

Today's Status of Digital Resources in Medical College Libraries

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Abstract

Digital resources have become integral to the advancement of medical education and research, enabling access to current scientific evidence, clinical guidelines, e-books, e-journals, and multimedia learning tools. Medical college libraries worldwide are transitioning from traditional print repositories to hybrid digital knowledge hubs. This transformation is driven by the evolution of Information and Communication Technology (ICT), rising expectations of learners and educators, institutional mandates for evidence-based practice, and the diffusion of national and global digital initiatives such as PubMed Central, National Digital Library of India (NDLI), and e-ShodhSindhu. Today's digital resources in medical colleges encompass electronic databases (PubMed, Scopus, Web of Science), subscription-based platforms (Ovid, EBSCOhost, ScienceDirect), open access portals, institutional repositories, and mobile access tools. Despite the widespread adoption of digital resources, medical college libraries face challenges related to infrastructure, licensing costs, digital literacy among users, and equitable access. Recent studies in India and abroad report increasing integration of digital libraries into curricula, but also highlight gaps in usage, awareness, and training. This article reviews the current landscape of digital resources in medical college libraries, discusses infrastructure and service models, examines user behavior and barriers, and proposes strategic recommendations for enhancing digital accessibility and effective utilization. The findings underscore the importance of collaborative licensing, user training programs, improved network infrastructure, and performance evaluation metrics to ensure these digital resources meaningfully support scholarly medical education and research.

Keywords: Digital literacy, digital resources, e-resources, electronic databases, healthcare education, ICT infrastructure, medical college libraries, open access

INTRODUCTION

Background

Medical knowledge is expanding at an unprecedented rate. By some estimates, biomedical information doubles every 73 days [1]. In this dynamic landscape, medical college libraries serve as intellectual gateways, empowering students, clinicians, and researchers with timely access to authoritative information. Traditional print collections — long the foundation of academic libraries — are insufficient for meeting the demands of contemporary healthcare education. This gap has driven a profound shift toward digital resources, defined as electronically accessible information like e-books, e-journals, databases, multimedia content, institutional repositories, and software tools for education and research [2].

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The transition to digital libraries was accelerated by several forces: the global spread of high-speed networks, the rise of mobile computing, the

emergence of online learning platforms, and policy initiatives, such as Open Access (OA) and national digital library consortia. The COVID-19 pandemic further highlighted the need for robust digital infrastructure, as remote learning became essential for continuity in medical education.

Definition and Scope of Digital Resources

In the context of medical college libraries, digital resources encompass:

- Bibliographic and full-text databases (e.g., PubMed, Scopus, Web of Science)
- Subscription platforms (e.g., Ovid, EBSCOhost, ProQuest)
- Publisher portals (e.g., Elsevier's ScienceDirect, SpringerLink)
- Open access repositories (e.g., PubMed Central, DOAJ)
- Multimedia learning tools (e.g., clinical video libraries, interactive modules)
- Mobile and app-based access tools (e.g., Medscape, UpToDate apps)
- Institutional repositories and archives

Digital resources are often hosted via library portals, single sign-on systems, and federated search tools, enabling seamless access regardless of physical location [3].

Importance In Medical Education

Digital resources are crucial because they:

1. Support evidence-based medicine by providing current research findings.
2. Enable access to peer-reviewed literature for clinical decision making.
3. Facilitate lifelong learning among healthcare professionals.
4. Enhance student learning through multimedia and interactive content.
5. Provide scalable access for large cohorts of users simultaneously.

In medical curricula, digital resources are used for coursework, assignments, journal clubs, research projects, and clinical practice [4].

Research Questions

This article explores:

- What digital resources are currently used in medical college libraries?
- How have libraries implemented and integrated digital access?
- What patterns of usage and user perceptions exist regarding these resources?
- What challenges and gaps affect optimal use?
- What strategies can improve access, training, and impact?

HISTORICAL EVOLUTION OF DIGITAL RESOURCES IN MEDICAL LIBRARIES

The evolution of digital resources in medical libraries represents a fundamental transformation in the way medical information is created, organized, and disseminated. This transition has been driven by advances in information technology, the exponential growth of biomedical literature, and the increasing need for timely, evidence-based information in medical education and healthcare. The journey from traditional print collections to sophisticated digital ecosystems can be broadly divided into several developmental phases [5].

Pre-Digital Era: Print-Dominated Medical Libraries

Before the advent of digital technologies, medical libraries primarily functioned as repositories of print materials, including textbooks, reference works, bound journals, indexes, and bibliographies. Access to medical literature was limited by physical availability, location, and operating hours. Indexing tools, such as Index Medicus played a crucial role in guiding users to relevant literature, but the search process was time-consuming and often required the assistance of trained librarians. Inter-library loan services were essential for accessing materials not held locally, leading to delays in information retrieval [6].

Early Automation and Computerization (1960s–1980s)

The first major shift toward digital resources occurred with the introduction of computers in library operations during the 1960s and 1970s. Medical libraries began using computers for cataloging, indexing, and database management. A landmark development during this period was the creation of MEDLARS (Medical Literature Analysis and Retrieval System) by the U.S. National Library of Medicine in 1964. MEDLARS enabled computerized indexing and retrieval of biomedical literature and laid the foundation for subsequent digital innovations.

During the 1980s, Online Public Access Catalogs (OPACs) replaced traditional card catalogs, allowing users to search library holdings electronically. Although access was often limited to on-site terminals, OPACs marked a significant step toward user-centered information retrieval [7].

Emergence of Online Databases and CD-ROM Technology (1980s–1990s)

The 1980s and 1990s witnessed the proliferation of online bibliographic databases, such as MEDLINE, EMBASE, and CINAHL, which transformed literature searching in medical libraries. Access to these databases initially required specialized search skills and was mediated by librarians. The introduction of CD-ROM technology further expanded access by enabling libraries to distribute large volumes of indexed data locally, reducing dependence on remote online systems. This period also saw the gradual democratization of database searching, as user-friendly interfaces and training programs allowed medical students and faculty to conduct searches independently [8].

Internet And Web-Based Resources (Mid-1990s–2000s)

The widespread adoption of the Internet in the mid-1990s marked a turning point in the evolution of medical libraries. The launch of PubMed in 1997 revolutionized access to MEDLINE by providing free, web-based searching of biomedical literature. This development significantly expanded global access to medical research and reduced barriers associated with subscription-based systems.

Simultaneously, publishers began offering electronic journals, allowing libraries to provide online access to full-text articles. Web-based platforms, such as ScienceDirect, SpringerLink, and Wiley Online Library became central to medical library collections. The shift from print to electronic journals accelerated during this period, driven by user demand for immediate access and enhanced search capabilities [9].

Integrated Digital Libraries and Consortia Models (2000s–2010s)

The early 21st century witnessed the integration of diverse digital resources into unified library systems. Libraries adopted integrated library management systems, discovery tools, and federated search engines to streamline access across multiple databases and platforms. The rise of library consortia, such as e-ShodhSindhu in India, enabled collaborative licensing and expanded access to high-quality resources at reduced costs. Institutional repositories emerged as platforms for preserving and disseminating locally produced research, supporting the growing open access movement. These repositories enhanced the visibility of medical research and facilitated global knowledge sharing [10].

Contemporary Digital Ecosystem (2010s–Present)

In the present era, medical libraries operate within a highly dynamic digital ecosystem characterized by mobile access, cloud computing, and advanced analytics. Digital resources now include not only text-based materials but also multimedia content, clinical decision support tools, and data repositories. Mobile applications and remote access technologies have further extended the reach of medical libraries beyond physical boundaries. The emphasis on open access, digital literacy, and user-centered services continues to shape the evolution of medical libraries. Emerging technologies, such as artificial intelligence and data-driven discovery tools are expected to further redefine digital resource management and utilization in the future [11].

CURRENT LANDSCAPE OF DIGITAL RESOURCES

The current landscape of digital resources in medical college libraries reflects a significant shift toward technology-driven information access and service delivery. Advancements in Information and Communication Technology (ICT), coupled with the increasing demand for evidence-based medical education and research, have positioned digital resources as central components of academic medical libraries. Today, medical college libraries operate within a hybrid environment, integrating traditional print collections with extensive digital holdings that support teaching, learning, clinical practice, and research.

Subscription-Based Electronic Resources

Subscription-based electronic resources form the core of digital collections in medical college libraries. These include bibliographic databases, full-text journal platforms, and specialized medical databases. Widely used databases, such as PubMed/MEDLINE, Scopus, Web of Science, Embase, and Cochrane Library enable comprehensive literature searching, citation tracking, and systematic review preparation. These platforms are particularly valuable for postgraduate students, faculty members, and researchers involved in clinical and biomedical research [12].

In addition to databases, medical college libraries subscribe to publisher-based platforms, such as Elsevier ScienceDirect, SpringerLink, Wiley Online Library, Taylor & Francis Online, and SAGE Journals. These platforms provide access to peer-reviewed journals, reference works, and e-books across medical and allied health sciences. Subscription-based resources are typically accessed through institutional IP authentication or remote access systems, ensuring availability to authorized users both on and off campus.

Consortia and National Digital Initiatives

To address the high cost of subscriptions and promote equitable access, many medical college libraries participate in consortia-based digital initiatives. In India, programs, such as e-ShodhSindhu, National Digital Library of India (NDLI), and One Nation One Subscription (ONOS) play a critical role in expanding access to scholarly content. These initiatives allow institutions to share licensed resources, negotiate collective agreements with publishers, and provide centralized access to academic content [13].

Consortia participation significantly enhances the digital resource base of government medical colleges, particularly those with limited budgets. NDLI, for example, provides free access to millions of digital items, including textbooks, research articles, theses, and multimedia learning materials. Such national initiatives contribute to narrowing the digital divide between well-funded and resource-constrained institutions.

Open Access Resources and Institutional Repositories

Open access (OA) resources have become an essential component of the digital landscape in medical college libraries. OA platforms, such as PubMed Central, Directory of Open Access Journals (DOAJ), and BioMed Central provide unrestricted access to peer-reviewed medical research. The growing emphasis on open science and public accessibility has increased the availability of high-quality OA literature, supporting teaching and research without financial barriers [14].

Institutional repositories maintained by medical colleges or universities store locally produced scholarly content, including theses, dissertations, faculty publications, and conference papers. These repositories enhance the visibility of institutional research output and contribute to global knowledge sharing. Many libraries actively promote OA publishing and repository use as part of their scholarly communication services [15].

Clinical Decision Support and Point-of-Care Tools

A distinguishing feature of digital resources in medical college libraries is the integration of clinical decision support tools. Resources, such as UpToDate, DynaMed, ClinicalKey, and BMJ Best Practice provide evidence-based clinical summaries, diagnostic guidelines, and treatment recommendations. These tools are extensively used by clinicians, interns, and postgraduate students during clinical rotations and hospital practice.

Point-of-care tools bridge the gap between academic learning and clinical application by offering concise, reliable information in real time. Their mobile-friendly interfaces and offline access options further enhance usability in clinical settings [16].

Multimedia and Interactive Learning Resources

Beyond text-based materials, medical college libraries increasingly provide access to multimedia and interactive digital resources. These include anatomy visualization software, medical imaging databases, surgical video libraries, simulation tools, podcasts, and webinars. Platforms, such as Visible Body, Complete Anatomy, and various medical video repositories support experiential learning and skill development.

The incorporation of multimedia resources aligns with modern pedagogical approaches, promoting active learning and accommodating diverse learning styles. Libraries collaborate with academic departments to integrate these resources into curricula and learning management systems [17].

Remote Access and Mobile Technologies

Remote access to digital resources has become a standard expectation among medical students and faculty. Libraries employ VPNs, proxy servers, and federated authentication systems to facilitate off-campus access. Mobile access through apps and responsive web platforms further extends the reach of digital resources, enabling users to consult medical literature anytime and anywhere.

The widespread use of smartphones and tablets has influenced resource design and delivery, prompting libraries to prioritize mobile-compatible platforms and user-friendly interfaces [18].

Trends and Emerging Developments

The current digital landscape is shaped by emerging trends, such as artificial intelligence–assisted search tools, data analytics, and personalized information services. Libraries are increasingly exploring AI-driven discovery tools that enhance search relevance and recommend resources based on user behavior. Additionally, there is growing interest in integrating research data management services and supporting open research practices.

CHALLENGES IN DIGITAL RESOURCE ADOPTION

The adoption of digital resources in medical college libraries has significantly enhanced access to medical knowledge, research literature, and clinical decision-making tools. However, despite substantial progress, medical college libraries continue to face a range of challenges that limit the effective adoption, utilization, and sustainability of digital resources. These challenges are multidimensional, encompassing technological, financial, human, organizational, and policy-related factors. Addressing these barriers is essential to fully realize the benefits of digital libraries in medical education and healthcare practice [19].

Infrastructure and Connectivity Constraints

One of the foremost challenges in digital resource adoption is inadequate ICT infrastructure. Many medical colleges, particularly in developing regions and rural areas, face limitations in terms of high-speed internet connectivity, network stability, and computing facilities. Digital resources, such as multimedia learning tools, high-resolution medical images, and full-text journal databases require

reliable bandwidth and uninterrupted access. Poor connectivity often results in slow loading times, interrupted access, and user frustration, discouraging consistent use of digital platforms.

Additionally, insufficient availability of computers, outdated hardware, and lack of mobile-compatible infrastructure restrict user access. Although students increasingly rely on personal devices, institutional systems must support secure and seamless integration of these devices to ensure equitable access [20].

Financial Constraints and High Subscription Costs

The high cost of licensing and maintaining digital resources represents a major barrier for medical college libraries. Subscription fees for premium databases, such as Scopus, Web of Science, Ovid, and UpToDate are substantial and often increase annually. Budgetary limitations, particularly in government-funded medical colleges, restrict the ability of libraries to subscribe to a comprehensive range of resources.

Moreover, fluctuations in currency exchange rates and complex licensing agreements further complicate budget planning. Libraries are often forced to prioritize certain resources over others, resulting in partial access that may not fully meet the diverse needs of students, faculty, and clinicians [21].

Licensing, Access, and Copyright Issues

Digital resource licensing agreements impose restrictions on the number of simultaneous users, access duration, and permitted uses of content. Such limitations can hinder access during peak academic periods, such as examinations or research submission deadlines. Additionally, restrictions on downloading, printing, or sharing content may conflict with academic and research needs.

Copyright compliance and digital rights management (DRM) systems add another layer of complexity, requiring libraries to balance legal obligations with user expectations for seamless access [22].

Human Resource and Skill Gaps

The effective adoption of digital resources depends heavily on the availability of skilled library professionals and technical support staff. Many medical college libraries face shortages of personnel with expertise in digital resource management, database administration, metadata standards, and user training. Limited opportunities for continuous professional development further exacerbate skill gaps.

Without adequate training, library staff may struggle to manage subscriptions, troubleshoot access issues, or provide advanced research support services, such as systematic review assistance and citation analysis [23].

User Awareness and Digital Literacy Challenges

User-related challenges significantly affect digital resource adoption. Although digital resources are widely available, many students and faculty members lack awareness of the full range of resources and services provided by the library. Inadequate orientation programs and limited information literacy training result in underutilization of valuable digital content.

Digital literacy levels vary widely among users, influencing their ability to conduct effective searches, evaluate information quality, and use advanced database features. As a result, users may rely on easily accessible but less authoritative sources, undermining the quality of academic and clinical work.

Organizational and Policy Limitations

Institutional policies and administrative practices also impact digital resource adoption. Delays in procurement processes, lack of standardized digital library policies, and limited coordination between libraries and academic departments can hinder timely access to resources. In some cases, library development is not aligned with institutional academic goals, reducing the strategic impact of digital resources.

Furthermore, the absence of systematic evaluation and performance metrics makes it difficult to assess the effectiveness of digital resource investments and justify budget allocations [24].

Security, Privacy, and Sustainability Concerns

As digital libraries expand, concerns related to data security, user privacy, and long-term sustainability become increasingly important. Libraries must protect user data, ensure secure authentication systems, and safeguard digital collections against cyber threats. Sustainability issues include long-term access to licensed content, preservation of digital materials, and dependency on external vendors.

STRATEGIC INITIATIVES AND BEST PRACTICES

To ensure effective adoption and sustained utilization of digital resources in medical college libraries, it is essential to implement strategic initiatives and best practices that address technological, organizational, and user-related challenges. These initiatives not only enhance access to digital resources but also align library services with the evolving needs of medical education, clinical practice, and research [25].

Strengthening ICT Infrastructure

A robust ICT infrastructure forms the foundation of successful digital resource implementation. Medical college libraries must invest in high-speed internet connectivity, reliable campus-wide Wi-Fi, updated computer systems, and secure servers. Integration with national networks, such as the National Knowledge Network (NKN) can significantly improve bandwidth and reliability. Libraries should also adopt cloud-based solutions to ensure scalability, data security, and uninterrupted access to digital platforms. Regular maintenance and upgrades of hardware and software are critical to prevent system obsolescence.

Collaborative and Consortia-Based Resource Acquisition

One of the most effective strategies to overcome financial constraints is participation in library consortia. Initiatives, such as e-ShodhSindhu, National Digital Library of India (NDLI), and One Nation One Subscription (ONOS) enable medical colleges to access high-quality digital resources at reduced costs. Collaborative licensing allows institutions to share subscriptions, expand their resource base, and avoid duplication of expenditures. Active engagement in regional and national consortia ensures equitable access to digital content across institutions [26].

User Education and Information Literacy Programs

User awareness and digital literacy are crucial for maximizing the benefits of digital resources. Libraries should conduct regular orientation programs, hands-on workshops, and online tutorials to train students and faculty in effective database searching, critical evaluation of information, and ethical use of digital content. Embedding information literacy modules into the medical curriculum enhances sustained engagement with digital resources. Additionally, personalized research support and virtual reference services can improve user satisfaction and resource utilization [27].

Capacity Building and Professional Development

Continuous professional development of library staff is essential for effective digital resource management. Medical college libraries should invest in training programs, workshops, and

certifications related to digital librarianship, database management, metadata standards, and research support services. Encouraging participation in national and international conferences helps librarians stay updated with emerging trends and best practices. Skilled library professionals are better equipped to support advanced services, such as systematic review assistance and research impact analysis [28].

Integration with Academic and Clinical Systems

Best practices emphasize the integration of digital library resources with learning management systems (LMS) and clinical information systems. Linking digital resources directly to course modules and clinical case discussions enhances relevance and accessibility. Such integration ensures that students and clinicians can seamlessly access required literature during learning and patient care activities, thereby promoting evidence-based practice.

Monitoring, Evaluation, and Policy Support

Regular assessment of digital resource usage and service quality is vital for continuous improvement. Libraries should implement usage analytics, user feedback mechanisms, and performance indicators to evaluate the effectiveness of digital initiatives. Institutional policies should support sustainable funding, data security, and long-term preservation of digital resources. Clear governance frameworks and strategic planning ensure alignment between library services and institutional goals [29].

FUTURE DIRECTIONS

The future of digital resources in medical college libraries is shaped by rapid technological advancements, evolving pedagogical models, and the growing emphasis on evidence-based healthcare. As medical education and research continue to expand in scope and complexity, libraries must adopt forward-looking strategies to remain relevant and effective knowledge facilitators. Several emerging trends and strategic directions are likely to redefine digital resource management and service delivery in medical college libraries [30].

Integration of Artificial Intelligence and Advanced Search Technologies

Artificial Intelligence (AI) is expected to play a transformative role in the future of digital libraries. AI-driven discovery tools can enhance search precision, reduce information overload, and provide personalized content recommendations based on user profiles and research interests. In medical libraries, AI can support advanced literature reviews, identify research trends, and assist clinicians in accessing relevant evidence quickly. The integration of natural language processing and machine learning algorithms will further improve the efficiency of information retrieval systems.

Expansion of Open Access and Open Science Initiatives

The global movement toward open access (OA) and open science will significantly influence the future digital landscape of medical libraries. Increased availability of OA journals, datasets, and educational resources will reduce dependency on expensive subscription-based platforms. Medical college libraries are expected to play a proactive role in promoting OA publishing, managing institutional repositories, and supporting compliance with funder mandates. This shift will enhance global knowledge sharing and ensure equitable access to medical research [14].

Enhanced Digital Literacy and Research Support Services

Future library services will place greater emphasis on advanced digital literacy and research support. Libraries will expand their role beyond resource provision to include training in research methodologies, data management, citation analysis, and scholarly communication. Personalized research consultations and embedded librarian models within academic departments will become more prevalent, fostering closer collaboration between librarians, faculty, and students.

Adoption of Emerging Learning Technologies

Medical college libraries are likely to integrate emerging learning technologies, such as virtual reality (VR), augmented reality (AR), and simulation-based learning tools. These technologies can enhance

medical training by providing immersive learning experiences in anatomy, surgery, and clinical procedures. Libraries will serve as access points and facilitators for such innovative educational resources.

Sustainable and User-Centric Digital Libraries

Sustainability and user-centric design will guide future digital library initiatives. Libraries will focus on long-term preservation of digital content, environmentally sustainable technologies, and inclusive access models. User feedback, usage analytics, and continuous evaluation will inform service improvements and resource selection. Ensuring data security, privacy, and ethical use of digital information will remain critical priorities.

CONCLUSION

Digital resources have fundamentally transformed medical college libraries from traditional print repositories into dynamic, technology-driven knowledge centers. The integration of subscription databases, open access platforms, consortia initiatives, and clinical decision-support tools has strengthened evidence-based education and research. However, challenges, such as infrastructure limitations, high subscription costs, licensing constraints, and digital literacy gaps continue to affect optimal utilization. Strategic measures including improved ICT infrastructure, collaborative licensing, user training, professional development, and continuous evaluation are essential for sustainable growth. By adopting innovative technologies and user-centric approaches, medical college libraries can enhance accessibility, promote research excellence, and effectively support the evolving demands of medical education and healthcare practice.

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