STM JOURNALS

Research & Reviews: A Journal of
Medical Science and Technology

https://journals.stmjournals.com/rrjomst/

ISSN: 2319-3417 (Online)
ISSN: 2349-1272 (Print)
Volume 14, Issue 3, 2025
September–December
DOI (Journal): 10.37591/RRJoMST

Review RRJoMST

Medical Science in the Digital Era: A Comprehensive Study on Computing in Healthcare

V. B. Hans*

Abstract

Adding computers to medical science has transformed how healthcare is delivered, how research is conducted, and how well patients do. This article discusses the various ways computer technology is utilized in modern medicine, including diagnostic imaging, electronic health records (EHRs), telemedicine, surgical robotics, and data-driven research. Improvements in artificial intelligence (AI) and machine learning have made it possible to make more accurate diagnoses, use predictive analytics, and create treatment plans that are unique to each patient. Computer-assisted simulations and modelling have become valuable tools in the medical field, playing a major role in both education and research. In medical training, these technologies allow students and professionals to practice complex procedures in a safe, virtual environment before applying them in real-life situations, thereby reducing risks to patients. Similarly, in drug discovery, simulations help researchers predict how new compounds might interact with the human body, which can significantly speed up the development process and lower costs compared to traditional methods. Despite these advantages, certain challenges remain pressing. Issues, such as data privacy, cybersecurity, and unequal access to digital technologies (the digital divide), raise ethical and practical concerns. Overall, this field highlights how computing and medicine are merging, showcasing not only current applications and benefits but also the ongoing problems that require careful solutions.

Keywords: Medical informatics, artificial intelligence, telemedicine, electronic health records (EHRs), medical imaging, clinical decision support systems, healthcare technology

INTRODUCTION

The fast growth of computer technology has changed the field of medical science in a big way. Computers are becoming essential instruments in modern healthcare. They help with everything from making administrative work easier to making clinical decisions better and helping with complicated diagnostic procedures [1–3]. The merging of computer technology with medicine has led to new ideas, including electronic health records (EHRs), telemedicine platforms, robotic-assisted procedures, and better ways to take pictures of the body. Recent advances in artificial intelligence (AI) and machine learning (ML) have opened up new ways to find diseases early, tailor treatments to individuals, and use predictive analytics [4–7].

This integration is not only making things run more smoothly, but it is also making care more accessible and diagnoses more accurate. Medical personnel increasingly use complex software and data systems to keep track of patient information, do research, and give consultations over the phone. However, with these improvements come more worries about data privacy, cybersecurity, and fair access to technology [8–10].

This article will look at the many ways that computers are used in medicine, talk about some of the most important new technologies, and discuss the problems and moral issues that come up as healthcare becomes more digital [11–13].

***Author for Correspondence**
V. Basil Hans
E-mail: vhans2011@gmail.com

Research Professor, Department of Management and Commerce, Srinivas University, Mangalore, Karnataka, India.

Received Date: July 21, 2025
Accepted Date: August 19, 2025
Published Date: 4 September 2025

Citation: V. Basil Hans. Medical Science in the Digital Era: A Comprehensive Study on Computing in Healthcare. Research & Reviews: A Journal of Medical Science and Technology. 2025; 14(3): 1–13p.

STM Journals 2025. All Rights Reserved

Importance

The use of computers in medical science is a major change that will have a big effect on healthcare systems all around the world. Computers have greatly improved patient care and clinical results by making it possible to diagnose patients faster and more accurately, handle data more effectively, and plan treatments better. AI-powered diagnostic tools, telemedicine platforms, and robotic-assisted procedures are just a few examples of technologies that are making it easier for healthcare professionals to do their jobs and making it easier for people to get good treatment, especially in areas that don't have enough of it.

Also, computers are important for medical research since they speed up data analysis, simulate how diseases grow, and help create novel drugs and treatments. Simulation software and virtual reality (VR) tools are making the training of future healthcare professionals better in medical schools. Being able to gather and study large amounts of health data also brings up new possibilities for personalized medicine and public health monitoring.

To move healthcare forward and deal with the moral, legal, and social issues that come up when technology is used in medicine, it is important to understand how important computers are in medical science.

Scope

This article looks at how computer technology is becoming more and more important in the field of medical science. It looks at how computers are used in different areas of healthcare, such as education, administration, clinical practice, diagnostics, and medical research. Some of the main areas of attention are:

- *Clinical Applications:* Using EHRs, clinical decision support systems, diagnostic imaging, and procedures that are helped by robots.
- *AI and Data Analytics:* Used to anticipate diseases, find patterns, and make medicine more personal.
- *Telemedicine and Remote Monitoring:* How computers help people get more healthcare through virtual consultations and wearable health equipment.
- *Medical Education and Training:* How simulation technologies, VR, and computer-based learning tools affect the training of medical practitioners.
- *Healthcare Management:* Using health informatics to make hospital operations run more smoothly, keep track of patient information, and make workflows more efficient.

The article also talks about problems that are happening right now, like data privacy, cybersecurity, digital literacy, and unequal access to technology. By listing these things, the scope shows what computer applications in medicine can do now and what they might be able to do in the future.

Questions for Research

1. How have computers made modern medical practice more accurate and efficient when it comes to diagnosing diseases?
2. In healthcare, how does AI help with personalized treatment plans and predictive analytics?
3. How well do telemedicine and remote monitoring technologies help people get better healthcare and have better health outcomes, especially in rural or underserved areas?
4. What are the biggest moral and legal problems that come up when computers are used to keep track of patient health data?
5. What effect do computer-based tools and simulations have on medical education and professional training?
6. What do computers do to speed up drug discovery and medical research?
7. How can healthcare institutions make sure that people from all backgrounds have equal access to computer-based technologies?

Objectives

The main goal of this essay is to look at how computer technology has changed many areas of medical study. The precise goals are:

STM Journals 2025. All Rights Reserved

To look at how computers can help make diagnoses more accurate, arrange treatments better, and keep an eye on patients.

- To look at how AI and ML can be used in healthcare, such as in personalized medicine and predictive modelling.
- To find out how well telemedicine and other distant healthcare technologies work to make medical services more accessible.
- To find out how much computer-assisted technologies help in medication development and medical research.
- To look into how computers are employed in medical school and professional training.
- To find the most important legal, moral, and safety issues that come up while using digital tools in healthcare.
- To talk about future trends and chances in combining computers with medical research.

Theoretical Basis

There are a number of related theoretical models and frameworks that can help us understand how computers are being used in medicine. These models and frameworks look at the adoption, impact, and ethical issues of technology in healthcare. The following important theoretical points are used in this article:

The Technology Acceptance Model (TAM) shows how doctors and nurses use and accept computer-based solutions. TAM says that how useful and easy to use people think technology is are two of the most important things that affect whether or not they accept it. These things affect how many people use EHRs, telemedicine platforms, and clinical decision support systems in the medical field.

- *Health Informatics Framework:* Health informatics helps us understand how IT helps with clinical decision-making, data administration, and communication in healthcare systems. It focuses on how to design, build, and use computer systems to handle health information.
- *Socio-Technical Systems Theory:* This theory focuses on how people (such as healthcare practitioners and patients), processes, and technology work together. It is especially helpful for figuring out how to build computer systems that work well in healthcare settings, taking into account the people and organizations who use them.
- *Diffusion of Innovations Idea (Rogers):* This idea describes how new technologies spread through a group or society. It helps to know what makes people use new technology like AI in diagnostics or health wearables in patient care.
- *Ethical Frameworks in Digital Health:* Ethical theories like principlism (autonomy, beneficence, non-maleficence, and justice) are used to deal with worries regarding patient data privacy, consent, and fair access to healthcare technologies.

When used together, these frameworks give us a whole picture of how computers perform in medical science and what they mean.

Empirical Data

Real-world research shows that computer technologies have a big effect on how healthcare is delivered, how diagnoses are made, and how well patients do. The following data points and case studies show how these ideas can be used in the actual world and what they can do:

A study by the Health Information and Management Systems Society (HIMSS) in 2023 found that more than 90% of hospitals in developed countries use EHRs. This has led to better patient data management and a 20–30% drop in medical errors because doctors can now access more historical patient information.

- *AI in Diagnostics:* A study published in the Lancet Digital Health in 2022 found that AI algorithms could find diabetic retinopathy with 95% accuracy, which is as good as or better than what human specialists could do. Similar AI tools in radiography have helped find breast cancer and lung lesions earlier.

STM Journals 2025. All Rights Reserved

According to a World Health Organization (WHO) study from 2024, the use of telemedicine around the world grew by 400% during and after the COVID-19 pandemic. This change made it easier for 35% more people in remote areas to get primary care services and cut down on missed appointments.

- *Results of Robotic Surgery:* A 2023 multi-center study published in JAMA Surgery found that robotic-assisted operations, such as prostatectomies and hysterectomies, led to shorter hospital stays (by 1.5 days) and fewer problems than traditional surgeries.
- *Wearable Health Devices:* A 2024 survey of 10,000 patients at Harvard Medical School who used wearable cardiac monitors (like smartwatches) found that they were 45% better at finding arrhythmias early, which meant that medical help could be given sooner.
- *Medical Education and Simulation:* Medical schools that used high-fidelity simulation software found that students who were trained with computer-based simulations were 30–50% more accurate in their procedures and diagnostic reasoning than those who were trained with traditional methods.

These results show how computer technologies can help in several areas of medicine, which supports their continued use in clinical, educational, and research contexts.

REVIEW OF THE LITERATURE

The use of computers in medicine has made a big difference in how healthcare is delivered, how patients are managed, and how clinical decisions are made. This literature review brings together new research on the link between computers and medical science, pointing out important topics and trends that have come up in the subject.

In their 2019 article, Shah Miah and others stress how important health informatics is for judging health information systems and clinical decision support systems. They stress how important data mining and text mining are in healthcare by showing how these technologies improve the design of computerized clinical audits and the training needs of healthcare workers. The authors also talk about how electronic hospital records and mobile health technology have changed things. They point out that improvements in health IT and informatics policies lead to better doctor performance and patient outcomes (Miah et al., 2019) [1].

Cios et al. also look into what makes medical data mining distinctive and say that doctors need to fully comprehend these tools in order to use technology in medicine. Their research shows that the Carle Illinois College of Medicine uses new ways of teaching that include computer science, math, and statistics as part of the medical school. The goal of this multidisciplinary approach is to provide future doctors the abilities they need to use AI and ML to save healthcare costs and improve patient care (J. Cios et al., 2019) [2].

Sun et al. [3] give us an overview of the idea of digital twins in healthcare as the field has grown. They talk about the possible uses of the technology and the problems that still need to be solved. They talk about basic ideas like the virtual physiological person, which is what digital twins are based on. The authors talk about how this technology can be used in medicine, including its pros and cons. They then call for more research into how digital twin technology can improve healthcare results**.**

Grezenko et al. look at the many ways that AI is changing surgical medicine and therapies in a more recent article. Their review shows that AI can handle a lot of medical data and can be used for things like diagnosing and helping with surgery. The authors look at the moral and technological problems that come up when AI is used in healthcare. They give a full picture of AI's current role in defining treatment plans and making patients' lives better (Grezenko et al., 2023) [4].

Lastly, Yadav talks about how new technology is changing the way healthcare works. The article shows how VR and augmented reality (AR) are changing the way doctors are trained and making surgeries more accurate. Yadav also talks about how important the internet of medical things (IoMT)

STM Journals 2025. All Rights Reserved

and remote patient monitoring (RPM) are for making treatment more proactive. The author talks about how ML can help make diagnoses more accurate and tailor treatments to each patient. They say that these changes are particularly important for changing how patients feel about their care and how healthcare is delivered (Yadav, 2024) [5].

This research shows that the merging of computing technology and medical science is not only changing the way doctors work, but it is also starting a new era of healthcare innovation that will improve patient outcomes and make operations more efficient.

- *The article "Emerging Insights of Health Informatics Research:* A Literature Analysis for Outlining New Themes" by Shah Miah et al. (Miah et al., 2019) [1] gives a thorough overview of how computer science has been integrated into medical science. It focusses on the many uses and ongoing research developments in health informatics. The authors carefully group the different types of computer applications, such as clinical decision support systems, health information systems, and data mining techniques, to show how important they are for improving healthcare delivery.

This article's main strength is that it gives a complete summary of research that has been done to evaluate the effects of new health informatics technologies. For example, the talk about automated prediction models, like those for root canal treatments, shows how data mining could make diagnoses more accurate. The addition of guidelines-based decision support that uses sensor data is an example of how patient care is becoming more personalized and real-time, which is in keeping with current trends in precision medicine.

The paper critically looks at how these new technologies affect doctors' performance and patient outcomes, using systematic reviews that look at how software engineering works in healthcare settings. This evidence-based method gives us a more nuanced view of how health informatics may make healthcare policies and clinical workflows better.

The article does a good job of outlining the range of current research topics, but it should go into more detail about the problems that come up when trying to use these systems, like problems with data privacy, interoperability, and user acceptance. Focusing on positive outcomes could make it easy to forget how hard it can be to turn research into widespread clinical practice.

- *The article "Uniqueness of Medical Data Mining:* How the new technologies and data they generate are transforming medicine" by Krzysztof J. Cios, Bartosz Krawczyk, Jacquelyne Cios, and Kevin J. Staley (J. Cios et al., 2019) [2] looks at how new technologies and data mining are changing the way medicine is practiced. The authors stress that healthcare workers need to have a good awareness of the technologies used in modern medicine in order to get the best results for their patients and run their businesses more efficiently.

The article's main contribution is its examination of changes to education, such as the curriculum of the Carle Illinois College of Medicine, which includes computer science, math, and statistics in medical school. The goal of this interdisciplinary approach is to give future doctors with the abilities they need to understand and use EHRs, database searches, and analytical algorithms. This will create a generation of doctors who are good at making decisions based on data. The writers say that this kind of training is necessary because it helps doctors find and employ technological solutions, including AI and ML, during clinical rotations and in their daily work.

The article makes an important point about how data mining could change the way healthcare works by lowering costs and making diagnoses more accurate. It calls for a change in the way medical students learn, so that they learn how to use technology as part of their education. This fits with the larger trend of personalized medicine and precise diagnoses. The article does a good job of showing the educational and practical benefits of combining these technologies, but it could go into more detail about issues, like privacy concerns, the need for standardized protocols, and the risk of relying too much on automated systems instead of clinical judgement.

STM Journals 2025. All Rights Reserved

- *The paper "Digital twin in healthcare:* Recent updates and challenges" by Sun, He, and Li (2023) [3] gives a full picture of how digital twin (DT) technology is being used in medicine. The writers say that DT is a sophisticated convergence of many different fields of technology that builds on prior ideas like the virtual physiological human. Their review highlights how DT could change personalized medicine by making dynamic, real-time virtual representations of individual patients that can be used for diagnosis, therapy planning, and predicting outcomes.

This work makes a big contribution by looking into DT applications that are specifically designed for medicine in a systematic way. It focusses on models that follow the unique needs of healthcare data and clinical settings. The writers do a thorough study of the literature from several academic databases, such as PubMed, Web of Science, Google Scholar, and Scopus, to make sure they have a wide and up-to-date view of the technical environment.

The paper talks about both the pros and cons of using DT in healthcare in a critical way. The authors say that one of the benefits is that diagnoses are more accurate, that monitoring can be done in real time, and that predictions can be made more accurately. These benefits are in line with the main purpose of digital health, which is to make patient care more proactive and personalized. The evaluation does, however, mention ongoing problems such worries about data security, difficulties with integration, and the necessity for strong models that can effectively represent complex biological systems.

The talk about models that fulfil medical standards is very important since it talks about how important it is to make DT systems that are not just advanced in terms of technology but also useful and trustworthy in a clinical setting. The authors' recognition of current constraints, like the lack of standardized frameworks and the difficulties in capturing the whole range of physiological variability, gives a realistic picture of where the discipline is headed.

The article also talks about future directions and stresses how important it is for different fields to work together, for data to be more interoperable, and for regulatory standards to be created to make it easier for more clinics to use the technology. This insight shows how DT technology could be a key part of future digital healthcare systems, as long as the problems we have now are dealt with in a methodical way.

- *Grezenko et al.'s Article "From Nanobots to Neural Networks:* Multifaceted Revolution of Artificial Intelligence in Surgical Medicine and Therapeutics" (Grezenko et al., 2023) [4] looks at how AI is changing the medical field, especially in diagnostics and surgery. The authors stress that AI can process and analyze huge amounts of medical data, which is key to its growing use in medicine. They point out that AI systems are getting better at figuring out complicated medical pictures like MRIs and radiography, which helps doctors make more accurate and quick diagnoses. In the field of personalized medicine, where treatment regimens are based on exact data interpretation, this capacity is very important.

The article also talks about AI's ability to make predictions, which includes predicting patient outcomes based on both historical and real-time data. Such predictive analytics help doctors make better decisions, which could lower the number of diagnostic errors and improve treatment plans. The authors also talk about how AI may help with complicated surgeries, from robotic-assisted surgeries to real-time decision support during surgery. They point out that ML algorithms make surgeries safer and more precise.

Grezenko et al. [4] agree that there are still technical and ethical problems with using AI in clinical practice, even though major improvements have been made. These include problems with data privacy, algorithm transparency, and the requirement for strong validation to avoid biases. The writers say that these problems must be solved in order to fully realize AI's potential to improve patient outcomes.

STM Journals 2025. All Rights Reserved

- *Sankalp Yadav's Paper "Transformative Frontiers:* A Comprehensive Review of Emerging Technologies in Modern Healthcare" (Yadav, 2024) [5] gives a full picture of how new technologies are changing the medical industry in important ways. The author stresses that the rapid growth and use of new technologies are not only changing how doctors work, but also making patients' lives much better. This marks the start of a new era of healthcare innovation.

The article's main point is that VR and AR can improve many parts of medical practice. Yadav [5] said that VR lets surgeons practice complicated procedures in safe settings, which can make them more precise and cut down on mistakes. VR simulations let doctors and nurses practice their abilities without putting patients at risk, which is a big step forward in surgical training. Also, AR's ability to show real-time data during procedures makes it easier to make decisions during the surgery, which leads to better results. This use of AR in surgery shows how augmented visualization can improve traditional methods, making them more accurate.

The article also talks about how VR is being used more and more to treat mental health problems, especially PTSD and anxiety disorders. VR therapy's immersive and regulated settings make exposure-based therapies possible, which can work better and be less stressful for patients than traditional techniques. This program shows that VR technologies can be used for more than just physical therapy; they can also be used for mental health care and to find new ways to engage in therapy.

Yadav [5] also talks about how important cloud migration is for healthcare, stressing how it makes data management more scalable and efficient. Cloud systems make it easier to store and share vast amounts of medical data, which is important for making quick diagnoses and coordinating care. Cloud technologies make it possible to apply ML algorithms, which are becoming more and more common for improving the accuracy of diagnoses and creating personalized treatment regimens. The author says that ML uses big data sets to find patterns and make predictions, which makes diagnoses more accurate and allows for more tailored treatments.

The essay gives a general and positive picture of these new technologies, but it also honestly talks about the problems that come with using them. To fully realize the potential of these new technologies, we need to address issues, like data privacy, cybersecurity, and the requirement for strong validation of new tools. Yadav [5] says that continued research, regulatory supervision, and ethical concerns are all important to make sure these technologies are used safely and efficiently.

The use of computers in medical science has led to big changes in how healthcare is delivered, how patients are managed, and how clinical decisions are made. This literature review focusses on the most important discoveries about the connection between computers and medical science. It emphasizes how important health informatics, data mining, AI, and new technologies are in creating modern healthcare practices.

Miah et al. (2019) [1] explain why health informatics is important, stressing how useful it is for judging health information systems and clinical decision support systems. Their research shows how data mining and text mining may change things for the better. These techniques improve computerized clinical audits and help healthcare practitioners figure out what training they need. The authors also talk about how electronic hospital records and mobile health technology help doctors do their jobs better and help patients get better. This shows how health IT and informatics policies have come a long way.

J. Cios et al. (2019) [2] build on this by looking at the particular features of medical data mining and calling for doctors to fully comprehend these technologies. Their study focusses on new ways of teaching at the Carle Illinois College of Medicine, which combines computer science, math, and statistics into medical school. This multidisciplinary approach intends to give future doctors the skills they need to use AI and ML technologies, which will lower healthcare costs and improve patient care.

STM Journals 2025. All Rights Reserved

Sun et al. (2023) [3] talk about digital twins in healthcare and look at the pros and cons of this technology. Their assessment talks on basic ideas like the virtual physiological human, which helps make digital twins possible. The authors talk about the pros and cons of using digital twin technology in medicine and how it could improve healthcare outcomes. They also talk about the several ways it could be used.

Grezenko et al. (2023) [4] give a thorough look at the many ways that AI can be used in surgical medicine and treatments. Their review shows that AI can handle huge volumes of medical data and can be used for everything from diagnosis to helping with surgery. They also look at the ethical and technological problems that come up when AI is used in healthcare and how it is affecting treatment plans and patient outcomes right now.

Yadav (2024) [5] talks on how new technologies, especially VR and AR, could change the way healthcare is delivered today. The article shows how new technologies are changing how doctors are trained and making surgery more accurate. The author also talks about how the IoMT and RPM can help with proactive care. They also talk about how ML can help make diagnoses more accurate and tailor treatment plans to each patient.

In conclusion, the merging of computing technologies and medical science is changing the way doctors work and opening up new possibilities for healthcare innovation. The literature shows that big steps are being made, yet there are still problems with data privacy, interoperability, and the need for strong validation of new tools. To fully realize the potential of these technologies to improve patient outcomes and operational efficiencies, it will be important to deal with these challenges.

RESEARCH GAPS

Even though a lot of progress has been made in using computers in medicine, there are still several areas that need more research:

- *Long-Term Impact Studies:* Most of the studies that have been done so far look at the short-term benefits of technology like AI diagnosis and telemedicine. Long-term research is needed to look at how clinical results, costs, and patient satisfaction change over time.
- *Bias and Fairness in AI Models:* Many current AI systems use data that may not be representative of all groups of people. We need to do more research to build algorithms that are fair and work well for people of all ages, races, and income levels.

Combining Different Types of Data While individual technologies (such as imaging, genomics, and EHRs) are getting better, there isn't much study on how to combine and make sense of different types of data streams to help with whole-person care.

Improving User Experience and Workflow There isn't enough research on how computer technologies change the way healthcare practitioners operate and think in different clinical settings. The focus of research should be on creating systems that put the user first and make things easier to use while causing as few problems as possible.

Ethical Frameworks for New Technologies The fast growth of AI and digital health tools is outpacing the current ethical rules. We need more real-world research to help us build adaptable ethical frameworks that deal with new problems like algorithmic transparency, accountability, and consent.

Accessibility in Low-Resource Settings There isn't much research on computer-based healthcare solutions that can be used in low-income and rural areas that are affordable and easy to use. For fair healthcare delivery, it is important to find out what makes it easier or harder for people to adopt in these situations.

STM Journals 2025. All Rights Reserved

- *How Computer Technology Affects the Interaction Between Patients And Providers:* The effects of digital tools on communication, trust, and the therapeutic relationship between patients and healthcare providers are still not well understood.

To get the most out of computer technology in medical science while making sure that healthcare is delivered in an ethical, fair, and effective way, it will be important to fill in these gaps.

ANALYSIS

Using computers in medicine has made healthcare more efficient, accurate, accessible, and of higher quality overall. The real-world data shown here shows how digital tools, like EHRs, AI diagnoses, telemedicine, and robotic surgery are changing the way healthcare works.

1. AI and ML algorithms have been very helpful in finding diseases including cancer, heart problems, and diabetes complications. These systems can quickly process enormous amounts of data and find patterns that people can't see, which makes it easier to find problems early and reduces the number of diagnostic errors. This study shows that AI can't take the role of doctors, but it may be a very useful tool for them.
2. *Accessibility and Fairness of Care:* Telemedicine and wearable electronics have made it easier to get care by removing geographic and logistical constraints. Data shows that people in distant or disadvantaged areas are getting far better access to healthcare. But the digital gap, which is the difference in access to the internet, gadgets, and digital literacy, is still a hurdle to true equity. This is important to make sure that everyone can benefit from computer-based therapies.
3. Operational Efficiency and Data Management EHRs and hospital information systems make clinical operations easier and cut down on duplicate work. These technologies make it easier to keep track of things and write down information, but some studies say they also make things harder for some providers, which raises issues about clinician fatigue and the need for improved user-centered design.
4. *Improvements in Education and Training:* Using simulation software and virtual training environments has made it easier to learn clinical skills, especially for difficult operations. This shows how important it is to keep putting money into computer-based training systems that can improve medical education without putting patients at danger.
5. *Ethical and Security Concerns:* The use of more computer technology in medicine poses big questions about data security, patient permission, and the openness of algorithms. As medical systems depend more on digital infrastructure, strong cybersecurity protocols and ethical frameworks become more important. The study shows how important it is to have robust regulatory supervision and regular ethical reviews.

In short, the use of computer technology in medicine has many great benefits, but to deal with issues of fairness, usability, and ethics, these improvements need to be carefully planned, put into action, and evaluated on a continuing basis.

RESULTS

Recent studies and implementations show that adding computer technologies to medical science has led to big improvements in many areas:

AI Tools increase Diagnostic Accuracy AI has shown that it can greatly increase the accuracy of diagnoses. For example, the AI tool Echo Next, made by researchers at Columbia University, was able to find structural heart disease in electrocardiograms (ECGs) with 77% accuracy, which is better than the 64% accuracy of 13 cardiologists in the same study. AI-based breast cancer detection systems have also showed potential in histological image categorization. These systems combine mammography, ultrasound, and histopathology images to improve the accuracy of diagnoses.

More telemedicine services are being offered. The use of telemedicine is growing quickly around the world, and by 2023, more than 80% of healthcare professionals will be using telehealth solutions.

STM Journals 2025. All Rights Reserved

Between 2022 and 2023, the number of people in India who used telemedicine for physical and mental health services went up from 22% to 33%. By 2027, the worldwide telehealth industry is expected to be worth $559.52 billion, which shows how important it is becoming in healthcare.

AI is helping companies like Recursion and Insilco Medicine speed up the process of finding new drugs. Recursion has moved eight AI-designed medications into clinical trials. Some of these drugs are for blood cancer and brain damage. These AI-powered methods are meant to make it easier to find and create successful remedies.

Better Pathology with AI Integration AI uses in digital pathology have shown to be quite good at diagnosing problems. A systematic review and meta-analysis of 100 research found that AI in whole slide imaging had an average sensitivity of 96.3% and specificity of 93.3%. This suggests that it could improve the way diagnoses are made.

- *Automation Bias in AI-Assisted Decision-Making:* AI tools make diagnoses better, but they also add concerns, such automation bias. A study in computational pathology indicated that being under time constraint could make people more likely to trust AI advice, which could lead to diagnostic mistakes.

Scalable AI Solutions in Radiology in India, an AI system that could work on its own to read chest X-rays got up to 98% accuracy and over 95% recall for classifying several pathologies. This system was used in 17 major hospital systems and processed more than 150,000 scans. It cut down on reporting times and made diagnoses more accurate.

These results show how computer technologies can change the way we do things by making diagnoses more accurate, making healthcare services more accessible, speeding up drug discovery, and improving pathology practices. But they also show how important it is to think carefully about the ethical issues and possible risks that come with using AI in medical study.

Implications

The growing use of computer technologies in medical science has big effects on research, teaching, legislation, and healthcare delivery:

- *Better Patient Outcomes:* Computers and AI-powered tools make it possible to identify patients earlier and more accurately, which leads to faster interventions and better patient outcomes. Better data management and decision support systems help make personalized treatment plans, which can lower the risk of problems and enhance health outcomes in general.
- *Expanded Access to Care:* Telemedicine and remote monitoring technologies make it possible for people in underdeveloped areas to get healthcare, regardless of where they live or how much money they have. This change could help make healthcare more equal, especially in rural areas and places with few resources.
- *Healthcare System Efficiency:* Automating administrative processes and making data flows more efficient make healthcare institutions run more smoothly. This can lower expenses, lighten the pressure on doctors, and cut down on medical mistakes, all of which will make healthcare systems more sustainable in the long run.
- *Ethical and Privacy Issues:* As we rely more and more on digital health data, we need to be very careful about patient privacy, data security, and informed consent. To keep patients' trust and follow the law, healthcare organizations must have strong cybersecurity safeguards and clear ethical guidelines.

The workforce is changing. Medical professionals need to learn how to use new technology and become more digitally literate in their work. To make sure that these technologies are used correctly and to deal with problems that may come up, such automation bias, people need to keep learning and training on how to utilize them.

STM Journals 2025. All Rights Reserved

Research and Innovation Acceleration Computers make it easier to analyze, simulate, and model data in medical research, which speeds up the process of finding new drugs and conducting clinical trials. This encourages new ideas and the creation of new treatments, which helps medical science move forward.

POLICY AND REGULATORY EVOLUTION

To keep up with the usage of computers in healthcare, policies and regulations need to be updated to cover technology use, data exchange, and ethical standards. Policymakers need to find a way to combine new ideas with the need to keep patients safe and their privacy protected.

These consequences show that computer technologies can greatly help medical science, but their success depends on healthcare practitioners, technologists, legislators, and patients working together to solve technological, ethical, and social problems.

Limitations

Computer technology has changed the field of medicine in many ways, yet there are still some problems and limitations:

- *Risks to Data Privacy and Security:* Healthcare data is very private, and digital systems are easy targets for cyberattacks and breaches. It is hard and expensive to make sure that security measures are strong, and data privacy laws are different in different areas, which makes it hard to standardize.
- *Digital Divide and Inequity:* Access to computer-based healthcare tools is not equal, especially in rural or low-resource areas. Poor internet access, a shortage of gadgets, and inadequate digital literacy make it harder for everyone to use technology equally and may make current health inequities worse.

Dependence on Data Quality

The quality, quantity, and variety of training data have a big impact on how well AI and ML models work. Bad or biassed datasets can give wrong or unfair results, which makes computer-assisted diagnosis and treatments less reliable.

- *Overdependence and Automation Bias:* Healthcare workers may become too reliant on AI suggestions, which could cause them to ignore their own clinical judgement or other possible diagnoses. If this automation bias isn't rigorously controlled, it could put patients' safety at risk.

High initial expenses for buying, integrating, and maintaining complex computer systems can make it hard for people to use them, especially in healthcare facilities that don't have a lot of money. Healthcare staff also need continual training and support because of the technical complexity.

- *Ethical and Legal Issues:* Rapid technological progress sometimes outpaces current ethical standards and legal frameworks, making it hard to know who is responsible, who has given consent, and what rights patients have in AI-assisted medical care.

User Acceptance and Workflow Disruption Medical personnel may not want to change, and established clinical workflows may be disrupted, which can make it harder to successfully adopt computer technologies in healthcare settings.

It is important to understand these limits in order to come up with plans that make the most of the benefits of computer technology in medical science while reducing the risks and differences that could happen.

Suggestions for Future Research

In order to improve the use of computer technology in medical science and fill in the gaps and restrictions that exist now, future research should focus on the following areas:

Longitudinal Outcome Studies Conduct long-term follow-up studies to find out how well AI-driven diagnostics, telemedicine, and other computer-assisted interventions work, how safe they are, and how much they cost for different groups of patients.

STM Journals 2025. All Rights Reserved

- *Making Fair and Inclusive AI Algorithms:* Make sure that ML models are trained on a wide range of representative datasets to avoid bias and make sure that they work equally well for all demographic groups.
- *Multimodal Data Integration:* Look into ways to easily connect multiple kinds of health data, like imaging, genomics, wearable device outputs, and EHRs, to improve overall clinical decision-making.

Human-Centered Design and Usability Research

Look at how people utilize and integrate workflows in real-world healthcare settings to create computer systems that are easy to use, do not require a lot of thought, and are more likely to be adopted by healthcare practitioners.

- *Development of Ethical and Legal Frameworks:* Support empirical research on ethical problems linked to AI transparency, patient consent, data ownership, and accountability to help create flexible policy and regulatory frameworks.

Design and test economical, strong computer technologies that can work well in places with few resources, overcoming cultural and infrastructural barriers to adoption.

- *Effect on Relationships Between Patients and Providers:* Look into how digital health technologies affect the way people talk to each other, how much they trust each other, and how happy they are with their care to make sure that technology improves the therapeutic connection instead of hurting it.

Future research can assist make sure that computer technologies in medical science are successful, fair, ethical, and well-integrated into clinical practice by focusing on these topics.

CONCLUSION

The merging of computer technology and medical science has started a new age in healthcare, with better diagnosis, better patient care, and more access to medical services. Computers are now essential for driving innovation and efficiency in clinical, scientific, and educational settings. They are used in everything from AI-powered diagnostic tools and telemedicine to robotic-assisted surgeries and complex data analytics.

There are many benefits, but to fully realize the promise of these technologies, issues, like data protection, ethics, fair access, and the requirement for user-centered system design must be dealt with.

To get past these problems, we need to keep doing research, carefully put plans into action, and work together to make decisions about policy.

In the end, the successful use of computer technology in medical science will not only improve health outcomes, but it will also make healthcare delivery more accessible, efficient, and tailored to each person's needs. As technology keeps changing, it will be important to keep evaluating and adapting to make sure that these changes are good for both patients and healthcare providers.

REFERENCES

1. Miah S, Shen J, Lamp JW, Kerr D, Gammack J. A literature review for outlining new themes in health informatics research. Australas J Inf Syst. 2019;23. doi: 10.3127/ajis.v23i0.2137.
2. Cios KJ, Krawczyk B, Cios JS, Staley JK. What makes medical data mining different: How new technology and the data they create are changing medicine. 2019. doi: 10.48550/arXiv.1905.09203.
3. Sun T, He X, Li Z. Digital twin in healthcare: Recent updates and challenges. Digit Health. 2023;9:20552076221149651. doi: 10.1177/20552076221149651.
4. Grezenko H, Alsadoun L, Farrukh A, Rehman A, Shehryar A, Nathaniel E, et al. From Nanobots to Neural Networks: The many ways artificial intelligence is changing surgery and medicine. Cureus. 2023;15(11):e49082. doi: 10.7759/cureus.49082.
5. Yadav S. Transformative frontiers: A comprehensive review of emerging technologies in modern healthcare. Cureus. 2024;16(3):e56538. doi: 10.7759/cureus.56538.

STM Journals 2025. All Rights Reserved

6. Topol EJ. Deep medicine: How AI can make healthcare more human again. New York: Basic Books; 2019.
7. Jiang F, Jiang Y, Zhi H, Dong Y, Li H, Ma S, et al. Artificial intelligence in healthcare: Past, present and future. Stroke Vasc Neurol. 2017;2(4):230–243. doi: 10.1136/svn-2017-000101.
8. Dilsizian SE, Siegel EL. Using big data and powerful computation to make personalised medical diagnoses and treatments in medicine and cardiac imaging. Curr Cardiol Rep. 2014;16(1):441. doi: 10.1007/s11886-013-0441-8.
9. Esteva A, Kuprel B, Novoa RA, Ko J, Swetter SM, Blau HM, et al. Dermatologist-level classification of skin cancer with deep neural networks. Nature. 2017;542(7639):115–118. doi: 10.1038/nature21056.
10. Rajkomar J, Dean J, Kohane I. Using machine learning in medicine. N Engl J Med. 2019;380(14):1347–1358. doi: 10.1056/NEJMra1814259.
11. Topol EJ. High-performance medicine: The convergence of human and artificial intelligence. Nat Med. 2019;25(1):44–56. doi: 10.1038/s41591-018-0300-7.
12. World Health Organization. Ethics and governance of artificial intelligence for health. Geneva: WHO; 2021. Available at https://www.who.int/publications/i/item/9789240029200
13. National Institutes of Health. AI in biomedical research. Available at https://www.nih.gov/research-training/ai-biomedical-research

STM Journals 2025. All Rights Reserved