Chapter 21
Informatics Education in Healthcare: Lessons Learned

Eta S. Berner

Informatics education programs have been evolving over an approximately 40-year span of time. Existing programs have changed over the years as new and different driving forces have influenced them. While some of the programs began with a few visionaries with expertise and interest in computer applications in healthcare, the current drivers for informatics education and manpower development are clearly the increased sophistication of technology, including electronic health records, distance learning technologies, and telemedicine applications as well as policies mandating their integration into healthcare delivery.

The audience for informatics education has grown in a similar manner. From an initial focus on the development of informatics researchers who would apply their informatics and computer science knowledge and skills to the healthcare domain, we have seen programs being developed for healthcare administrators, practitioners and scientists who recognize that they need informatics expertise to function within their own domain.

Despite the differences among the programs in terms of focus, students, and purpose, there are also many commonalities, but these may be more difficult to recognize as one reads each individual chapter in this book. For that reason, this chapter synthesizes the lessons that have been described throughout the book using the following organizational framework:

- Evolution of Informatics Education Programs
- Relationship of Educational Programs to Workforce Needs and Opportunities
- Informatics Competencies and Sources of Curriculum Materials

E. S. Berner (✉)
Department of Health Services Administration, School of Health Professions, University of Alabama at Birmingham, Birmingham, AL, USA

Department of Medical Education, School of Medicine, University of Alabama at Birmingham, Birmingham, AL, USA
e-mail: eberner@uab.edu

E. S. Berner (ed.), *Informatics Education in Healthcare*, Health Informatics,
https://doi.org/10.1007/978-3-030-53813-2_21

- Online Instructional Strategies
- Evaluation and Accreditation of Informatics Education Programs in Healthcare

These topics mirror the stages of individual program development including development and evolution of the overall program, identification of competencies and development of the curriculum, instructional strategies, and program evaluation methods. They also reflect the evolution of the professionalism of the field of informatics.

Evolution of Informatics Education Programs

Informatics Education Programs in Europe and the U.S.

John Mantas identified phases that were encountered in the evolution of many of the European informatics programs. As Mantas described it, these phases include the initiation phase, when individual programs, led by a visionary leader, began and, because there were no models or examples, development of curricula was more or less a trial and error endeavor. As some of these early programs developed, eventually there became more of a consensus on curricular guidelines and programs began to expand. As curricula became consolidated, in the last several years the need for evaluation of programs across sites and accreditation of individual programs was seen (John Mantas, PhD, personal communication, 2013).

In the U.S., since most of the early programs were funded with NIH funding from the National Library of Medicine (NLM), the curricular content of many of the U.S. programs was largely responsive to what the NIH saw as key manpower needs, generally for sustaining the healthcare research enterprise. At first the NLM training programs, since they were funded by the National **Library** of Medicine, were more heavily focused on librarian training, but as the field evolved to include more automated means of managing healthcare information in practice, they shifted more into the domain of clinical informatics research and development, where they remained until fairly recently when, with increasing growth of genomics research, the NLM programs also began to incorporate bioinformatics content, public health informatics and the use of clinical applications in practice. With the need to manage and utilize the growing amount of electronic health information in both research and clinical practice, the most recent evolution has been for the NLM training programs to incorporate data science into the curriculum, as described in Chap. 2.

It was after the programs had been operational for quite a while that more formalized program evaluation criteria for the overall NLM program were developed, as well as better guidelines for individual programs that apply for NLM funding. These criteria include making sure that the content draws from the variety of disciplines and domains that are either the underpinnings of the field or are application areas of informatics in healthcare. The curriculum should include key informatics

concepts, methods and state-of-the art technology assessments and a variety of approaches should be employed to evaluate the program's success in meeting its goals [1].

The US Office of the National Coordinator for Health Information Technology (ONC) workforce program described in Chap. 20 had some of the same visionary beginnings, but it was addressing a more applied need. With the rapid increase in the use of health information technology anticipated with the passing of the HITECH Act [2], it was envisioned that new workforce roles would be needed and, to prepare individuals for those roles, new training programs would be needed as well. The ONC workforce program was designed to meet the needs for new types of individuals who could support the growing health information technology developments.

In many ways, all of these programs were future-oriented. The NLM training programs began when nobody, with the exception of the early developers, was using clinical computing in healthcare. The ONC workforce programs began with envisioning new roles for a healthcare system that would become increasingly electronic, but was not there yet. Over the same time period that the NLM training programs evolved to include broader domains than just clinical informatics, electronic health records and clinical decision support systems, which was a focus of the early programs, began to be applied in healthcare. Now that these electronic systems are commonplace, the future developments will involve using the data from these systems, and hence, NIH and NLM are now focusing on incorporating training in data science (Chaps. 2 and 10) as well as translating bioinformatics applications into clinical practice (Chap. 5).

Unlike the programs that envisioned new roles and new applications, the programs for managers of healthcare information systems (Chap. 4) informatics programs for healthcare administrators (Chap. 8), and certification programs for clinical informatics practitioners (Chap. 16) developed after individuals without formal informatics training had been in practice for a number of years. For instance, Chief Information Officers and healthcare administrators usually did not have formal training in informatics. More recently, with the increase in clinical computing, the role of Chief Medical Information Officer, or CMIO, has become prominent, but many of the individuals filling these roles did not have formal informatics training.

The perceived need for more formal training on the part of the individuals already in these roles, as well as informatics educators recognizing the need for more formal educational programs, has spurred the development of many of the newer, more applied programs. These programs include entire degree programs like the health informatics masters programs (Chap. 4), nursing informatics masters programs (Chaps. 3 and 12), health information systems courses within health administration programs (Chap. 8), and informatics continuing education programs, such as the AMIA 10 × 10 program described in Chap. 18 and mentioned in many of the other chapters. Not only have graduate education programs broadened, but at the other end of the spectrum there are undergraduate programs developing (Chap. 6).

In addition to the new educational programs, there has been a parallel recognition of the need to certify the competencies of individuals in these applied roles, and, as the educational programs have gotten established, more of them are becoming

accredited as described in Chap. 17. The clinical informatics subspecialty certification and training programs described in Chap. 16 and similar programs for nursing informatics described in Chap. 3 are examples of these programs. Finally, to accommodate the growing number of health informatics practitioners, a new certification program in advanced health informatics was started in 2019 (Chaps. 3 and 16).

What is common to all of the formal programs that evolved after individuals without formal training had been in practice is that they all emphasize the need to look to competencies exemplified by the best of the those practitioners, as well as the more theoretical informatics concepts, to develop training curricula and certification content. These types of programs will also continue to evolve, as they should, as the workforce needs change. At this stage of the field of informatics, where the applications and principles are now beginning to be used in clinical practice, new program developers should be keenly aware of the market needs and should develop programs focusing on the competencies needed to thrive in that market.

Informatics Education Programs in Low Resource Areas

As described in several of the chapters in Part IV, the development of informatics programs in many of the developing countries evolved differently from either the early U.S. or European countries or the more applied programs where there were already practitioners in the field. First of all, in many of these low resource settings, telemedicine programs were initiated to address the regional healthcare needs for better access, better care, and the limitations of long distances and limited transportation that were prevalent in these countries. This telemedicine infrastructure required a workforce who could manage it, but in addition, the infrastructure could also be used not only for health education, but for health informatics education as well.

Thus, in part because these programs were started later than those in the more developed countries, many of the informatics programs in these countries began as online programs, unlike in the U.S., where online education occurred at a later stage of program evolution. Second, again because the European and U.S. programs were already established and many were already providing online education, many of the programs in the developing countries began in partnership with the more established programs. In some cases, such as with the AMIA 10 × 10 programs (Chap. 18), students from developing countries took the same program as those in the U.S., either in English or translated into the native language. In other cases, there was a partnership to develop a program that made use of materials originally developed in the U.S. or Europe, but which was tailored for the unique needs of the country. More recently, as discussed in Chaps. 13–15, many of these programs evolved to more independent programs and there is increased sharing of expertise and curricula within regions, rather than only between the more developed and developing countries.

While there are certainly benefits in developing new programs by partnering with more mature programs there are also challenges. Both those who are disseminating the materials and those who are receiving them, identify the need to address not just language differences, but broader cultural, organizational, and infrastructure differences as well. Examples of the programs that have been developed as well as the challenges and how to address them are discussed in the chapters in Part IV. There may now be enough programs within the developing countries to be a resource for new programs. Individuals interested in starting programs in low-resource areas should consider a broad range of partners, including those from the established programs in the U.S. and Europe, as well as those from within their region. However, even within a given region, there are differences between countries on how receptive the healthcare systems are to establishing roles for those with informatics training.

Relationship of Educational Programs to Workforce Needs and Opportunities

There is a complex relationship between informatics educators, potential students and the leaders of the healthcare delivery systems. As discussed above, the NLM and the ONC anticipated future workforce needs for informatics-knowledgeable individuals and funded the development of education programs to prepare those individuals. The NLM training program began long before EHRs were commonplace and the ONC programs began with the HITECH Act, again prior to the increase in the use of EHRs. As the field matured, with the development of the Informatics subspecialty certification exam, clinical informatics fellowship programs were started (Chap. 16). Yet in the six years since the first subspecialty examination was administered in 2013, there are less than 50 clinical informatics fellowship programs and most have only one or two fellows. Part of the reason for this small number is that, like other fellowship programs, funding comes from the healthcare delivery system in which they work and receive training and health system leaders may not realize the value these fellows can bring [3]. If the health systems do not recognize the value of informatics fellowship training, residents who are trying to decide on a sub-specialty may not consider clinical informatics either. As Lehmann and colleagues discuss in Chap. 16, even the small number of current programs cannot fill all of their applicant slots. There is a circularity to this problem in that if there are very few programs, they may not be as visible as other subspecialty training programs, and hence find it more difficult to get fully established. The increased visibility of informatics and the increasing recognition of the need for clinical informatics expertise may change this situation in the future.

This mismatch between the visionaries who see the need for individuals with informatics training and the lack of explicit positions in the workforce that require individuals with informatics knowledge is not unique to the clinical informatics

fellowship programs in the U.S. One of the things that is striking about the programs developed in other parts of the world discussed in Part IV, is the variation among countries, even within the same general region of the world, in terms of whether there are jobs for the graduates. In countries where there are not positions that explicitly require informatics training, it is much more difficult to establish programs and to attract students.

Zozus and colleagues provide advice on starting a bioinformatics program, but the advice is appropriate for starting any type of program, including informatics (Chap. 5). The advice emphasizes the need to do an assessment of the market needs, of potential employers, potential students, and competing programs. When the field of informatics was in its infancy and the main programs were the few NLM training programs which received federal funding, the issues of market assessment was much less urgent. As the field is maturing, but where the healthcare market may not yet have caught up, such assessment is essential if the educational programs are going to thrive.

Competencies and Curricula for Informatics Education in Healthcare

Almost half of the chapters in this book address the content of the ideal curriculum for informatics education. Although there is overlap in the proposed competencies and accompanying course materials, none of the chapters proposes an identical curriculum, or even identical broad competencies. In most cases this is because the roles for which the individuals are being prepared are different. For instance, in the curricular content described in Chaps. 4 and 8, for healthcare IT managers and healthcare administrators, there are several courses (in the masters' program) or topics (in the health administration curriculum) related to management, finance, strategic planning and organizational behavior. Both curricula emphasize topics that are a key focus for leaders and managers in an operational environment.

These topics, perhaps with the exception of addressing the HIPAA regulations [4], are absent from both the NLM training programs and the AMIA 10 × 10 programs that were derived from them, such as the OHSU program described in Chap. 18. That is because the NLM training programs were clearly designed to produce informatics researchers and developers, not managers.

Conversely, while the more applied programs have more management content, some of the foundational informatics topics are usually not included in the applied curricula. Such topics as information retrieval, imaging informatics, in-depth computer science, ontologies, and in-depth coverage of standards that are included in the research and development-focused programs are usually not addressed in detail in the more applied programs. The programs for clinical users of systems such as those for nurses described in Chap. 3 and physicians described in Chap. 7 have still another set of competencies.

The content of the clinical informatics subspecialty examination described in Chap. 16 has similarities to those for all three types of users and is essentially a combination of competencies in basic informatics, IT management, and clinical information management. These general types of competencies are supported by an analysis of practice, as well as the opinions of informatics leaders. The practice analysis for the clinical informatics subspecialty delineated five domains of practice [5]. Because the clinical informatics subspecialty examination currently comprises these domains, as is noted in Chap. 16, many of the informatics textbooks, which are mainly geared for one or another of the different audiences, may not adequately cover the full range of competencies.

This challenge of integrating different disciplines has been both an ongoing challenge and an accomplishment for the field of informatics. Despite the difference in the curricula for different roles there are, as noted in Chap. 17, key foundational domains for the competencies that are needed, not just for one specific role, but for all informaticians. The foundational domains described in Chap. 17 relate to health sciences, computer and information sciences and social sciences and the intersections among these domains. As described in Chap. 9 and also addressed in Chap. 7, program developers need to identify the intended role of the users, whether their needs are for more foundational or applied learning, the breadth and depth of curricular content needed and the appropriate level of detail. Depending on the intent of the curriculum, for example, competencies in computer and information sciences can mean anything from a very basic comfort with, and understanding of, computers and information technology, to being proficient in developing decision support and other clinical, bioinformatics or clinical and translational research informatics applications. Healthcare administration students may be at one end of the continuum and students in NLM training programs at the other end.

Using the foundational domains and key competencies as a basic framework, developers of new programs need to carefully consider what role their students will assume upon graduation and develop the curricula accordingly. While identifying these roles may be only a small challenge for faculty, it is often difficult for students to navigate selecting among the different programs, since students are not always aware of the possible roles and in many cases, students from some of the basic research and development programs wind up in applied roles anyway. To avoid a mismatch of student and faculty expectations, program developers should identify their focus as clearly as possible and recruit students whose interests and skills match the curricular focus.

In some cases, curricular decisions might be made by a consensus process similar to the one that was used to develop the original criteria for the clinical informatics certification exam and training program requirements as described in Chap. 16. Even better might be to include a data driven analysis of the competencies of those who are currently fulfilling the roles for whom the program is geared, as was now done for the current certification exam. This is also what was done to develop the initial curriculum described in Chap. 4 [5]. Such analysis of current workforce roles and functions is recognized as a best practice for developing competencies and

competency examinations, although it should also be supplemented by input from experts [6]. The difficulty occurs, however, when existing roles are in transition. For instance, the competency examination program that was part of the ONC workforce program described in Chap. 20, found it challenging to identify competencies by asking individuals currently in somewhat relevant positions about their job responsibilities because the ONC roles were ones that were anticipated to be needed in the future and may not have been part of current job descriptions.

In addition to the competency domains from the practice analysis for clinical informatics (Chap. 16), Chap. 7 includes references to detailed competencies for several informatics roles—those for basic researchers, applied managers, as well as clinician users. Chap. 9 provides examples of competencies in the domain of clinical research informatics, while Chap. 3 describes new competencies for roles in nursing informatics. Chap. 17 describes domains of competencies used as part of health informatics program accreditation standards. While early informatics education programs often had an implicit understanding of the competencies they were aiming for, as program accreditation efforts become more established, more explicit competency definitions are now required.

Once the roles and competencies are determined, curricular content, learning activities and assessments to address the competencies need to be identified. Often new programs do not have the full complement of faculty who can teach the complete range of topics that will be needed. This may be especially acute in programs where a single course is needed in a curriculum which does not otherwise address informatics. An approach discussed in Chaps. 3 and 7 is to have clinical faculty, for instance, take informatics continuing education programs, such as the AMIA 10 × 10 programs (Chap. 18) or a certificate program in informatics. One approach that can work for individual courses or sometimes entire programs, as discussed in Chaps. 11 and 13, is for newly starting programs to partner with existing programs and utilize courses, materials or faculty from these programs. Still another approach is to enlist faculty from other relevant departments for some of the courses. For instance, basic computer science might be able to be taught by computer science faculty rather than only relying on the faculty in the informatics program.

More recently there have been three major efforts to make curricular materials broadly available. As described in Chap. 20, the materials originally developed for the ONC Workforce Program are freely available for educators and have been used by educators worldwide. Chap. 20 also describes the open-source materials available in the NIH BD2K program. Similarly, the HIMSTA modules described in Chap. 8 are available for educators in healthcare management educational programs who need to address the required information management competencies. These resources, developed by expert informatics educators, are a tremendous boon even to experienced informatics instructors, but are especially useful for new programs that might not be fully staffed. The other advantage of these materials, in addition to being free to educators, is that they can be used "as is" with narrated lectures available for online education. They also can be modified to fit the needs of particular courses. The disadvantage is that the generic materials may not always meet the needs of the particular program, so educators should be prepared to adapt

them. Hersh, in Chap. 20, discusses other challenges in using open-source educational materials. One of the main challenges is knowledge maintenance, as all of these materials were developed with grant funding with no mandate to keep them up-to-date.

Online Instructional Strategies

The informatics programs described in this book have deployed a variety of instructional strategies. Most of the NLM training programs described in Chap. 2 are focused on doctoral or post-doctoral students (physicians coming for additional training in informatics). Because of the needs for supervised research of small cohorts of students, often in operational healthcare settings, most of these programs have remained as traditional face-to-face educational programs. On the other hand, as mentioned earlier, in part because of the infrastructure issues, many of the programs in low-resource settings began, and have remained, as primarily online programs (Chaps. 11–15) as have the 10 × 10 programs (Chap. 18). The ONC workforce programs at the community colleges described in Chap. 20 were a mixture of online, face-to-face, and hybrid programs, with significant online components. Finally, other programs began as face-to-face programs, but eventually transitioned to online programs, as did the program described in Chap. 4.

There are many motivations for decisions to use, or intentionally not use, online instructional strategies. In the countries described in Chaps. 13–15, the motivation was dictated by the unique circumstances of the region—few programs, many potential students spread over wide distances, and a telemedicine infrastructure already established. For other programs such as the one described in Chap. 4, expanding the applicant pool was a major motivator for the transition to online instruction. These reasons are similar to the rationales for MOOCs (Massive Open Online Courses)—the online format permits broad access relatively inexpensively—and may be particularly appropriate for relatively short term programs like the AMIA 10 × 10 courses, where it would not be feasible for the students who take those courses to be on-site.

In considering online instruction, it is important also to consider the pedagogical, as well as the access, rationale. In looking at the informatics competencies one should ask, “In which mode can students best acquire the necessary knowledge and skills?” For instance, some of the competencies that clinical informaticians must have cannot be taught online. On the other hand, educators unfamiliar with online instruction may incorrectly assume that online instruction is valuable only for didactic instruction. They may not realize that demonstrations can be effectively conducted online, as can discussions among students. And with modern videoconferencing technologies, synchronous class sessions among dispersed students may not be very different from face-to-face lectures. In fact, studies have shown that interaction among students may be even better in situations where they can communicate online than it is in face-to-face classrooms [7].

Sometimes avoidance of online teaching on the grounds that face-to-face instruction is "better" may just mean that the instructor is more comfortable in a face-to-face situation. Instructor comfort with an online, often asynchronous, mode of teaching is important to consider. As Chap. 19 illustrates, strategies that work in a face-to-face setting may have to be rethought when teaching online. If the instructor is uncomfortable with the medium, the students are likely to be dissatisfied as well.

Hybrid or blended learning environments may offer a way around the limitations of online instruction. In deciding to move the UAB masters' program online (Chap. 4), several face-to-face sessions were deliberately retained. These sessions permit site visits to healthcare settings, and offer the students and instructors an opportunity for more informal interaction. This type of interaction is missing in online instruction, as Chap. 19 discussed. The AMIA 10 × 10 program discussed in Chap. 18 has most sessions online in an asynchronous mode, but it also includes an in-person session at the AMIA Fall Symposium.

It is likely that the number of informatics programs that are delivered online will continue to grow. The suggestions in Chap. 19 include strategies to help instructors become comfortable in this mode of teaching and methods to reduce what has been called "transactional distance [8]," so that both students and faculty can make optimal use of the online resources.

Program Evaluation and Accreditation

As informatics education programs in the various disciplines mature there has been more consensus on the curricula that are needed and a clearer idea of the standards to be used for both internal evaluation and external accreditation. Several disciplines already have accrediting bodies in place that specify the evaluation criteria for informatics education. The informatics education programs may be subspecialty programs or may be incorporated as part of the overall requirements for education in the discipline. For instance, as described in Chap. 3, the American Nurses Association has defined the scope and practice for nursing informatics [9] and nurses are certified by the American Nurses Credentialing Center [10]. Similarly, the Commission on Accreditation of Healthcare Management Education [11] has had a long history of accrediting healthcare management programs, although the criteria related specifically to informatics and information systems have changed over the years (Chap. 8). With the development of the subspecialty in clinical informatics, as mentioned in Chap. 16, the accreditation of fellowship programs in clinical informatics is conducted by the accrediting body for other medical subspecialties, the Accreditation Council for Graduate Medical Education (ACGME) [12].

Although the funders of the informatics training programs, such as the NLM, are not accrediting bodies per se, they do serve as an external evaluation body. When an existing program applies for renewal funding, the grant reviewers evaluate the structure of the program, its previous accomplishments, and its future plans.

The NLM has developed criteria for evaluating their overall informatics training program funding initiative, as well as individual program proposals and program accomplishments.

Currently, few of the informatics training and education programs have undergone formal accreditation, although the number is growing. As of May 2020, in the U.S. the Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) [13] had accredited 19 masters' level health informatics programs.

At this stage of the development of the field of informatics education, when many programs are not accredited, there are advantages and disadvantages for a program to seek accreditation. One advantage is that accreditation means an outside organization has given a stamp of approval to the quality of the program, which can provide reassurance that the program is following best practices. It can also provide a competitive advantage in attracting students and may also be required for certification as well as employment. A potential disadvantage is that any accreditation process introduces more uniformity into curricula across institutions, which may constrain some sites that have been following a very unique curriculum. In addition, it subjects sites to the priorities of the accrediting agency which may not be entirely congruent with an institution's internal priorities. Most of the NLM training programs have already faced that issue when the priorities of the funding agency evolved.

Since the clinical informatics subspecialty training process has gotten underway, we have seen more accredited training programs, even those that are not focused on producing clinical informatics physician subspecialists. Being accredited is likely to become the standard by which all programs are judged and those that are not accredited, regardless of how creative and individualized they are, will be at a disadvantage in terms of attracting students and being recognized as high quality by their peers. Informatics education program leaders need to stay abreast of developments in the field in regard to accreditation initiatives such as those described in Part V of this book. Educators also need to be aware of how their programs will be judged, and should design, implement and evaluate their programs accordingly.

Conclusion

Many forces are driving the field of informatics education, which is likely to continue evolving over time. The chapters in this book have illustrated the variety of informatics educational programs, strategies, audiences and challenges. This chapter synthesized the lessons learned across the other chapters related to informatics program development strategies, matching workforce needs, development of competencies and curricula, instruction, and evaluation. As the field of informatics reaches new levels of maturity and greater integration into the healthcare environment, these lessons will be valuable to new and existing informatics educators.

References

1. Florance V. Chapter 3: Training for informatics research careers: history of extramural informatics training at the National Library of Medicine. In: Berner ES, editor. Informatics education in healthcare: lessons learned. London: Springer; 2014. p. 27–42.
2. Blumenthal D. Launching HITECH. N Engl J Med. 2010;362(5):382–5. https://doi.org/10.1056/NEJMp0912825.
3. Detmer DE, Shortliffe EH. Clinical informatics: prospects for a new medical subspecialty. JAMA. 2014;311(20):2067–8. https://doi.org/10.1001/jama.2014.3514.
4. U.S. Department of Health and Human Services [HHS]. Health Information Privacy. http://www.hhs.gov/ocr/privacy/. Accessed 1 May 2020.
5. Silverman HD, Steen EB, Carpenito JN, Ondrula CJ, Williamson JJ, Fridsma DB. Domains, tasks, and knowledge for clinical informatics subspecialty practice: results of a practice analysis. J Am Med Inform Assoc. 2019;26(7):586–93. https://doi.org/10.1093/jamia/ocz051.
6. Berner ES, Bender KJ. Determining how to begin. In: Morgan MK, Irby DM, editors. Evaluating clinical competence in the health professions. St. Louis: The C.V. Mosby Company; 1978. p. 3–10.
7. Locatis C, Berner ES, Hammack G, Smith S, Maisiak R, Ackerman M. Communication and proximity effects on outcomes attributable to sense of presence in distance bioinformatics education. BMC Med Educ. 2011;11:10. https://doi.org/10.1186/1472-6920-11-10.
8. Moore MG, Kearsley G. Distance education: a systems view of online learning. 3rd ed. Belmont: Wadsworth Publishing Company; 2012.
9. American Nurses Association. Nursing: scope and standards of practice. 3rd ed. Silver Spring: American Nurses Association; 2014.
10. Informatics Nursing Certification (RN-BC). https://www.nursingworld.org/our-certifications/informatics-nurse/ Accessed 1 May 2020.
11. Commission on Accreditation of Healthcare Management Education. Home page of CAHME website. 2012. www.cahme.org. Accessed 1 May 2020.
12. Accreditation Council for Graduate Medical Education. http://www.acgme.org/acgmeweb/. Accessed 1 May 2020.
13. Commission on Accreditation for Health Informatics and Information Management Education. Welcome to CAHIIM. 2013. http://cahiim.org/. Accessed 1 May 2020.