledge to effectively use these technologies.

V Training methodologies for Medical Practitioners' to get trained in various digital technologies

Hands-on Practical Training

Experiential learning and the development of new technology proficiency are the goals of hands-on, practical training. Doctors can practice tasks like using AI-assisted diagnostic tools or conducting remote consultations using telemedicine systems by utilizing simulation-based learning platforms. Additionally, through digital platforms like telemedicine, role-playing exercises are used to mimic patient interactions, giving participants controlled exposure to the real world. [8]

E-Learning and Online Courses

The goal of online courses and e-learning is to give doctors self-paced education so they can comprehend the theoretical underpinnings of digital technologies. This approach includes interactive webinars and online workshops with professionals in

digital health technologies, as well as online platforms that provide structured courses, like modules on cloud computing, robotic surgery, or AI in healthcare. The method is effective because it gives doctors the freedom to learn at their own speed and fit their studies into their hectic schedules, all the while giving them the fundamental knowledge they need to understand new technologies. Finding conceptual knowledge gaps is the main goal of the needs assessment, especially for technologies with intricate theoretical underpinnings.

Blended Learning Approach

The blended learning strategy offers a thorough educational experience by fusing online instruction with practical, in-person training. This approach consists of theory-based online courses that are followed by live workshops or hands-on training sessions. For instance, physicians could take part in an in-person session where they set up and conduct a live telemedicine consultation after finishing a module on the fundamentals of telemedicine. This method is effective because it combines the flexibility of online learning with the interaction and assistance of face-to-face sessions, which improves the application of acquired skills. The needs assessment emphasizes filling in knowledge gaps with adaptable online courses and strengthening abilities through practical application.

Peer Learning and Mentorship

The goals of mentorship and peer learning are to promote knowledge sharing and offer advice from seasoned professionals. Peer-led training sessions, in which more seasoned medical professionals instruct their peers on technologies like robotic surgery or AI-driven diagnostics, are part of this approach. Furthermore, mentorship programs provide both practical training and emotional support to junior physicians or those who are not familiar with the technologies. Because doctors tend to learn best from colleagues who are already familiar with the technology, this method works well and is especially useful in medical settings. Addressing knowledge gaps and boosting confidence are the main goals of the needs assessment, particularly for practitioners who are hesitant to adopt or are not familiar with the technology.

Workshops and In-person Training

Offering comprehensive, interactive training in a targeted setting with real-time feedback is the goal. This approach consists of workshops that focus on particular technologies, like blockchain applications in healthcare or AI algorithms. Experts also give live demonstrations of technologies like telemedicine and robotic surgery. This method works because it allows physicians to ask questions, interact with experts directly, and practice using the technology in a real-world setting. In order to address practical technical skills that cannot be adequately addressed by theoretical training alone, the needs assessment is conducted.

Case-Based Learning

The goal is to use real-world case scenarios to contextualize digital technologies. This approach uses clinical case studies to demonstrate how technologies such as AI in radiology or remote monitoring can be used to enhance patient outcomes. Group discussions on the use of these technologies in particular situations are also employed to improve comprehension of their practical implications. This strategy improves retention and comprehension by teaching physicians how to use digital technologies in routine clinical practice. The integration of technology into patient care and its practical applicability are the main topics of the needs assessment.

Mobile Learning (M-Learning)

The goal is to accommodate a medical practitioner's hectic schedule by offering learning that can be done while on the go. This approach includes platforms and mobile apps that provide brief, interactive training courses on topics like AI-powered diagnostic tools or best practices for telemedicine. In order to ensure ongoing learning, push notifications are also used to remind physicians of important features or updates regarding the technologies they are using. This method is effective because it provides doctors with mobile devices for easy and convenient learning while they are on the go. Addressing knowledge gaps in an adaptable, ongoing learning environment is the main goal of the needs assessment. [9]

Continuous Professional Development (CPD) and Certification Programs

Keeping physicians abreast of the most recent developments in digital health technologies is the goal. Accredited certification programs for technologies like digital health analytics, telehealth, and artificial intelligence in medicine are part of this approach. CPD courses are also intended to guarantee that physicians stay up to date on new developments in technology and changes in regulations. This strategy is effective because continuous education guarantees that physicians stay up to date in the quickly changing field of digital health. Addressing the need for ongoing, changing education as new technologies and healthcare practices emerge is the main goal of the needs assessment.

Collaborative Learning and Interdisciplinary Training

The goal is to promote a team-based approach to healthcare technology use and improve collaborative skills. This approach entails multidisciplinary workshops in which physicians, nurses, IT personnel, and data scientists work together on projects like cloud-based EHR systems or the Internet of Things in healthcare. Furthermore, collaborative learning environments are established in which various healthcare professionals exchange viewpoints regarding digital tools and systems. This strategy promotes team-based learning and equips medical professionals to collaborate with IT specialists and other stakeholders in the adoption of digital technologies. By fostering interdisciplinary collaboration, the needs assessment aims to address integration issues and facilitate more efficient workflows. [10]

On-the-Job Training and Shadowing

The goal is to assist medical professionals in learning while utilizing technology in their real-world workplace. This approach involves observing more seasoned professionals who are adept at utilizing digital tools like robotic surgical instruments or AI-based decision support. With the help of a mentor or trainer, doctors gradually take over tasks utilizing the new technology as part of the learning-by-doing process. Real-world learning enables practical application and adaptation to the subtleties of particular technologies, which is why this method is effective. The integration of new technologies into current clinical workflows while offering real-time support and feedback is the main focus of the needs assessment. [11]

VI Challenges:

Evaluating possible obstacles to the adoption of new technology is essential to guaranteeing its effective incorporation into medical procedures. The cost of purchasing, deploying, and maintaining the technology is one of the first issues to be resolved. These expenses could cover hiring personnel, buying hardware and software, and providing continuing maintenance or updates. It's critical to assess the organization's budget and decide whether more money is required or whether grants or partnerships can provide financial support. A lack of leadership support for the technology or resistance from employees used to traditional methods are examples of organizational or cultural barriers that may also appear. By clearly communicating the advantages and providing training to boost staff confidence, these difficulties can be lessened. Another possible obstacle is patient resistance, especially with wearables or telemedicine technologies where patients might be reluctant to embrace new methods of receiving care. In order to solve this, it's critical to inform patients about the advantages and usability of these technologies while also making sure that sufficient assistance is offered to help them navigate the process. Healthcare organizations can create focused mitigation strategies that facilitate the seamless adoption of new technologies and improve patient care and operational efficiency by identifying these logistical, cultural, and financial obstacles. Implementing digital technologies in healthcare presents several significant challenges. One major obstacle is the resistance to change among medical practitioners. Many professionals are accustomed to traditional methods and may feel overwhelmed or apprehensive about adopting new technologies, which can hinder the pace of integration. Additionally, there are often gaps in training, as many practitioners may not possess the technical skills required to use complex systems like AI, machine learning, or telemedicine platforms effectively. These knowledge gaps create barriers to adoption, especially for technologies that require advanced understanding or specialized expertise. [12]

Technological infrastructure is another challenge, as many healthcare facilities may lack the necessary resources, such as

reliable internet connectivity or compatible hardware, to support the effective use of digital tools. Data security and privacy concerns are also prominent, as medical professionals must ensure compliance with regulations like HIPAA while safeguarding patient data from cyber threats. The financial cost of implementing digital technologies can be a significant barrier as well, with many institutions facing high upfront costs for hardware, software, and ongoing training and maintenance.

These challenges require a proactive approach, including strategic planning, comprehensive training programs, investment in infrastructure, and a focus on security and compliance to ensure the successful adoption of digital technologies in healthcare settings.

CONCLUSION

To equip medical practitioners with the necessary skills for digital technologies, training methodologies must be tailored based on the results of the needs assessment. Combining hands-on training, e-learning, peer learning, and continuous professional development ensures that doctors not only gain foundational knowledge but also become proficient in applying technologies in real-world clinical settings. By addressing specific gaps in knowledge, skills, and resources identified during the needs assessment, healthcare institutions can ensure successful technology adoption and improve patient care outcomes.

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