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On the Need for Healthcare Informatics Training among Medical Doctors in Jordan: A Pilot Study

Shefa M. Tawalbeh ^{*}, Ahmed Al-Omari , Lina M. K. Al-Ebbini and Hiam Alquran

Biomedical Systems and Informatics Engineering Department, Yarmouk University, Irbid 21163, Jordan

^{*} Correspondence: s.tawalbeh@yu.edu.jo

Abstract: Jordanian healthcare institutes have launched several programs since 2009 to establish health information systems (HISs). Nowadays, the generic expectation is that the use of HIS resources is performed on daily basis among healthcare staff. However, there can be still a noticeable barrier due to a lack of knowledge if medical doctors do not receive proper training on existing HISs. Moreover, the lack of studies on this area hinders the clarity about the received versus the required training skills among medical doctors. To support this research initiative, survey data have been collected from specialized medical doctors who are currently affiliated with five Jordanian universities to assess their need for HIS training. The results also aim to explore the extent of medical doctors' use of HIS resources in Jordan. Moreover, they examine whether medical doctors require additional training on using HIS resources or not, as well as the main areas of required training programs. Specifically, this paper highlights the main topics that can be suitable subjects for enhanced training programs. The results show that most respondents use HISs in their daily clinical practices. However, most of them have not taken professional training on such systems. Hence, most of the respondents reported the need for additional training programs on several aspects of HIS resources. Moreover, based on the survey results, the most significant areas that require training are biomedical data analysis, artificial intelligence in medicine, health care management, and recent advances in electronic health records, respectively. Therefore, specialized medical doctors in Jordan need training on extracting useful and potential features of HISs. Education and training professionals in healthcare are recommended to establish training programs in Jordanian healthcare centers, which can further improve the quality of healthcare.



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Keywords: health information systems in Jordan; survey analysis; data analysis; professional training; artificial intelligence in medicine; biomedical data analysis; decision support system; medical doctors

1. Introduction

Over the years, developed countries have successfully adopted information technology in the healthcare sector. Since the mid-2020s, the American college of surgeons (ACOS) sought to improve the standards of records being created in clinical settings. So, they started to officially document patient data to create standardized records [1]. With the development of computers, in the 1960s and 1970s, the combination of computers and medical records started to appear. In the 1980s and 1990s, a big leap in health information software development occurred [2]. Thus, HISs shifted from paper-based to computer-based processing and storage of healthcare data. Moreover, HISs have shifted from institutional-centered, departmental, and hospital to regional and global connections. HIS users expanded from patients and health consumers to healthcare professionals and administrators. HIS data are used for patient care and administration, healthcare planning, and clinical research. Moreover, HISs have a big effect on collecting different types of health data (i.e., medical, health, and genomic data). Indeed, these types of data act as a jackpot for research projects. Therefore, HISs will support medical research and the development of the healthcare sector. The healthcare givers' roles are currently occurring

in the context of the digital health revolution, which is not just a technological but also a cultural one. The transition to digital health, according to Mesko et al., is essentially a cultural one. The authors go into greater detail about many transformational themes, such as the changing roles of patients and professionals, empowered consumers, the effects of disruptive technology, and the incorporation of digital technologies in developing models of care [3].

In Jordan, healthcare sectors started to adopt HISs in 2009. This was started mainly under governmental adoption to automate the public healthcare sector in Jordan through a program named Hakeem [4]. The program started to successfully implement electronic health record solutions (EHS) all over the public health sector [5]. Healthcare providers, pharmacists, nurses, and others can access medical records electronically through the patients' national ID numbers. All types of medical information can be accessed through EHS such as physical examinations, surgical reports, patient visits, digital radiological exams, laboratory results, and others. At this point, it is worth mentioning that many functionalities have been implemented in the public health sector in Jordan such as a computerized patient record system (CPRS), a patient information management system (PIM), a clinical scheduling system, emergency department integration software (EDIS), clinical reminders, a nutrition and food system (NFS), bar code medication administration (BCMA), VistA imaging, laboratory instrument interfaces, an electronic medical record review tool (EMRRT), a patient billing module, an inventory management module, and care management [6].

Moreover, many extra modules have been developed as applications in the Internet-of-Things (IoT). For example, the Dr@Hakeem mobile application is the first national mobile application in Jordan [7] that provides details for the physicians concerning their daily appointments and patient's medical history, and enables physicians to track patients' appointments remotely; thus, improving the healthcare process in the public health sector in Jordan. Other examples were represented in dashboards and reporting tools, a medical calculator, and a medical chart review tool.

As previously mentioned, HISs are starting to spread in all Jordanian healthcare centers, and all medical staff are expected to use HISs daily. However, it is not clear if the healthcare providers are well-trained on HISs. More specifically: Do medical doctors require training on HIS, and what specific skills are needed? In this paper, we are highlighting the previous questions by conducting a survey targeting medical doctors with relatively high expertise in Jordanian healthcare centers and who are involved in academic organizations. The purpose of such investigation is to assess the needs of HIS training for appropriate planning for training programs. There is a gap in knowledge about the required training skills that should be included in programmed training. This pilot study could serve as a guideline for educational professionals developing training programs targeting medical doctors, where medical doctors are considered the pillar of the healthcare sector.

2. Related Work

Around the same time that Jordan adopted HISs, regional nations began to establish HISs. For instance, HIS integration began in 2008 in the United Arab Emirates and Saudi Arabia. Although it began in Bahrain and Oman a decade earlier, in 2000 [8,9]. Alsadaan et al. performed a systematic review of the status of HISs in the Arab world and they found that they lag behind due to financial and professional incompetency. Strategic plans are required to overcome financial and cultural barriers to be competitive in the HIS field [10]. His recommendation supports one of the aims of this paper, which is educating HIS users, especially medical doctors, and highlighting their needs in a more specific manner. More barriers were discussed by Hayajneh et al. [11], which were summarized as a lack of financial resources, poor management, poor staff IT competency, and a lack of qualified IT personnel. A recent interpretive study explored the challenges to e-health in Jordan by Jalghoum et al. [12]. According to his findings, the main challenges are the lack of regulations and policies to support health information systems, lack of financial

resources, privacy concerns, and the nature of the healthcare sector. In this paper, we are focusing on the need for training on HISs which will overcome some challenges that face HISs. Many studies were conducted to assess the needs and challenges of HISs by nurses [13–15], accordingly training programs are established to train nurses to use HISs through Hakeem Academy [16]. However, in this study, we are focusing on the needs of medical doctors. Another important study that is more closely related to the scope of our paper was conducted by Jabareen et al. in 2020. This study was carried out in Jordan and Palestine to determine health informatics use and to assess the training needs of health professionals [17]. The respondents were health professionals (i.e., physicians, allied health professionals, and nurses) that are subject to the use of HIS. The study recommended that health professionals in Palestine and Jordan are in need of training in HIS. In our study, we are specifically targeting medical doctors and highlighting their specific training needs.

In Jordan, Hakeem Academy is the only program that is responsible for the development and education of EHS [16]. The aim of this academy, which was established in 2013, is to provide training to healthcare professionals, EHS employees, and university students in the field of health informatics and information technology. They have the mission to educate healthcare sector employees to use HISs to provide them with the required skills necessary to work efficiently on informatics platforms. The academy targets all health professionals. Most of the ongoing training programs are specific to nurses, where they serve an important role in entering the patient data, however, to date there are no training programs designed specifically for medical doctors in Jordan. In this paper, we are specifically focusing on medical doctor needs; moreover, the targeted sample has academic experience in universities, which provides another layer of experience to support professionally programmed training.

Nurses, administrative staff, and radiologists, etc., use HISs differently and therefore, require a different type of training. Here, we are investigating what specific needs are required for medical doctors to help them in their daily clinical/academic practice. This question is asked to help design a suitable training program specifically for medical doctors and HIS needs may be reflected on the curriculum that they teach in universities (most of the participants are medical doctors affiliated in teaching hospitals).

Our study aims to assess the need for training and investigate the needed skills that require training among medical doctors in Jordan. This will be a guideline for healthcare professionals to establish professional training programs and/or diplomas. The next section will show the method used to conduct the survey followed by the results of the survey.

3. Materials and Methods

A descriptive cross-sectional design was conducted among medical doctors at five universities in Jordan. A sample of medical doctors with a subspecialty in medicine was selected. The study questionnaire was sent via email to medical doctors that hold a subspecialty in medicine and work in governmental universities. The survey was created using Microsoft Outlook (Microsoft Outlook, Redmond, DC, USA) forms by the research team and it was sent to the work email of the selected doctors. These emails were collected from the website of the university manually. The sample of participants was carefully collected so that all are medical doctors with subspecialists who work both in an academic and clinical environment. The participants hold different specializations in medicine such as surgery, internal medicine, anesthesia, pediatrics, obstetrics and gynecology, and others. This information was collected once the research team collected the emails from the university websites. A total number of 537 emails were sent; unfortunately, only 65 respondents responded to our survey. The questionnaire sought information about the demographic characteristics of participants, the use of computerized health systems, training and usage of HISs, and the needed health informatics skills. The perception of medical doctors regarding the use and adequacy of HISs for healthcare practice at their institutions was explored by asking 12 questions using a multiple-choice question for some questions, and a 5-point Likert-type scale for the rest of the questions. The questionnaire

was self-completed and filled out anonymously. Completing the questionnaire required an estimated average time of 3–5 min. The list of questions of the survey can be found in the Supplemental Data S1. The results of the survey can be found in Supplemental Data S2. Data were analyzed using Microsoft Excel, and R [18]. Data were described using means, counts, and percentages as appropriate.

4. Results

4.1. Participants

A total of 65 medical doctors responded to the survey. Respondents all have a subspecialty in medicine or a higher degree after their medical degree. Fifty percent have 10–20 years of experience in medicine, and 37% have more than 20 years of experience. Table 1 shows more details about the demographic data of the respondents.

Table 1. Demographic table of survey participants.

Gender	71% Male 29% Female
Qualifications *	15% MD with a specialty 80% MD with subspecialty 5% other
Years of experience	5% 1–5 years 9% 5–10 years 51% 10–20 years 35% >20 years
Workplace	13.5% private clinic 13.5% governmental hospital and/or private hospital 61.5% university or academic institute and/or university hospital 11.5% governmental medical center and/or research center
Most of daily work distribution	31% equally distributed between academia and clinical practice 53% clinical practice 15% academia

* Specializations in medicine such as surgery, internal medicine, anesthesia, pediatrics, obstetrics and gynecology, radiology and nuclear medicine, neuroscience, and other.

4.2. Training and Usage of Health Information Systems

Fifty-three percent of the participants did not take professional training on healthcare information systems, though almost half of the participants use HISs moderately to high-level usage in their daily clinical practice. The respondents were asked to choose which HISs they use in their daily work (i.e., health informatics tools, biomedical application tools, and biomedical systems). Respondents were able to choose one or more options. The results showed 82% of the respondents use health informatics tools (i.e., medical electronic records and patient portals). Moreover, 31% of the participants in the survey use biomedical application tools (i.e., image processing software and data analysis software). Also, 12% of the respondents use biomedical systems (i.e., remote monitoring and telemedicine systems). Finally, 2% reported that they do not use any of the mentioned HISs.

4.3. Extra Needs

In the previous section, the participants showed the usage of HISs. Here we are highlighting if the participants need extra training in HISs or not, and in which area training is required. More than 80% of the participants reported that they need training (or extra for those who received previous training). Figure 1 is a pie chart that shows the percentage of respondents who rated the extent of training on HISs. The results showed that 80% of the participants need extra training in biomedical systems and applications

with moderate to high need. Moreover, 84% of participants reported a moderate-high to high need for extra training in biomedical data analysis for research purposes. Fifty percent of the participants require moderate-high to high need for extra training related to healthcare management (i.e., administrative and management aspects of HISs including staffing, budget, and records). Table 2 shows details of the number and percentage of participants who require extra training in the previously mentioned skills.

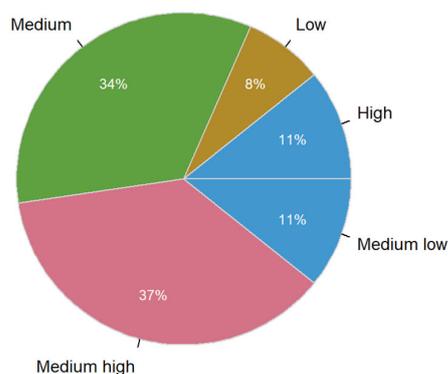


Figure 1. Pie chart showing the percentage of participants that requires extra knowledge or training on biomedical systems and applications in Jordan.

Table 2. Percentage of participants who reported the need for extra training on biomedical data analysis tools and healthcare management.

	High and Medium-High	Medium	Medium-Low and Low
Biomedical data analysis tools for research purposes	57%	32%	11%
Healthcare management	51%	31%	18%

Extra analysis has been conducted on the respondents who have more than 20 years of experience (23 respondents out of 65). This sample of respondents witnessed the transition of using HISs in Jordan in 2009. The analysis showed that 15 out of 23 did not take any previous training on HIS. Thirteen out of 23 use HISs in their daily clinical practice from medium to high usage, and 10 out of 23 said they have low usage of HISs. Twenty out of 23 responded that they need extra training on HISs at a medium to high extent. This is compared to 33/48 of younger respondents who require extra training on HIS at a medium to high extent. So, from this pilot data, older generations still showed a degree of interest in receiving extra training on HISs. We note again that most of these MDs are academicians in universities who have knowledge of the importance of HISs and have a major role in educating medical students, so they are required to update their knowledge of how to use these HISs. Moreover, these MDs have seen the difference before and after adopting HISs in Jordan in 2009. They have realized the difference and importance of such systems and how HISs can enhance their daily clinical practice; thus, they showed interest in receiving more training.

4.4. The Needed Skills

As presented in the previous section, the majority of medical doctors reported the need for extra training in HISs. In this section, we highlight more specifically the skills they prefer to have training in. Mainly the respondents reported the need for extra training in biomedical data analysis, artificial intelligence in medicine, healthcare management systems, and recent advances in patient medical records. The bar plot shown in Figure 2 shows the health informatics skills reported by the medical doctors in Jordan in more detail.

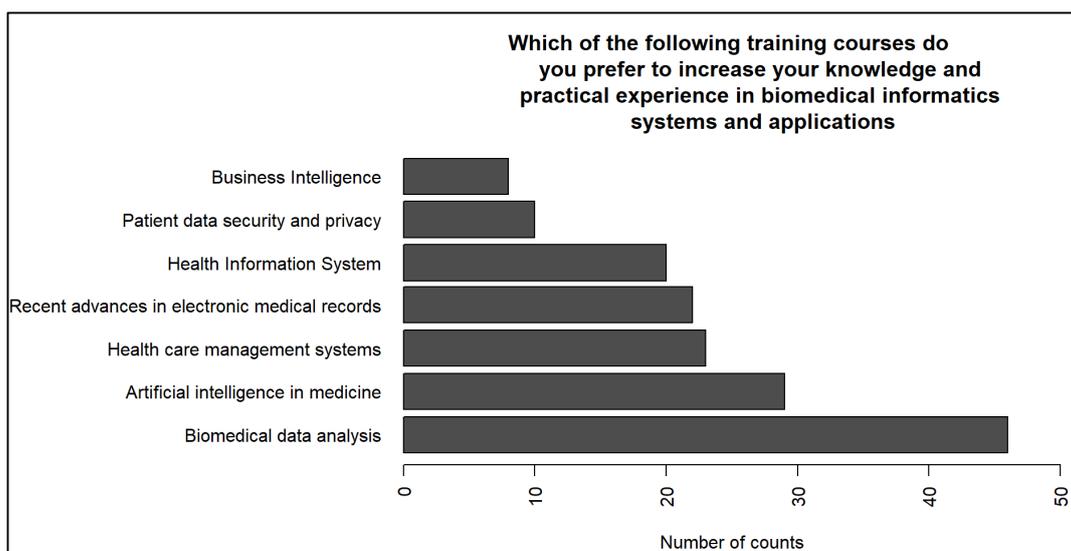


Figure 2. Bar plot showing the percentage and count of participants that require more training in health informatics skills (i.e., biomedical data analysis, artificial intelligence in medicine, recent advances in electronic health records, healthcare management, health information systems, cyber security—patient data security and privacy, and business intelligence.). Note that respondents could choose more than one training course; the total number of choices was 158 among the 65 respondents.

5. Discussion

The recommendations of this survey have practical implications in the healthcare, academic, governmental, and private sectors in Jordan. Being data literate allows us to make the best use of data to increase service quality and safety, support decision-making, forecast outcomes, lower risks, and plan services and workforce resourcing. Much of the data we currently collect is underutilized. Without everyone playing their part, data are not analyzed or used to their full potential. Hence, data will be better collected, processed, and used if there is an analytics-savvy workforce. A group effort in which everyone participates results in more intelligent choices and actions. Developing healthcare models requires a combination of hardware and software. Regarding the former, hardware penetration has grown along with internet access, mobile phone use, and smartphone use. Robotics, genomics, telemedicine, virtual reality, and augmented reality are examples of disruptive medical technologies. Regarding the latter, software/information components along with peer assistance, open-access clinical studies, and a vast amount of medical information generated daily in our professional practice and across our health systems are all becoming more and more accessible. This not only provides the potential for higher quality and more information to be gathered in healthcare, but also the opportunity for self-care [19].

The majority of medical research on health information systems has prioritized technology over the human element. For instance, studies that sought to use health sensors to influence patient behavior did not consider the significance of providing coaching with the technology for both doctors and patients [1]. Despite similar technology changes that have occurred in healthcare before, the status quo has never undergone a significant cultural upheaval. In the 1990s, when personal computers were widely accessible, e-health evolved [20]. Tele-medical services emerged when such computers could be connected to networks [21]. Applications for health 2.0 and medicine 2.0 were made possible by the growth of social media networks [22] and the increase in computation power from harnessing the power of GPUs [23,24]. The widespread use of smartphones and, later, mobile devices prompted the development of mobile health [25]. However, as of the 2010s, both patients and their caregivers are finding it difficult to keep up with the pace of emerging disruptive technology. Furthermore, a caveat that the use of health information systems raises: Unreliable web sources and incorrectly interpreted data from digital health devices

might result in medical decisions that put patients' lives in danger if they are made without consulting any medical specialists [26]. In addition, unauthorized third parties could obtain sensitive patient health information with devices that make data accessible to stakeholders and patients. It was demonstrated that medical gadgets may be hacked remotely [27]. Thus, we will soon endanger patients' health if we are unable to appropriately and securely incorporate digital health into healthcare.

We present some recommendations for Jordan and comparable nations to implement the necessary changes to their health information systems. First, patients are the main driving reason for starting these changes because doctors are reluctant and lack incentives to undergo this cultural revolution. Therefore, encouraging patients to choose and visit doctors that use health information systems in their treatments will result in time savings and better treatments for the patients. Second, the culture of successful healthcare delivery depends on patient-physician communication, empathy, and collaborative decision-making. Therefore, by sharing accountability, medical professionals might also share the load of selecting the appropriate therapy and incurring the associated risks. Third, medical professionals must be persuaded that disruptive innovations also have the potential to eliminate the tedious aspects of their work, allowing them to devote more time and attention to the patient. In this situation, doctors are transitioning from being an authority, making all the decisions, to become guides for their patients in the maze of healthcare information and technologies [28]. Fourth, modern medical education must adopt new methods, including post-graduate instruction, to teach students skills that make their jobs easier and prepare them to use technology. Mesko et al. demonstrated that a well-designed course may be effective in preparing students for the widespread use of the internet, social media platforms, and digital technology. This is enhanced by ongoing evaluation-based feedback [29]. Fifth, the proper use of the HISs should be considered as a requirement for promotions and rewards. Sixth, set up the necessary follow-up strategy with the managers. Finally, reduce the doctor-patient ratio to provide doctors more time to operate on the systems effectively.

As mentioned above, Hakeem Academy is responsible for HIS training in Jordan. The academy has partnerships with four private and public universities to educate and train students on HISs. Moreover, the company provides training to their employees to be able to perform their duties for HIS implementation. The recommendations of this paper will serve as a guideline for Hakeem Academy and Jordanian HIS educators to collaborate and establish training diplomas to improve the skills of medical doctors on HIS. From the survey results, the respondents reported the need for extra training in biomedical data analysis, artificial intelligence in medicine, healthcare management systems, and recent advances in patient medical records respectively. These topics are discussed in the following subsections to explain how these topics are considered a priority for medical doctors.

5.1. Data Analysis for Research Purposes

In Jordan, in 2019 a health data analytics program named 'HDA' was launched [30]. It was established to support research and decision-making for the healthcare sector in Jordan. The HDA program was developed after the accumulation of large amounts of medical data that were created after automating around 195 healthcare facilities in Jordan by the Hakeem program. The resulting large database offers a repository for healthcare research on different topics. The HDA program offers a reliable way for researchers to extract information from the HDA database and offers technical solutions, data-mining tools, and analytical solutions. Therefore, this program supports studies and research, improves data quality, and the data analysis leads to better business intelligence solutions.

Considering the availability of healthcare data, we raise the question: Do medical doctors, who are the pillars of healthcare sector, have the skills to analyze healthcare data efficiently? This question has been proposed in many developed countries and training courses and programs have been proposed [31–35]. The effectiveness of such training will have a big effect on the utilization of our medical data, and will enhance the way they are

stored and used. Most of the medical doctors included in our survey noted the need of training on data analysis to support their research studies. This will definitely be a hot topic that could be the subject of training.

5.2. Artificial Intelligence and Machine Learning in Medicine

The ability to quickly process large amounts of data is one of the major benefits of artificial intelligence and machine learning techniques. The purpose is to supplement clinicians' knowledge with the speed and accuracy of AI and machine learning to find the most appropriate diagnosis for each patient. The personalization of prescription medications is a further area that is rapidly developing. Patients respond differently to different types of drugs. They also have different ways of interacting with the healthcare system. So, personalizing that interaction may help identify the right prescription for the right person. Various medicine types have different effects on patients. Additionally, patients connect with the healthcare system in various ways. Finding the appropriate medication for the right patient at that particular period in the healthcare trajectory means customizing that engagement.

Many researchers have conducted experiments in building a reliable AI model to assist doctors in their field and develop these strategies as milestone programs in their clinics. However, diagnoses, treatments, the monitoring system, and visualization procedures for some images or histopathological samples images are not trustworthy or sufficiently robust for individual doctors; they need an automated system to make decisions that are similar across all areas and countries, without being subject to human opinions. This study is carried out by researchers in Jordan to estimate the need for doctors to train on such AI systems. This issue is crucial due to the lack of specialists in our country, especially in remote villages and Bedouins in Jordan. Training on such systems and utilizing them in clinics will reduce the crowding of public hospitals in towns and will preserve effort, time, and money. The availability of robust systems with good training will lead to fewer misdiagnoses and mistreatments of patients, easier prescribing of medication drugs and less variation among doctors.

5.3. Recent Advances in Electronic Health Records

Electronic health records which are basically considered the digital version of patients' paper records, provides accurate, up-to-date, and complete information about patients at any healthcare location. Enabling quick access to patient records results in more coordinated and efficient care. The past decade has encountered an eruption in the volume of digital information archived and administered in electronic health records (EHR). Thus, machine learning and deep learning have evolved in clinical tasks based on EHR data. These techniques have various clinical and medical applications such as information extraction, output prediction, phenotyping, visualization, and representation [36]. In addition, current research discusses challenging topics in EHR such as data heterogeneity and the shortage of universal standards to achieve interoperability. Although heterogeneous data were handled using code-based representations such as natural language processing (NLP) [37], many important real-value measurements such as vital signs and laboratory tests are ignored. As such, deep EHR studies represent an ongoing area of future research.

5.4. Health Management Aspects and Their Importance in Improving Healthcare Quality

Quality of healthcare is represented by desired health outcomes achieved using effective, safe, and integrated health services. Here, the importance of operations management arises, because the effective delivery of healthcare services leads to the ultimate saving and improvement of lives. In general, healthcare management includes (i) planning and coordinating a healthcare establishment's non-clinical activities, (ii) creating work schedules and staff training and hiring new staff, (iii) managing finances of the whole healthcare institution, (iv) identifying ways to improve healthcare services such as getting feedback from patients, and (v) overseeing the workflow in all departments of the healthcare institution

so that it ensures adherence to standards [38]. In addition, open-source EHR (OS-EHR) is a new phenomenon in the management of any healthcare organization [39]. The importance of OS-EHR is due to various EHR implementations that are becoming financially worrying. Ultimately, research will be focused on the planning of OS-EHR in the future.

5.5. Educating Medical Doctors on HISs and Needed Improvements

Walsham [40] asserted that training is a typical strategy for dealing with HISs. While receiving training in methods and procedures might be beneficial, it is also important to educate people at all levels in order to improve their capacity for efficient information use. Training is typically done in days, but educating someone to use information requires consistent work over years-long time periods [40]. This might be accomplished by working with various organizations, including colleges, hospitals, and medical businesses, to offer workshops, training sessions, and courses on HISs. More important, healthcare professionals need to understand how to use health information systems for action. Developing communication, information literacy, and knowledge sharing skills are some of the broader skills that are needed for this than just data entry.

A list of recommendations to aid in the path of education on HISs is started by being observant and data reliant. Usually, a question is asked before using data. Knowing what information is needed and making sure of excellent data gathering, as well as having a clear data query and a plan for how to use the results. Proactively ensuring the accuracy of data. Make sure that accurate data is collected, report any problems with it, and help and guide others in doing the same. Be aware of your safety nets. Who in your organization—internally and externally—can help you with your data needs and questions. The HIS journey will be more feasible if the appropriate people and resources are available. Follow privacy and data security regulations. Sharing data and information provides other people a transformative resource. Consider enhancing or brushing up on quantitative skills, statistical knowledge, and data analysis to take advantage of the latest technologies and tools. Participate in campaigns or co-designs that promote inventions and the use of digital technology.

Additionally, the government should provide hospitals and healthcare facilities with the necessary electronic health systems, including PCs, software, training, and internal networking within the same facility and among different facilities, also, make sure that health services are adequately funded, operated by qualified personnel, and subject to legal restrictions so they can use technology in a professional manner. Shim et al. [41] adapted the updated DeLone and McLean Model of Information Systems Success (D&M IS Success Model or DMISM) [42] to suggest factors necessary for the provision of health information that brings benefits to users. They concluded that the quality of information systems comprises three major factors: information quality, system quality, and service quality and they presented empirical evidence on DMISM usefulness and effectiveness in this area. Moreover, at various levels of the health system, new or improved training (basic and in-service) curricula and materials should be established to improve the performance of current data management activities. Also, new surveys, survey modules, and inquiry methodologies should be employed periodically or regularly in the future to monitor development and carry out frequent evaluations.

5.6. Limitations of the Study

There are some limitations to this study. It was carried out as part of a survey to determine the extent of HIS usage, and to assess the training needs. We neither tested any hypothesis nor examined associations between variables. The number of respondents is not equally distributed between the selected institutes. Moreover, the number of respondents was relatively small compared to those who were invited to participate in the survey, which was the main challenge in this study. Moreover, Jordan is a low-population country compared with regional areas, and it is a developing country that lacks advanced resources in many specialized medical area. However, the respondents cover almost all areas under

consideration and many medical fields. On the other hand, this raises the issue that non-respondents are likely to be either uninterested or busy to participate. Nonetheless, the survey does reveal some potentially important issues concerning the daily operation of a professional group. This group is represented by medical doctors with subspecialties in medicine who also work in the academic field. Another limitation, is the lack of studies related to training development for medical doctors in Jordan or in similar countries.

6. Conclusions

Medical doctors in Jordan are in need for additional training on using recent HIS resources. Educational and training programs on health informatics are strongly recommended in Jordanian medical centers. Enhancing healthcare quality is heavily associated with the main aim of performing such HIS training programs. This paper has served as a guideline for identified training programs that may be specifically designed to train medical doctors. It highlighted important issue to assess the need of medical doctors to receive specific training on recent HISs. Based on the findings from this study, we suggest the following topics as candidates for medical doctor training on HISs: IT in healthcare, statistical analysis tools, introduction to health informatics, management control and funding systems in healthcare, and IT project management in healthcare. Moreover, this paper paves the way for academicians to enhance the curriculum of medicine in Jordanian universities, where topics related to health informatics may be embedded as core courses for medical students.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/informatics10020035/s1>, Supplemental file S1. The survey list of questions sent to the medical doctors. Supplemental file S2 contains the survey results for the 65 participants.

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Institutional Review Board Statement: The data was taken anonymously, so authors sought that there is no risk.

Informed Consent Statement: Participants consent was waived because participants approved to take the survey after they were notified the topic and aims of the study. The aims are shown in the survey sheet before the list of questions (please refer to Supplemental Data File S1 attached).

Data Availability Statement: Data is contained within the Supplementary Materials. The data presented in this study are available in Supplemental Data S1 and S2 Files.

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Conflicts of Interest: The authors declare no conflict of interest.

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