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A qualitative study of students' perspectives on barriers to and challenges in health informatics research in Iran

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Abstract

Background Health Informatics (HI) is a crucial field of study that combines computer science, medical science, and information science to develop and produce information systems and software that support healthcare providers. As a multidisciplinary area, it presents specific challenges for research. This study aimed to identify the barriers and challenges faced by HI researchers.

Methods This qualitative study was conducted in 2023. The study population consisted of students from Health Information Management and Medical Informatics who were actively engaged in research. Data collection was carried out through interviews using a voice recorder, with the process continuing until data saturation was achieved. Data analysis was performed using the content validity method.

Results Barriers and challenges were classified into four main themes and 13 main categories. The main categories included teaching, data, time, finances, relationships and cooperation, individual factors, organizational aspects, project management, instruments and infrastructure, cultural influences, methodological concerns, and laws and procedures.

Conclusion Research in HI faces both global challenges and region-specific barriers, such as sanctions and ambiguous roles within healthcare systems, necessitating international collaboration and targeted policy frameworks. Strengthening problem-solving skills, fostering professional mentorship, and adopting interdisciplinary approaches can enhance student engagement and research quality. By emphasizing HI's critical role in advancing healthcare and leveraging successful global case studies, opportunities for innovation and growth in this field can be unlocked.

Keywords Health informatics, Challenges, Perspectives, Barriers of research, Educations

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Introduction

In the 1950s and 1960s, Health Informatics (HI) was introduced as a new field of study, but it has recently gained recognition as a core component of healthcare [1]. This field has emerged in response to various challenges and medical practices of today [2]. HI is also referred to as "Medical Informatics," "Clinical Informatics," or "Biomedical Informatics" in Research findings have demonstrated that medical informatics plays a crucial role in advancing research within the medical sciences [3]. The primary purpose of Health Informatics (HI) is to provide effective healthcare to patients by integrating higher quality and efficiency, which in turn can lead to reduced costs and increased accessibility, along with new opportunities [4, 5]. HI is applied across various domains, including nursing, clinical care, dentistry, pharmacy, public health, occupational therapy, and (bio)medical research.

Research in these areas plays a vital role in developing and enhancing the organization and management of information, collecting health metrics, improving patient care quality, identifying best practices, and pinpointing healthcare problems to resolve them [6–8]. However, there are numerous obstacles that hinder the execution of such research activities. According to Hristidis, the primary challenge in medical informatics research lies in coordinating two groups of experts: those with information system backgrounds and those with medical backgrounds. The lack of integration between these two groups can diminish the quality of research output and reduce its overall effectiveness [9].

Various studies have identified several barriers to healthcare research, including limitations in human and financial resources, inadequate supportive services, a lack of research training and sufficient skills, insufficiently allocated research time, organizational cooperation, challenges in replicating studies, unavailability of scientific resources, and work-related stress [6, 10–12].

It has previously been discussed regarding the challenges of health informatics, which primarily focuses on data collection for its utilization. Shepherd emphasize two key challenges in medical informatics: information integration and context-based retrieval. These barriers include data heterogeneity, the need for dynamic user modeling, and the lack of semantic standards, which are presented as obstacles to the advancement of this field [13]. Norris identifies challenges such as data heterogeneity, resistance to the adoption of new technologies, and ethical issues [14]. Abdul et al. [15] identified challenges such as the complexity of healthcare systems, data and standards heterogeneity, ethical and legal issues, and resistance to technology adoption in implementing health informatics in rural healthcare settings. In a study conducted by Paton and his colleagues, the challenges of publishing medical informatics articles in developing countries are well articulated. This study demonstrated that language issues, lack of access to reputable journals, lack of financial resources, and the bias of international publications in favor of developed countries are significant obstacles to publishing articles in this field [16].

Most studies conducted in relation to medical informatics are linked to the application of medical informatics technologies, and it seems that specialized articles on research in medical informatics, although they overlap with the field itself, are relatively scarce. Another point is that the very nature of the medical informatics discipline involves generating insights from the application of technologies and the data derived from them. Therefore, in a sense, the challenges of medical informatics can also be regarded as barriers to research in this field.

Both qualitative and quantitative research are important in the field of medical informatics. However, in some cases, such as distinguishing between medical informatics and research in medical informatics, they may have a greater impact for the following reasons: focusing on human and contextual complexities (users' subjective experiences, unmeasurable barriers, social and cultural contexts), uncovering hidden and unexpected needs (users' unexpressed needs, conflicts in workflows, indirect effects of technology), and developing theories and designing reality-based solutions(formulating research questions, designing quantitative questionnaires, creating conceptual frameworks), along with flexibility in responding to environmental dynamics (exploratory approaches, adaptability to changes).

Considering that research is a crucial factor in the development of countries [17], identifying and eliminating research barriers can significantly enhance both the quality and quantity of studies. This improvement fosters better research activities, strengthens communication between researchers and users of research results, and aids in problem-solving and decision-making [6, 17]. Given the critical role of Health Informatics (HI) in enhancing the efficiency of healthcare service delivery, it can contribute to reducing healthcare costs and improving healthcare systems [18]. In Iran, the disciplines of Medical Informatics and Health Information Management have been endorsed by the Ministry of Health for educating researchers in the field of HI, with programs offered at universities of medical sciences. Additionally, most research in Health Informatics (HI) is conducted by graduate students under the supervision of their professors, making students the largest group involved in HI-related research. As a result, they are more likely to encounter the direct limitations associated with research in this field. This study aims to identify the barriers and challenges faced by HI researchers.

Methods

This qualitative, conventional content analysis [19] was conducted to determine the barriers and challenges of research in HI studies in 2022. Participants included PhD students in two fields: medical informatics and health information management. The number of PhD students in these two fields is studying at several universities in Iran. The participants were selected based on purposeful sampling. Samples were selected based on research goals [20] and specific information needed. The inclusion criteria were as follows: PhD candidate in the two fields above of study at thesis level. Three individuals were excluded from the study due to personal reasons. Data collection was conducted using semi-structured interviews and an interview guide. To formulate the questions, the objectives of the interview were first established. Then, prior research and studies were conducted. The questions were designed in an open format and assessed by colleagues, with feedback taken into account. Following that, the questions were revised and finalized, and their ethical considerations were also reviewed. The study received ethical approval from the Ethics Committee of Lorestan University of Medical Sciences prior to its initiation. All participants provided verbal informed consent before completing a demographic questionnaire. The interviews were conducted by two members of the research team: HN, a PhD candidate, and AG, a faculty member with a PhD. A brief guide outlining the barriers and challenges of research in Health Informatics (HI) was presented to the participants. Semi-open questions were utilized during the interviews to facilitate a more in-depth discussion on the topic. The interviews were conducted in the participants' academic environment. Face-to-face interviews were recorded after obtaining consent from the respondents, with each interview lasting between 50 and 60 min. Data saturation was achieved after 12 interviews; however, in order to enhance confidence in the findings, a total of 14 interviews were conducted.

Data analysis was conducted using MAXQDA10 software, employing a content analysis method. This method is well-suited for extracting valid and reliable information from interview transcripts [21]. Agreement on the coding and verification of the transcribed interviews was facilitated through peer checking and member checking. Specifically, the research team, consisting of all four authors, reviewed the codes to ensure consistency in understanding the participants' statements. To enhance the credibility and transparency of the research, the SQRS (Standards for Reporting Qualitative Research) checklist has been used to ensure that various aspects of the study are examined and reported. Additionally, the transcribed interviews were provided to the authors for verification to confirm that their interpretations aligned.

Results

In this study, 14 interviews were conducted with eight men and six women. Interviewees were from different universities in Iran (Table 1).

After analyzing the interviews, the barriers and challenges of conducting the research consisted of four main themes and 13 main categories (Table 2).

Educational factors

Educational factors are defined as elements related to the educational structure and program planning of the field of health informatics. The three primary categories of educational factors identified in the study include: teachers' weaknesses, deficiencies in educational programs,

Table 1 The demographic information of ph.d. Students participating in the study. Health information management (HIM), medical informatics (MI)

	Items	Category	Frequency	Percent
1	Sex	Men	8	57.14
		Women	6	42.86
2	Medical universities	Iran	2	14.29
		Tehran	3	21.43
		Kashan	3	21.43
		Shiraz	1	7.13
		Shahid Beheshti	4	28.57
		Tabriz	1	7.12
3	Field of study	HIM	8	57.14
		MI	6	42.85
4	Age range	25–30	9	64.28
		30–35	5	35.72
5	Experience	1–2	3	21.43
		2–3	3	21.43
		3–4	5	35.71
		4–5	3	21.43

Table 2 Obstacles and challenges of health informatics research

Main theme	Main categories	Subcategories
Educational factors	Weaknesses among professors	- Some professors lack up-to-date knowledge. - Some professors show inadequate competency. - Professors provide insufficient support to students.
	Deficiencies in training programs	- Weaknesses in the curriculum - Insufficient focus on practical training - Lack of clarity in educational objectives
	Lack of scientific resources	- Poor quality of translated textbooks - Challenges in accessing electronic resources - Shortage of reference books in Persian - Limited access to English-language resources - Absence of suitable educational workshops - Lack of resource books for research methodology, particularly in Persian
Stewardship factors	Legal challenges	- Absence of mechanisms for healthcare providers to utilize produced software - Legal gaps concerning software usage - Lack of regulatory oversight for the production of HI-related software - Absence of accreditation or approval standards
	Structural issues	- Non-targeted training programs - Neglect of innovative approaches - Weak collaboration between academia and industry - Inadequate promotion criteria for professors - Inadequate communication between medical informatics professors and medical professionals - Overemphasis on article extraction from research - Focus on publication in foreign journals - Incompetence in staff recruitment - Undefined mechanisms for organizations to conduct research projects - Structural deficiencies in the Ministry of Health - Absence of an accreditation and approval organization
	Inadequate necessary infrastructure	- Limited access to necessary equipment - Insufficient educational facilities - Absence of specialized laboratories for software testing - Lack of adequately equipped libraries - Insufficient computational infrastructure and expertise for artificial intelligence and machine learning - Inadequate computer systems in certain colleges - Slow internet connectivity and restricted access in hostels and colleges - Blocking of valuable websites (e.g., YouTube) - Absence of a dedicated research center for Health Informatics
	Problems related to project management	- Extensive scope of research projects - Projects not aligned with specific needs - Lack of transparency in research prioritization by universities and research centers - Low level of innovation in research projects - Weaknesses in the evaluation system - Neglect of the evaluation system - Inadequate oversight in the implementation of research projects - Undefined mechanisms for organizations to conduct research projects - Bias in certain research projects
Cultural factors	Culture of individualism	- Low willingness to engage in teamwork - Limited interdisciplinary cooperation
	Resistance to adopting new technologies	- Resistance from service providers - Opposition from executives and policymakers
Financial factors	Insufficient funding	- Minimal financial support for research ideas - Insufficient budget allocation for research centers -Lack of financial backing for theses from universities
	Lack of information about sponsors	- Poor communication with accelerators - Weak visibility of research products from startups
	High costs of tools and equipment required	- Absence of clear standards - Lack of high-speed internet access in remote areas - Insufficient availability of customized hardware and software - Challenges in self-health assessment and lack of necessary facilities
	Impact of international sanctions	- Sanctions affecting certain biosensors - Impact of international sanctions restricting access to valuable databases, standards, and websites - Devaluation of the national currency impacting article publication and international collaboration

and a lack of academic resources. Several participants noted concerns regarding the faculty's inadequate abilities and overall quality. For example:

> *Many faculty members do not have the opportunity to study comprehensively; upon receiving a PhD, they may believe that they possess a thorough understanding of all subjects and can work in various fields. This perception can hinder the ability to focus deeply on a specific topic. Moreover, they are often not taught essential skills such as system analysis, algorithmic programming, or data and artificial intelligence analysis, which are crucial for conducting in-depth research in their respective areas. (Participant #8)*

Other points mentioned by study participants are weaknesses in eHealth education programs. For example:

> *Interestingly, as undergraduates, we are often more practical in our approach. However, once we transition to master's and PhD programs, we frequently find ourselves in a purely academic environment, without engaging in practical settings such as hospitals or research centers. Many students enter these advanced programs without any work experience and have yet to encounter a Health Information System (HIS), highlighting a significant gap in practical training. (Participant #12)*

Participants in the study stated a lack of scientific resources as another challenge in this area.

> *I won't name a specific book, but it is evident that many Persian books in our field suffer from poor translations. Oftentimes, even the professors themselves seem to lack a clear understanding of what they have authored, resulting in a series of literal, meaningless, and nonsensical translations. Unfortunately, as you know, access to foreign resources is also limited in our country. (Participant #11)*

Stewardship factors

Certain factors are associated with the stewardship sector of the e-Health field as governed by the Ministry of Health. The findings of the present study indicate that stewardship factors can be categorized into four main areas: legal challenges, structural issues, insufficient infrastructure, and project management concerns. Participants in the study specifically cited legal challenges in conducting research within the field of Health Informatics (HI) as a significant obstacle:

> *Suppose I developed an application to support my thesis and successfully defended it. What comes next? There is currently no mechanism for implementing my product, and using apps and software in this context is not legally permissible. I believe the Ministry of Health should take serious action to address this issue. (Participant #1).*

Study participants also identified structural issues as a significant challenge in this area: *"Despite having empowered individuals in the field of Health Information (HI), the high capacity is unfortunately underutilized due to a poor and inadequate structure. This stems from the flawed and poorly organized nature of our Ministry of Health".* (participant #9).

Participants in the study also highlighted the lack of infrastructure needed to conduct HI research as one of the challenges in this field.

> *The reality is that there are numerous restrictions on conducting research in this area in Iran. Additionally, our university faces challenges such as international sanctions that hinder access to valuable databases and websites. (Participant #4)*

According to the study participants, project management problems in implementing HI research are one of the HI challenges.

> *A major concern for all students is the timely completion of our education. In our country, there are circumstances where delayed graduation can result in the loss of numerous job opportunities. This uncertainty regarding the future diminishes the focus on the thesis's sensitivity, ultimately sacrificing the quality of our work. As a student, I find that quality is not my top priority, which is a significant disadvantage. (Participant #13)*

Cultural factors

Cultural factors pertain to the cultural and human aspects associated with Health Informatics (HI) research in Iran. The results of the current study revealed that these factors can be divided into two primary categories: the culture of individualism and resistance to new technologies. A challenge frequently highlighted by research participants is the prevailing culture of individualism in HI research. For example:

> *Given that our field is interdisciplinary, it is expected that both clinical and technical expertise will be integrated. Unfortunately, the policies of the Ministry of Health are largely article-based and sometimes our professors do not permit colleagues*

from other specialties to join our research groups. This limitation hinders the collaborative potential necessary for comprehensive understanding and innovation in our field. (Participant #8)

Other results of the present study showed that resistance to new technologies is one of the major challenges in HI research.

At the doctoral level, we are required to develop a product as part of our dissertation, but the resistance from doctors and authorities renders these products ineffective. This lack of utility negatively impacts students' motivation to engage in thesis work over the long term. When students believe their products will not be used, they tend to neglect the quality of their work. This has created a vicious cycle, where our theses fail to address any significant health problems. (Participant #14).

Financial factors

Financial factors highlight the challenges related to the financial and economic aspects of conducting research. These challenges can be categorized into four main areas: inadequate funding, insufficient sponsorship information, high costs of necessary tools and equipment for information technology—such as telemedicine—and the impact of international sanctions.

Participants in the study identified insufficient funding for implementing Health Information (HI) research projects as a significant challenge: *"In recent years, research budgets in the country have decreased, and our field has naturally been impacted by this issue. Some research projects, such as the development of systems, appear practically impossible without adequate financial support."* (participant #9).

Lack of information about potential sponsors has also been acknowledged as a challenge in implementing health information research projects: *"There is no industry liaison office in the universities, and most professors, including ourselves, are unaware of these funding opportunities. Consequently, information is not being effectively communicated."* (participant #12).

Providing equipment for telemedicine projects is costly, encompassing expenses for the setting, cameras, laptops, and bandwidth, even for store-and-forward types of telemedicine. Research centers are often reluctant to offer financial support. Moreover, to justify the costs of research projects, these centers prioritize publication in foreign journals over the comprehensive project reports, which undermines the value of the research. (participant #2).

International sanctions pose a significant challenge for Health Information (HI) research projects in Iran. For instance, *"the issue of sanctions affecting biosensors, particularly in bioinformatics, is more pronounced, as some biosensors cannot be imported into the country. This is concerning, as scientific progress should not be subject to sanctions."* (participant #4).

Discussion

Health Informatics (HI) is an emerging discipline that indeed faces more challenges compared to established fields. One of the most important researchers in the field of health informatics consists of doctoral students in this discipline, who are engaged in research and publication to gain credibility for obtaining their doctoral degrees and to contribute to improving treatment in this area. Health informatics, by its nature, generates information through the use of systems and data production. Therefore, conducting a qualitative study by students with the aim of identifying challenges and obstacles in carrying out research is essential. However, certain challenges are common across disciplines, including selecting an appropriate research topic, choosing the right methodology, recruiting study participants, securing institutional involvement, and managing data effectively [22, 23], and some others are specifically for HI. The multidisciplinary nature of Medical Informatics increases the challenges arising from the integration and interaction of various fields. In 2009, Peter et al. examined the challenges and opportunities within clinical research informatics. They identified a range of challenges associated with clinical research and proposed a new definition of clinical research informatics [7]. Our study explores medical informatics research in a broad context, rather than focusing specifically on clinical informatics or any particular technology. In Iran, Hospital Information Systems (HIS) are still in their early stages of development. Despite significant advancements in recent years, ongoing human and technical progress is essential to align more closely with the expectations and needs of organizations and users [24]. Despite its numerous benefits for enhancing disease management and research, the electronic health record (EHR)—which serves as the cornerstone of health information systems—falls short of meeting international standards, such as HL7 [25]. Furthermore, there are currently no data repositories or integrated systems available for data aggregation and maintenance, which are crucial for research, population health management, and quality of care programs [26]. Additionally, many systems are unable to automatically record data, leading to the potential for numerous data errors. Beyond these technical obstacles, our study highlights various other barriers to research that need to be addressed.

Educational factors

Quality education is a crucial factor in advancing any field, and given the nascent stage of Health Informatics (HI), it is essential to enhance the standard of education. Challenges such as inadequate educational quality and the inability of instructors to effectively teach are prevalent across many disciplines and universities. Due to the multidisciplinary nature of HI, strong collaboration among professors from various disciplines is necessary to ensure the delivery of high-quality professional education [27]. This finding aligns with the study conducted by Peter et al. [28] Regarding the rapid growth of the discipline in recent years, it is imperative that both the curriculum and resources are regularly updated. Another educational challenge is the insufficient application of approved headings; instructors often do not effectively utilize these headings and frequently deviate from the core topics. Additionally, a significant factor contributing to the educational challenge is the lack of appropriate training workshops, such as those for Hospital Information System (HIS) software, this situation hinders students from effectively communicating in both real and theoretical contexts. Students have expressed that their informatics education lacks purpose and does not provide them with research-based knowledge. Instructors from other fields often lack familiarity with the mission of Health Informatics (HI), which diminishes the quality of education. Consequently, this impacts both the quality and quantity of research projects undertaken by students.

The lack of innovation presents another significant challenge in Health Informatics (HI) education. This absence of innovation stifles students' creativity, as highlighted by some researchers [29]. Certain scholars tend to shy away from exploring new topics within their field, opting instead to focus on outdated, repetitive, and traditional subjects. For various reasons, they often neglect to pursue emerging areas of science or embrace creative thinking. One contributing factor to the lack of innovation is the reliance on technologies from more advanced countries in the field of Health Informatics (HI). Researchers often utilize technologies and research from developing nations, following the established pathways of developed countries. This reliance creates a psychological barrier that significantly hampers research progress and inhibits the pursuit of new investigations. The authors recommend the establishment of a robust committee tasked with researching and publishing educational resources at a national level. This committee would conduct evaluations of published materials, periodically assess teaching staff, evaluate academic departments, and research the effectiveness of student teaching methods. Such initiatives aim to enhance the quality of education and ensure that teaching practices align with current standards and innovations in the field.

A final educational challenge in medical informatics research is the disproportionate emphasis on technical aspects, while students and researchers should be trained more in clinical environments and informatics interventions related to clinical research and treatment workflows. By prioritizing familiarity with clinical processes and treatment workflows, researchers can better address clinical problems. This understanding can significantly bridge information gaps and leverage emerging technologies to enhance patient care and treatment outcomes.

Stewardship factors

One of the primary goals of Health Informatics (HI) is to gather real-world medical data from various levels of human existence, aimed at enhancing our understanding of health and the medical profession to improve overall health outcomes [30]. Consequently, data collection becomes a crucial component of health and HI research. However, one significant challenge in HI research lies in data acquisition. Securing permission to collect data from healthcare centers often involves a lengthy administrative process, which can frustrate both students and researchers, hindering their ability to conduct effective research.

Technical barriers, including tools and infrastructure, are significant factors affecting the success of medical informatics research. Following financial constraints, these technical challenges may be the second leading cause of failure in hospital projects and systems. Insufficient or inadequate technological tools and infrastructure can impede the implementation and effectiveness of research initiatives, ultimately affecting healthcare delivery and innovation [25]. The absence of laboratories and workshops dedicated to testing software—without concerns about patient privacy, security issues, or disruptions to healthcare centers—poses a significant barrier in Health Informatics (HI) research. Additionally, the lack of libraries stocked with specialized books at universities, frequent malfunctions of computer systems, slow internet speeds, and limited bandwidth in student and university dorms further exacerbate these challenges. Furthermore, the filtering of many donor websites and the boycott of numerous platforms create additional obstacles. Together, these tool and infrastructure barriers significantly hinder the advancement of HI research and education.

The absence of clear rules and procedures surrounding software and systems significantly impairs research efforts in Health Informatics. This challenge is particularly crucial for students, as it hampers their ability to complete the referral process needed to engage organizations in collaborative research. Additionally, the lack of accessible legal information regarding the use of hospital software restricts individuals, while companies often

prefer to collaborate with larger organizations and hospitals. This issue is further compounded by administrative bureaucracy, which can create additional barriers to meaningful research partnerships and collaborations. On the other hand, there is potential for collaboration to reform existing laws and regulations regarding software use. Currently, these rules are primarily designed for groups and organizations, leaving a significant gap for individual users. By working together, stakeholders can advocate for clearer guidelines that address the needs of both organizations and individuals, thus fostering a more inclusive environment for research and innovation in Health Informatics. This collaborative effort could enhance accessibility and support for all researchers in navigating the legal landscape.

Another significant obstacle to data collection at healthcare centers is the absence of a unified, comprehensive dataset and an electronic data repository that effectively consolidates properly collected patient information. Often, inadequate attention to data quality compels hospital staff to generate dummy data, which contributes to inaccuracies in the information. This not only undermines the integrity of research but also hampers clinical decision-making and the overall quality of patient care. Addressing these issues is crucial for improving the reliability and validity of health informatics data. It is recommended that researchers and relevant authorities collaborate to design and implement registries that offer robust information support for researchers in the field. By establishing these registries, accurate and comprehensive data can be made more accessible, facilitating informed decision-making and research initiatives. Additionally, it is essential to regularly evaluate and update this data to ensure its accuracy [31].

Another significant obstacle to conducting research projects is the time limitation imposed by lengthy bureaucratic processes. Students often face strict deadlines for their dissertations and research projects, which adds pressure to complete their work on time. The process of review and supervision by professors and advisors tends to be prolonged and sensitive, requiring careful attention to detail. This can hinder students' ability to thoroughly engage with their research and may compromise the quality of their work. Streamlining these processes and allowing more flexibility could greatly enhance the research experience for students [32].

Effective communication and collaboration among stakeholders involved in healthcare and research are essential factors for success. However, the dominance of medical professionals can lead to poor communication between hospital staff, patients, and researchers, resulting in misunderstandings and missed opportunities for collaboration. Additionally, the lack of a significant relationship between universities offering medical informatics programs further complicates this landscape, as it hampers the potential for unified decision-making and coordinated efforts in the field. Strengthening these connections and fostering a more inclusive dialogue among all parties can enhance research outcomes and improve patient care. Another obstacle to studying medical informatics is the weakness of teamwork in medical research from the researchers' perspective. Insufficient communication between doctoral students and software system providers or developers, as well as their connection to the clinical environment and healthcare centers, exacerbates issues of miscommunication. Additionally, the ineffective relationship between medical informatics departments and technical or engineering universities further weakens research efforts. Creating stronger partnerships and promoting open lines of communication among all stakeholders can significantly enhance collaborative research, leading to improved outcomes in medical informatics. The separation of colleges from one another presents another barrier to effective communication among students. This physical and institutional divide can lead to a lack of collaboration and the sharing of ideas across disciplines. When students from different colleges do not have opportunities to interact, it limits their exposure to diverse perspectives and hinders interdisciplinary research and projects. Fostering interconnectedness and creating platforms for collaboration between various colleges can greatly enhance the educational experience and promote innovation in research endeavors.

In addition to individual challenges, organizational issues can serve as significant barriers to conducting research in health informatics (HI). These obstacles may include rigid institutional structures, inadequate support for interdisciplinary collaboration, and limited access to necessary resources. A lack of clear policies and procedures can create confusion and hinder the research process, while insufficient funding may restrict researchers' ability to pursue their projects effectively. Addressing these organizational barriers by fostering a culture of collaboration, providing adequate resources, and streamlining processes can enhance the ability of researchers to conduct impactful studies in health informatics. Indeed, several organizational issues significantly impact health informatics (HI) researchers. Weak project management can lead to inefficiencies and hinder the progression of research initiatives. Insufficient attention to research quality, along with inequalities and structural weaknesses in the research review process, can undermine the credibility and outcomes of research efforts.

In Iran, the incomplete structure of the Ministry of Health presents additional challenges, as it may limit the necessary support and resources for researchers. The absence of an accreditation and product validation

organization in HI further complicates the landscape, making it difficult to ensure the reliability of research findings and innovations. Moreover, the lack of specialized medical informatics centers that focus on reviewing and recruiting experts for specific HI issues restricts access to crucial knowledge and expertise.

Addressing these organizational barriers through improved project management, the establishment of accreditation bodies, and the creation of specialized centers can foster a more supportive environment for HI research, ultimately leading to better outcomes for the healthcare system. Indeed, the lack of a clear definition and scope of health informatics (HI) presents a significant challenge for researchers and medical professionals alike. This ambiguity can lead to misunderstandings regarding the goals and methodologies of HI research, resulting in inconsistent practices and fragmented efforts within the field. Without a well-defined framework, researchers may struggle to align their projects with broader objectives, thereby limiting the impact of their work.

Additionally, medical professionals may find it difficult to integrate HI principles into their practice when the scope is not clearly articulated. This can hinder the adoption of health informatics solutions that are essential for enhancing patient care, streamlining processes, and facilitating data-driven decision-making.

Establishing a comprehensive and widely accepted definition of health informatics, along with a clear scope of work, is crucial for fostering collaboration among researchers and practitioners. This clarity can help unify efforts within the field, promote best practices, and ultimately enhance the quality and effectiveness of health informatics initiatives.

Absolutely, project management in health informatics (HI) encompasses several components that can be further specialized to address the unique challenges of the field. The extent of projects, for instance, often affects their feasibility and scope. When projects are not appropriately prioritized, it can lead to a dilution of resources and focus, ultimately resulting in less impactful outcomes.

Moreover, low levels of creativity and innovation in HI projects contribute to stagnant research, with many initiatives yielding poor or redundant results. This situation is exacerbated by the tendency for researchers to prioritize publication over substantive contributions to the field. When the primary goal becomes merely producing articles that stray from the original research framework, the genuine advancement of knowledge suffers.

To mitigate these issues, it is essential to emphasize strategic project management that includes clear objectives, prioritization based on relevance and potential impact, and fostering an environment that encourages creative thinking and innovative approaches. By doing so, health informatics research can yield more meaningful and progressive results that better serve healthcare needs. Participants raise an excellent point regarding the necessity of adhering to international standards in health informatics research. As the field increasingly operates within a global context, ensuring research quality becomes paramount for compliance and cooperation across borders. Aligning with international guidelines not only enhances the credibility of research but also fosters collaboration among researchers and institutions worldwide.

Establishing specialized centers equipped with experts in health informatics can play a pivotal role in overcoming significant barriers to research. These centers can serve as hubs for knowledge sharing, innovation, and collaboration, providing the necessary support for researchers to navigate complex methodologies and maintain adherence to global standards.

By bringing together specialists who are well-versed in international regulations, best practices, and emerging trends, these centers can help facilitate high-quality research that is both relevant and impactful. Additionally, they can aid in aligning local projects with global initiatives, thus enhancing the potential for interdisciplinary cooperation and the sharing of valuable insights that can benefit the entire field of health informatics.

The interviewees identified a critical issue in the realm of medical informatics—the absence of a centralized data repository significantly hampers the ability to collect and preserve valuable information, including medical images. This lack of cohesive data management can lead to the loss of crucial insights, which ultimately affects patient care and the progression of medical research.

The establishment of a comprehensive data repository is essential for leveraging stored data effectively. By doing so, healthcare providers can enhance knowledge discovery, enabling researchers and practitioners to analyze patterns and trends that may otherwise remain hidden. Techniques such as data mining can uncover vital correlations within large datasets, contributing to improved clinical decision-making and personalized medicine.

Moreover, image processing plays a pivotal role in analyzing medical images, facilitating advancements in diagnostics and treatment planning. With a structured repository, medical specialists can utilize sophisticated algorithms to enhance image analysis, leading to better detection of diseases and more accurate assessments.

In summary, creating a centralized data repository not only preserves essential information but also opens up avenues for innovative research and improved healthcare outcomes through effective utilization of collected data. This will ultimately enhance the capabilities of medical informatics and transform the practice of medicine. We have accurately highlighted a significant challenge within the intersection of medical informatics and clinical

practice—the absence of a structured and clear relationship between researchers and clinical professionals. This disconnect can severely limit the effectiveness of the data collected, confining its utility primarily to initial diagnosis rather than expanding its application into broader planning, analysis, and reuse.

To address this issue, it is essential to foster a collaborative environment where medical informatics researchers and clinical professionals can work together seamlessly. Establishing formal partnerships and creating integrated teams can enhance communication and ensure that the insights derived from data analysis directly inform clinical practices. Moreover, embedding informatics specialists within clinical settings, such as specialists' clinics, can facilitate the continuous flow of information and collaboration, making data more relevant and actionable.

By developing shared goals and understanding between these two groups, it becomes possible to leverage collected data not only for immediate diagnosis but also for strategic planning and long-term patient management. This approach enhances the potential for evidence-based decision-making and allows for the iterative refinement of data-driven practices.

In conclusion, nurturing formal relationships and integrating medical informatics within clinical environments can significantly increase the value of collected data, transforming it into a powerful tool for comprehensive analysis, planning, and ongoing reuse.

Peter et al.'s study provides valuable insights into a critical barrier facing medical informatics (MI) as a field. The identified lack of coordination among informaticians, research investigators, and operational staff stands out as a significant impediment to maximizing research productivity and capacity. This fragmentation not only hinders the flow of information but also restricts collaborative opportunities that are essential for advancing research efforts [28].

Effective coordination across national, regional, and local MI research programs is crucial for several reasons. First, it helps ensure that data collected is standardized and interoperable, allowing researchers to effectively share and analyze findings. Second, fostering collaboration encourages the sharing of best practices, methodologies, and resources, ultimately enhancing the overall quality and impact of research outcomes.

To overcome these challenges, stakeholders must prioritize establishing formal frameworks for collaboration. This could include regular interdisciplinary meetings, joint research initiatives, and shared platforms for data management. By creating a cohesive ecosystem in which informaticians and investigators work in tandem, the potential benefits of MI research can be fully realized, leading to improved healthcare practices and patient outcomes.

In summary, addressing the coordination gap is essential for unlocking the full potential of medical informatics research, ultimately driving forward the advancements needed in clinical practice and patient care.

Financial factors

Participants bring up an important point regarding the influence of financial issues on laboratory processes and research practices in the field of medical information. Funding constraints can have widespread implications, affecting everything from the scope of research projects to the ability to implement innovative technologies and maintain essential resources.

Financial limitations may lead to inadequate staffing or a lack of access to cutting-edge tools, which can hamper the efficiency and efficacy of research efforts. Additionally, if budgets are not aligned with the strategic priorities of medical informatics, research teams may find themselves unable to pursue promising avenues of inquiry or respond swiftly to emerging challenges.

Moreover, the competition for limited funding often means that only the most compelling proposals receive support, potentially sidelining valuable projects that could contribute to the advancement of medical informatics knowledge. This can create an environment where only certain areas of research thrive, leaving others neglected and underexplored.

To mitigate these financial challenges, it is essential for institutions and organizations to develop sustainable funding strategies. This might involve seeking diverse funding sources, fostering partnerships with industry, or advocating for increased governmental support for medical information research. By addressing financial barriers head-on, we can enhance the research landscape, ensuring that medical informatics can evolve in ways that truly benefit healthcare delivery and patient outcomes.

In conclusion, a comprehensive understanding of the financial context is crucial for optimizing processes and driving impactful research in the field of medical information. Addressing these issues proactively will lead to a more resilient and productive research environment.

Poor support for research projects and insufficient organizational backing can hinder progress in medical informatics, creating a ripple effect that impacts the quality and scope of research.

The lack of accessible information and resources from supporting organizations further exacerbates these issues. When researchers do not have the necessary tools, guidance, or funding, their ability to generate impactful results is severely limited. This is particularly evident in areas like telemedicine, where high costs associated with technology and implementation can deter organizations from adopting necessary innovations.

Certainly, as noted by Peter et al., financial and administrative matters are paramount in the realm of medical informatics research [7]. Without adequate financial support, researchers may struggle to secure the resources needed for meaningful investigations. Moreover, the bureaucratic burden associated with funding applications, compliance, and oversight can divert attention from the essential research work itself, leading to inefficiencies.

To address these financial challenges, it is vital for stakeholders to advocate for increased investment in health information technology and to simplify administrative processes. Collaborating with governmental and private sector partners to obtain funding and support for HI research can also play a crucial role in overcoming these obstacles.

In summary, economic issues are indeed a significant barrier to progressing in health information research. By recognizing and addressing these challenges, we can better support researchers and facilitate the implementation of transformative technologies in healthcare, thereby improving patient outcomes and care delivery [28]. Our recommendations for establishing an industry liaison office at universities are insightful and could foster stronger connections between academia and industry. Such an office would serve as a vital resource, helping to bridge the gap between innovative research and practical application. By keeping researchers informed about sponsorship opportunities and innovations in the field, universities can enhance their capacity to secure funding and support for their projects.

Additionally, the challenges posed by US sanctions against Iran, particularly regarding the provision of essential tools like biosensors, represent significant barriers in conducting research. These sanctions not only limit access to critical technologies but also hinder collaboration and knowledge exchange between researchers in different countries. This situation creates an environment where researchers are unable to access the resources necessary to advance their work effectively.

Moreover, the impact of such sanctions can be far-reaching, affecting not only individual research projects but also the broader research ecosystem. When tools and technologies are restricted, it stifles innovation and slows progress in crucial areas of medical informatics and health technology.

To navigate these complex challenges, universities and research institutions may consider exploring alternative partnerships or funding sources that are unaffected by sanctions. Additionally, advocating for policy changes that facilitate collaboration in scientific research could help ease some of these constraints.

In summary, establishing an industry liaison office can significantly enhance the support for research initiatives, while awareness of the implications of sanctions is essential in addressing the broader context in which research occurs. By tackling these issues collaboratively, we can create a more conducive environment for impactful research in medical informatics and related fields.

Cultural factors

The value of teamwork in research cannot be overstated, as collaborative efforts often yield innovative solutions and comprehensive findings. However, cultural reluctance to embrace team-based approaches can hinder progress and diminish research quality. To address this, universities and research institutions should actively promote collaborative practices through initiatives such as interdisciplinary projects, team-building workshops, and incentives for joint efforts. Leadership plays a pivotal role in fostering environments that prioritize open communication, mutual support, and recognition of collective achievements over individual accolades.

Non-scientific competition, driven by pressures to prioritize publication quantity over impact, risks stifling genuine inquiry and creativity. Institutions should shift toward valuing quality research by implementing evaluation criteria that emphasize innovation and societal impact. Mentorship programs led by experienced researchers can guide students in meaningful inquiry, while structured monitoring systems—including robust evaluation and feedback mechanisms—can enhance accountability and track the progress of research initiatives.

The lack of cooperation among students from different disciplines, particularly in fields like medicine, limits holistic problem-solving. Establishing joint programs, interdepartmental workshops, and collaborative research projects can bridge this gap. Partnerships between medical universities and other academic institutions are essential to facilitate knowledge exchange and interdisciplinary research, fostering a richer academic ecosystem.

User resistance to new technologies often stems from uncertainty about their utility. Applying frameworks like the Technology Acceptance Model (TAM) can help identify barriers to adoption [33, 34]. Educational programs, hands-on workshops, and pilot testing can empower users by demonstrating the benefits of these tools. Integrating practical experiences—such as internships and collaborative projects with healthcare organizations—into curricula ensures students gain confidence and align theoretical knowledge with real-world applications.

Uncertainty about the role of HI in hospitals undermines student motivation and professional engagement. Stakeholders must articulate HI's value in improving healthcare outcomes, supported by case studies showcasing its tangible impacts. Clear career pathways, mentorship programs, and partnerships between academia and

healthcare institutions can provide direction. Strengthening problem-solving skills through interdisciplinary education (e.g., integrating data science and ethics) prepares students to address complex challenges in medical informatics.

In summary, enhancing research quality requires a multifaceted approach: fostering collaboration, redefining success metrics beyond competition, bridging disciplinary divides, addressing technological resistance, and clarifying career pathways in emerging fields like HI. By cultivating environments that prioritize meaningful contributions, interdisciplinary synergy, and practical relevance, institutions can drive innovation and elevate the impact of research outcomes.

The small number of doctoral students at each university, typically only two or three per admission cycle, along with the limited number of universities offering this field distributed across various cities in Iran, pose significant constraints on this research. These limitations were identified through correspondence and emails, as well as by reviewing the CVs of these students, and they were made aware of the research process prior to meetings with them. The next limitation was the reluctance of students to participate in interviews, as it required planning for face-to-face meetings. However, by providing incentives and informing them about the research process, their consent was achieved.

Conclusion

Research in Health Informatics (HI) is fast-paced, with several countries leading the way, including those in the developing world [33]. However, the field encounters numerous challenges in both research and practice. These challenges are often compounded by the need for collaboration between countries, institutions, and researchers, which is crucial for sharing knowledge and resources to address common issues.

Medical informatics encompasses various technologies and tools, each presenting its own challenges [35]. However, our examination focuses on the general challenges of research in medical informatics. We believe this research offers valuable insights for both developing and developed countries to advance their medical informatics objectives and, as a result, improve human health. Furthermore, the impact of this research on policymakers could help create supportive frameworks necessary for the growth of HI.

Although conducting research poses challenges, several of the obstacles discussed here (such as general research factors) can be viewed as deterrents to data manipulation and breaches, ultimately impacting research quality. Some barriers, like sanctions on biosensors and site filtering, are specific to Iran and do not exist in most countries; however, they adversely affect HI research. It is hoped that the findings of this study will positively influence the advancement of the HI field around the world. This study also suggests that future research should explore technological innovations that could help alleviate some of these challenges. By examining successful implementations of HI in other countries, researchers may find encouraging evidence that overcoming these obstacles is achievable.

Implications

The uncertain role of Health Informatics (HI) in hospitals and students' weak problem-solving abilities are factors contributing to their reluctance to engage in research within the field of medical informatics. To address these issues, it is necessary to:

1. Clarify the Role of HI: Communicating the value and importance of HI in the healthcare system can encourage students to show greater interest in this area.
2. Enhance Problem-Solving Skills: Universities should incorporate specialized educational units aimed at strengthening problem-solving skills into their curricula and utilize experiential teaching methods.
3. Establish Mentorship Programs: Counseling programs involving professionals can help enhance students' skills effectively.
4. Promote an Interdisciplinary Approach: Collaborating with other fields such as data science and public health can provide new perspectives to students and improve their ability to tackle complex issues.

By strengthening these factors, a brighter future for research in the field of medical informatics can be created.

Abbreviations

MI	Medical Informatics
HI	Health Informatics
HN	Hamed Nadri
AG	Ali Garavand
HIM	Health information management
HIS	Hospital Information Systems
EHR	Electronic Health Record

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
The authors confirm their contributions to the studies as follows: H.N., A.G., and N.A. conceived and designed the study; H.N., H.A., A.G., and N.A. revised the data collection instruments, analyzed, and interpreted the results; and H.N., A.G., and N.A. wrote the first draft of the manuscript. All the authors reviewed the results and approved the final version of the manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the relevant institutional review board prior to the commencement of the research. Informed consent was obtained from all participants, ensuring that they were fully aware of the study's purpose, procedures, potential risks, and their right to withdraw at any time without penalty.
Permission was obtained from the Lorestan University of Medical Science and Research Ethics Committee with code No. IR.LUMS.REC.1404.001. Written informed consent was obtained from all participating students.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Nadri H, Rahimi B, Timpka T, Sedghi S. The top 100 articles in the medical informatics: a bibliometric analysis. J Med Syst. 2017;41(10):150.
2. Hoyt RE, Yoshihashi AK. Health informatics: practical guide for healthcare and information technology professionals: Lulu. com; 2014.
3. Mullner RM, Chung K. Current issues in health care informatics. J Med Syst. 2006;30(1):1–2.
4. Chen L. Essays on health information technology: insights from analyses of big datasets. Atlanta: Georgia State University; 2016.
5. Hanna MG, Pantanowitz L. The role of informatics in patient-centered care and personalized medicine. Cancer Cytopathol. 2017;125(S6):494–501.
6. Balali Meybodi F, Mahmoudi Zarandi M, Hassani M, Rajabi MJIJHR. Surv Barriers Health Res Promotion. 2015;4(2):63–70.
7. Bath PA. Health informatics: current issues and challenges. J Inform Sci. 2008;34(4):501–18.
8. Ashrafi N, Kuilboer J-P, Joshi C, Ran I, Pande P. Health informatics in the classroom: an empirical study to investigate higher education's response to healthcare transformation. J Inform Syst Educ. 2014;25(4):305–16.
9. Hristidis V. Challenges and communities of medical informatics research. ACM SIGMOD Record. 2013;41(4):51–4.
10. Mitwalli H, Al Ghamdi K, Moussa NJE-EMHJ. 99–104. Perceptions, attitudes, and practices towards research among resident physicians in training in Saudi Arabia. 2014.
11. Kim K. Perceived barriers to research utilization by Korean university librarians. J Acad Librariansh. 2005;31(5):438–48.
12. Kumar J, Memon A, Kumar A, Kumari R, Kumar B, Fareed SJC. Barriers experienced by medical students in conducting research at undergraduate level. Cureus. 2019;11(4):e4452.
13. Shepherd M. Challenges in health informatics. In: Proceedings of the 40th Annual Hawaii International Conference on System Sciences (HICSS'07); 2007 Jan 3-6. Waikoloa, HI: IEEE; 2007. p. 135. https://doi.org/10.1109/HICSS.2007.123.
14. Norris AC. Current trends and challenges in health informatics. Health Inf J. 2002;8(4):205–13.
15. Abdul S, Adeghe EP, Adegoke BO, Adegoke AA, Udedeh EH. A review of the challenges and opportunities in implementing health informatics in rural healthcare settings. Int Med Sci Res J. 2024;4(5):606–31.
16. Paton C, Househ M, Malik M. The challenges of publishing on health informatics in developing countries. Appl Clin Inf. 2013;04(03):428–33.
17. Nabeiei P, Mousavinezhad H, Amini M. Barriers that prevent implementation of research in medical education. 2015.
18. Simoes E. Health information technology advances health care delivery and enhances research. 2015;112(1):37.
19. Samadbeik M, Asadi H, Mohseni M, Takbiri A, Moosavi A, Garavand A. Designing a medical tourism website: A qualitative study. Iran J Public Health. 2017;46(2):249–57.
20. Martínez-Mesa J, González-Chica DA, Duquia RP, Bonamigo RR, Bastos JL. Sampling: how to select participants in my research study? Bras Dermatol. 2016;91(3):326–30.
21. Johansson G, Östberg A-L. Oral health-related quality of life in Swedish young adults. Int J Qual Stud Health Well-being. 2015;10:27125.
22. Lyytinen K, Baskerville R, Iivari J, Te'eni D. Why the old world cannot publish? Overcoming challenges in publishing high-impact IS research. Eur J Inform Syst. 2007;16(4):317–26.
23. 7 Research Challenges (And how to overcome them): Walden University. 2010. Available from: https://www.waldenu.edu/connect/newsroom/publications/articles/2010/01-research-challenges.
24. Riazi H, Abedian S, Bitaraf E. Functional evaluation of hospital information systems. Tehran: Sarvar Kian; 2015.
25. Wager KA, Lee FW, Glaser JP. Managing health care information systems: a practical approach for health care executives. Wiley; 2005.
26. Torabi M, Safdari R. Electronic health electronic: structure, content and evaluation. Tehran: Jafari; 2010.
27. Sittig DF. Grand challenges in medical informatics? J Am Med Inform Assoc. 1994;1(5):412.
28. Embi PJ, Payne PRO. Clinical research informatics: challenges, opportunities and definition for an emerging domain. J Am Med Inform Assoc. 2009;16(3):316–27.
29. Ferrari A, Cachia R, Punie Y. Innovation and creativity in education and training in the EU member States: fostering creative learning and supporting innovative teaching. JRC Tech Note. 2009;52374:64.
30. Herland M, Khoshgoftaar TM, Wald R. A review of data mining using big data in health informatics. J Big Data. 2014;1(1):2.
31. Moghaddasi H, Asadi F, Rabiei R, Rahimi F, Shahbodaghi R. Presenting an evaluation model for the cancer registry software. Acta Informatica Med. 2017;25(4):267.
32. Abhari S, Monem H, Garavand A, Bastani P, Rezaee R. Designing a thesis telesupervision system for postgraduate medical sciences students. J Adv Med Educ Prof. 2019;7(4):191.
33. Rahimi B, Nadri H, Lotfnezhad Afshar H, Timpka T. A systematic review of the technology acceptance model in health informatics. Appl Clin Inf. 2018;09(03):604–34.
34. Garavand A, Aslani N, Nadri H, Abedini S, Dehghan S. Acceptance of telemedicine technology among physicians: A systematic review. Inf Med Unlocked. 2022;30:100943.
35. Amiri P, Nadri H, Bahaadinbeigy K. Facilitators and barriers of mHealth interventions during the Covid-19 pandemic: systematic review. BMC Health Serv Res. 2023;23(1):1176.

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