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**DEVELOPMENT HISTORY AND THE CURRENT STATE
OF PROFESSIONAL TRAINING IN HEALTH INFORMATICS
IN CANADA**

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МУКАН Наталія – доктор педагогічних наук, професор кафедри педагогіки та інноваційної освіти, Національний університет «Львівська політехніка», вул. Степана Бандери, 12, Львів, 79013, Україна

MUKAN Nataliya – PhD hab. (Education), Professor of Pedagogy and Innovative Education Department, Lviv Polytechnic National University, 12 Stepan Bandera Str., Lviv, 79013, Ukraine

E-mail address: nataliya.v.mukan@lpnu.ua

ORCID: <http://orcid.org/0000-0003-4396-3408>

ResearcherID: <https://publons.com/researcher/1739818/nataliya-mukan/>

КОБРИН Надія – аспірант кафедри педагогіки та інноваційної освіти, Національний університет «Львівська політехніка», вул. Степана Бандери, 12, Львів, 79013, Україна

KOBRYN Nadiya – Postgraduate student of Pedagogy and Innovative Education Department, Lviv Polytechnic National University, 12 Stepan Bandera Str., Lviv, 79013, Ukraine

E-mail address: nadiia.z.kobryn@lpnu.ua

ORCID: <http://orcid.org/0000-0003-1960-1212>

ResearcherID: <https://publons.com/researcher/2018398/nadiia-kobryn/>

ЗАПОТИЧНА Марія – аспірант кафедри педагогіки та інноваційної освіти, Національний університет «Львівська політехніка», вул. Степана Бандери, 12, Львів, 79013, Україна

ZAPOTICHNA Mariya – Postgraduate student of Pedagogy and Innovative Education Department, Lviv Polytechnic National University, 12 Stepan Bandera Str., Lviv, 79013, Ukraine

E-mail address: zapotichnam@gmail.com

ORCID: <http://orcid.org/0000-0002-1504-9136>

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ІСТОРІЯ ТА СУЧАСНИЙ СТАН РОЗВИТКУ ПРОФЕСІЙНОЇ ОСВІТИ ФАХІВЦІВ З МЕДИЧНОЇ ІНФОРМАТИКИ У КАНАДІ

Мета статті – висвітлити історію розвитку та сучасний стан підготовки фахівців з медичної інформатики у Канаді. Проаналізовано особливості інформатизації системи охорони здоров'я цієї країни як передумови її становлення. З'ясовано, що на початкових етапах комп'ютерна техніка повільно й нерівномірно проникала у заклади охорони здоров'я канадських провінцій та територій. Політика комп'ютеризації була децентралізованою, що не сприяло ефективному обміну медичною інформацією. Тому на початку 2000-х рр. у Канаді інформатизація системи охорони здоров'я набула централізованого характеру. Це вимагало якісного кадрового забезпечення і стало каталізатором підготовки фахівців з медичної інформатики.

Проведено ретроспективний аналіз означеної проблеми. Встановлено, що її історія сягає 60-х років ХХ ст. Виокремлено дві фази підготовки фахівців з медичної інформатики: доінституційну (1960–1980) як основа виникнення та становлення професійної освіти фахівців з даної галузі; інституційна (1981 – дотепер), яка сприяла підготовці фахівців з медичної інформатики у закладах вищої освіти Канади. Характерними ознаками інституційної фази є зародження медичної інформатики як спеціальності; формування освітніх концепцій розвитку й узгодження типової програми з медичної інформатики; стрімкий розвиток професійної освіти фахівців з медичної інформатики у середині 2000-х рр.; уніфікація її науково-методичного забезпечення.

Зроблено висновок, що вона побудована на принципах багаторівневості й неперервності. Освітній процес організований так, що майбутні фахівці з медичної інформатики можуть здобувати кваліфікацію на усіх рівнях вищої освіти, зокрема диплом чи сертифікат у закладах неступеневої освіти, а також ступені бакалавра, магістра та доктора філософії – в університетах. Аналіз змісту професійної підготовки фахівців з медичної інформатики у Канаді дає підстави стверджувати, що його формування залежить від рівня вищої освіти і характеризується різною комбінацією та кількістю навчальних дисциплін у межах трьох галузей знань – інформаційних наук, медицини та менеджменту.

Ключові слова: професійна освіта; медична інформатика; спеціальність; фахівець; інформатизація; Канада.

DEVELOPMENT HISTORY AND THE CURRENT STATE OF PROFESSIONAL TRAINING IN HEALTH INFORMATICS IN CANADA

The article studies the history and the current state of the professional training in health informatics in Canada. The specifics of healthcare informatization in Canada as a precondition for its formation are analyzed. At its initial stages, the

computer technology was implemented into the provincial and territorial healthcare institutions slowly and unevenly. The computerization policy was decentralized, and this did not promote an effective medical information exchange. Thus, at the beginning of the 2000s, Canada set course for the centralized healthcare informatization. It required a qualified workforce and became a catalyst for the development of professional training in health informatics in Canada.

A retrospective analysis of the professional training in health informatics development in Canada is conducted. The research reveals that in its development professional training in health informatics has gone through the pre-institutional phase (the 1960s – 1980), which laid the basis for the appearance and further development of professional training in health informatics, and the institutional phase (1981 – till present time), when it began to be implemented into the Canadian higher educational institutions. The characteristic features of the institutional phase include the rise of health informatics as an academic speciality; the conceptualization of professional training in health informatics; the rapid increase in the number of health informatics professional programs in the mid 2000s; the unification of methodological, scientific framework for training health informatics professionals.

The current state of the professional training in health informatics in Canada is studied. It is concluded that the Canadian system of the health informatics professional training is built on the principles of degree education and life-long learning. The educational process is organized in such a way that future health informatics professionals can receive a credential at different levels of the higher education, in particular a health informatics diploma or certificate in the non-degree granting institutions and Bachelor's, Master's and PhD degrees at universities. The analysis of the professional training content in health informatics enables to state that its development depends on the level of the higher education and is characterized by various combinations of academic disciplines in the health informatics curriculum within three knowledge domains – information sciences, health sciences, and management.

Key words: professional education; health informatics; speciality; professional; informatization; Canada.

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Introduction

The professional training in health informatics (hereafter – HI) is a modern pedagogical problem. Its topicality is induced by transformational changes in the healthcare – the rapid development of information and communication technologies (hereafter – ICT), their implementation in the health care, the creation of the common medical information space, and the informatization of the healthcare

sector. In our research, the professional education in HI is defined as a process and the result of formal education activities aimed at the professional training of specialists competent in creating and applying medical information technologies. Nowadays, HI as a speciality is gradually conquering the educational market. A large number of higher educational institutions worldwide provide programs to train HI professionals. For example, Canada's experience in the professional training in HI covers over 35 years. Besides, it is the first country in the world to introduce a Bachelor's degree program in HI. The authorities of those countries where HI as a speciality is absent in the higher education system stress the importance of its introduction into the educational process for the sake of successful employing ICT in the healthcare. Therefore, the research into preconditions, characteristic features of the development and the contemporary state of the professional training in HI in Canada is relevant, appropriate and of current interest.

The analysis of recent research demonstrates that the problem of the professional training in HI development in Canada is insufficiently studied. Only some aspects of the problem are discussed by modern researches. In particular, Buckeridge (1999) defines the notion of HI and gives insight into the specifics of HI education in Canada. Kushniruk, Lau, Borycki, & Protti (2006) study the experience of the School of Health Information Science at the University of Victoria (British Columbia) in providing the professional training in HI. Lau, & Bell (2003) describe the pan-Canadian strategy of HI education development. Covvey, Zitner, & Bernstein (2001) work on developing the professional training in HI content to train healthcare workers, HI practitioners, and scholars. Covvey, & Fenton (2013–2014, 2015–2016) study the HI curricula at the Canadian degree and non-degree granting institutions, etc. Nevertheless, a comprehensive study of the professional training in HI development in Canada has not been conducted.

In the context of our research, a special attention is paid to the documents published by professional organizations, more specifically *Canada's Health Informatics Association*. They contain information on the first attempts of computerizing the Canadian healthcare institutions, the development of the standard of the professional training in HI, certification of HI professionals, the analytical study of HI programs in the Canadian higher education system, etc. The information about the professional training in HI is also retrieved from the Canadian higher educational institutions' web-sites that provide up-to-date data on the the professional training in HI.

The purpose of the research is to study the history and current state of the professional training in HI development in Canada. The following objectives are defined: 1) to overview computerization initiatives in the Canadian healthcare setting; 2) to make a retrospective analysis of the professional training in HI, and 3) to outline the current state of the professional training in HI in Canada.

The overview of healthcare computerization initiatives in Canada

According to the *Canada Health Act* (1984), the responsibility for medical servicing in Canada is precisely distributed between the federal and provincial/

territorial governments. The local authorities are responsible for managing the healthcare sector in the provinces. The decentralization of the healthcare system in Canada is the reason why in their informatization policy the local governments, medical institution associations and hospitals made independent decisions on introducing computer technology.

The early computing machines began being introduced into the Canadian healthcare system in the 1960s – 1970s. In frequent cases, these were associations of healthcare institutions that initiated and coordinated the computerization process. In some Canadian provinces, computers were also first introduced by large hospitals that had sufficient financial resources to buy computer hardware. There were also rare occasions when provincial governments assisted in providing their hospitals with computers and software for medical purposes. Nevertheless, it is worth mentioning that local authorities joined the healthcare computerization process much later (Huesing, 2005). Data systematization on the hardware and software used in the Canadian healthcare setting enables us to see the following trends. Firstly, computers for Canada were mainly purchased in the USA. However, programs for information processing were developed by local engineers taking into account a healthcare institution's specific needs. Secondly, computers were initially used for automation of administration units in the Canadian hospitals, in particular for financial information management and accounting statements. Huesing (2005) also mentions other instances of computer usage in the healthcare system of Canada: claims processing, laboratory automation, clinical computing, creating systems for patient admission, discharge and transfer, central patient registry, order entry, and results reporting.

At first, the computerization of the Canadian healthcare institutions was a slow process. The provinces and territories did not cooperate or share their experience. However, there were exceptions, for example the cooperation between *Alberta Hospital Association* and *Manitoba Medical Organizations* at the end of the 1970's. They created a Remote Job Entry facility in Edmonton (Alberta) that was connected to *Manitoba Medical Organization's* data processing center in Winnipeg. Such cooperation provided a large number of Alberta hospitals with an opportunity for computerized information procession, thus creating the largest computer network of that time in Canada (Girard & Crewson, 2005).

In the 1980s – 1990s, Canada faced a significant breakthrough in the computerization of its healthcare institutions. It was caused by the creation of hospital information systems. Their architecture became patient-oriented and met hospitals' needs in providing medical services. Thus, the Canadian National Healthcare Computer Survey, conducted in 1988–1989, demonstrated that financial systems were automated in more that 90% of hospitals. The most computerized units in the Canadian healthcare institutions were also material management (73%), admitting (70%), and health records (64%) departments. The pharmacies were computerized in half of the hospitals in the country (Newsham & Clement, 2015).

In spite of a significant progress in the healthcare computerization in Canada at the end of 1980s, there were a number of challenges that required both local authorities' attention and the participation of *the Government of Canada* to respond. Romanow (2002) states that the major healthcare informatization problem was related to the absence of common standards for medical information system on both the provincial and pan-Canadian levels. It hindered from effective exchange of medical information and caused improper funding usage. Such a decentralized approach to healthcare informatization in Canada did not promote the functionality, efficiency and cost effectiveness of the created medical information systems. Thereby, the necessity to agree and develop a national strategy of the pan-Canadian healthcare informatization was highlighted. For this purpose, at the beginning of 1990s *the Government of Canada* started funding a project aimed at developing a telecommunication network that would facilitate the exchange of medical information at all levels of the Canadian healthcare system.

Finally, in 1997 *Health Canada*, a department of *the Government of Canada* being responsible for the national health, established *Advisory Council on Health Infostructure*. Its goal was to develop a national strategy on advancing the functionality of ICT for medical information procession and exchange in Canada. In 2000, the first strategic milestones to reach this goal were detailed in the document *Blueprint and Tactical Plan for a pan-Canadian Health Infostructure (Advisory Committee on Health Infostructure, 2000)*. The key task allocated to the federal and provincial governments consisted in developing and supporting projects aimed at digitalization of electronic health records and fostering ICT usage in the healthcare system. The governmental cooperation on both levels promoted the development of common standards of medical information exchange, thus ensuring compatibility of medical information systems within the Canadian healthcare sector. In the document a special attention was focused on providing medical information confidentiality and privacy (Bickenbach, 2003).

Blueprint and Tactical Plan for a pan-Canadian Health Infostructure (Advisory Committee on Health Infostructure, 2000) also acknowledged the need in developing the professional training in HI as a necessary precondition and a catalyst of the healthcare informatization in Canada. An increased focus was maintained on studying HI as an academic discipline and integrating its content into professional training programs of medical practitioners, nursing staff, and pharmacists. Moreover, it discussed opportunities of receiving the professional training in HI by medical and technical specialists. Therefore, at the beginning of the 2000s, the centralized informatization of the healthcare system in Canada was launched. The pan-Canadian medical information system was created. It integrated medical information systems that had been formally created by local governments. As a result of the centralized healthcare informatization, the Canadian society faced the demand for the HI workforce as the competent staff to develop, implement, and service the medical information infrastructure. It gave rise to a significant number of syllabi of the

professional training in HI and increased the community interest in studying HI as an academic discipline by medical students (Buckeridge, 1999).

The retrospective analysis of the development of professional training in health informatics in Canada

The development of the professional training in HI took place gradually but unevenly in the Canada. There was mainly no coordination among higher educational institutions in providing the professional training in HI. Generally speaking, the professional training in HI overcame two phases of development – the pre-institutional and institutional ones.

The pre-institutional phase of the development of the professional training in HI covers the period from the 1960s to the year 1980. This phase provided a basis for the appearance and further development of the professional training in HI. Although at that time there were no HI educational initiatives, the Canadian community started discussions about computer usage in medicine. The key event of the period occurred in 1975, when the *Canadian Organization for Advancement of Computers in Health* (later renamed into *Canada's Health Informatics Association*) was founded. At that time, Canada's health industry representatives officially started discussing the necessity to introduce computer technologies into medical theory and practice. Approximately at the same time, the issue of training the workforce competent in computer usage in medicine became urgent. In the late 1970s, it was foreseen that the Canadian labour market would face the demand for a new type of the professionals who would be able to computerize Canada's healthcare system ("Welcome to the School", 2012).

The institutional phase of the development of the professional training in HI in Canada covers more than 35 years and is characterized by appearance of HI curricula in higher educational institutions. The rise of HI as a speciality in Canada is related to the emergence of the first HI department and undergraduate program in 1981. The University of Victoria initiated the introduction of the Bachelor's program in Health Information Science. Although the opening of the program at the university was announced in 1981, the training of HI professionals began only in 1983. Such a delay was caused by an international expert consultation on developing HI curriculum based on foreign positive achievements (Kushniruk et al., 2006).

For many years, the HI Bachelor's program at the University of Victoria was the only educational initiative to provide formal the professional training in HI in Canada. Thus, the number of graduates with the Bachelor's degree in HI was insufficient to meet the need of the Canada's labour market for HI professionals. In the 1980s – 1990s specialists who promoted the use of computers in the healthcare system did not have a formal education and developed their expertise by using computers to optimize their professional activities (Gaudet et al., 2013). In the mid 1990s, Canada started the centralized policy on ICT adoption into the healthcare sector. It became apparent that healthcare informatization required significant investments into human resources to ensure the proper development of HI infras-

structure. The afore-mentioned conditions demanded a professional training in HI, which necessitated the need to develop a conception of the professional training in HI.

In general, the conception of the professional training in HI in Canada was focused on the educational needs of its key receivers and their role in the healthcare system. The three roles were identified: 1) a physician as a competent user of medical information and HI tools; 2) a HI professional to implement healthcare informatization projects, and 3) a HI scholar that creates and tests new developments in HI. Thereon, main directions of the development of the professional training in HI were determined. The recommended levels of education for each of them were selected. For example, in order to train competent users of medical information technologies, the necessity to introduce HI as an academic discipline into future medical practitioners' training programs was recognized. In order to meet the labour market demand for HI professionals, the introduction of Bachelor's and Master's programs in HI became crucial. In its turn, the training of HI scholars required a formal education on the PhD level. As for the format of delivery, distance learning programs became of topical importance enabling working specialists to improve their qualifications or to choose HI as an additional specialization and a new profession (Buckeridge, 1999).

The Canadian conception of the professional training in HI also gave insight into the content of the professional training in HI. It took into account the afore-described professional roles in healthcare, as well as the current and future needs of the healthcare system being computerized. The main focus of the professional training in HI was on the allocation of the common learning content for training competent users of medical information, HI professionals and scholars. It was aimed at facilitating the medical information exchange and integrating different sectors of the healthcare system. On the other hand, meeting each group's specific needs required modifying the volume of learning material and specifying the depth of its study. Accordingly, the educational process organization for each of the afore-mentioned groups of professionals was based on a broad core content, the components of which were studied in depth depending on their needs and specific roles in the healthcare system (Buckeridge, 1999).

In 2001, a national health information research network *Health Evidence Application and Linkage Network* followed the proposed conception of the professional training in HI. With the support of professional organizations, faculty members of higher educational institutions and healthcare system staff, it completed the project of developing a HI curriculum having been launched in 1999. The curriculum was designed for educational programs to train HI professional and scholars, as well as to develop HI competency by health practitioners. The document described macro roles, functional professional duties, job tasks, and competencies necessary for professional activity related to the healthcare informatization (Covvey, Zitner, & Bernstein, 2001). The formulation of the first conception of the professional training in HI and discussion of the HI curriculum showed its results in the 2000s, when the number of HI programs in Canada's higher educational insti-

tutions began to increase rapidly. Another reason for such an increase was the pan-Canadian policy on informatization of the healthcare system. The ambitious plans of the federal government to digitize the healthcare sector, to use electronic health records, and to create a nation-wide health information network demanded highly qualified professionals being able to implement these tasks (Goel & Royce, 2003).

The rapid increase in the number of the professional training in HI syllabi in Canada also demanded unified approaches to training HI professionals. The initiative to unify the scientific and methodological framework for the professional training in HI was undertaken by *Canada's Health Informatics Association*. In 2007, it published and in 2012 issued an updated version of the document *Health Informatics Professional Core Competences* (2012). The document provided a general description of the HI professional profile and highlighted 'a common core or shared set of skills, knowledge, attitudes, and capabilities necessary for each of us to effectively perform as a Health Informatics Professional' ("Health Informatics", 2012, p. 4). It was the first time in Canada when the content of the professional training in HI was detailed from the perspective of the professional standard. Moreover, *Canada's Health Informatics Association* as a professional organization has developed the HI professional' career profile. The association presented *Health Informatics Professional Career Matrix* (2013) that gives a clear idea of HI as a profession in Canada, typical positions of HI professionals in the labour market and the basic requirements for their education level and work experience in order to move within the HI career ladder.

Finally, *Canada's Health Informatics Association* is now working out mechanisms for ensuring the quality of the professional training in HI in the system of the formal education in Canada. In 2013, the association initiated the certification of HI professionals. It encompasses procedures for assessing the relevance of HI professionals' competency to the established requirements. In particular, in cooperation with the *International Health Information and Management Systems Society*, it provides a proficiency exam for HI professionals to receive a certificate of a certified specialist in medical information systems and systems management of Canada. The certificate is recognized internationally and certifies the professional competency of a HI specialist in accordance with international and Canadian standards of professional training. Moreover, it confirms that a HI professional has developed professional skills and has received a qualification enabling him/her to work in many areas of practical application of medical information technologies ("CPHIMS-CA Canadian Supplemental", 2013).

The current state of health informatics professional training in Canada

Canada has a valuable experience of providing the professional training in HI that chronologically covers a relatively short period of time. This fact explains why at present there is no unified system to regulate the professional training in HI at the national level. Moreover, the study into the problem of providing the professional training in HI only began in 2010. It was the year when the *Curriculum Discussion Working Group* established by *Canada's Health Informatics Association* launched

an analytical research into HI programs in the Canadian higher educational institutions. The aim of the research was to characterize the professional training in HI by comparing options of its receiving, finding similarities and differences in approaches used for educational process organization and determining the influence of HI programs on HI professionals' development. In 2013, the research results were published on the basis of analysis of 15 HI programs (Gaudet et al., 2013).

However, the professional training in HI as a pedagogical phenomenon is constantly developing. Thus, new HI programs are occasionally introduced into the Canadian higher education institutions. According to a research conducted by Covvey & Fenton (2013–2014), the number of HI programs grew to 28 in the 2013–2014 academic year. The similar research conducted during the 2015–2016 academic year revealed a decrease in their number to 25 (Covvey & Fenton, 2015–2016). Therefore, we made an attempt to collect, analyze and update the previously obtained data. To achieve this goal, we additionally processed information retrieved from the site called *Canada's Higher Education and Career Guide* (2018) as it provides current and up-to-date information about HI programs in Canada.

The scientific enquiry showed that geographically the majority of higher educational institutions (73%) providing the professional training in HI is located in the province of Ontario. In particular, in Great Toronto Area there are three large universities (York University, University of Toronto and Ryerson University) that provided HI programs. Besides, Western University, University of Waterloo, University of Ontario Institute of Technology, McMaster University, and St. Jerome's University also provide the professional training in HI in Ontario. It is worth noting that Centennial College is the only non-degree granting institution with a HI program.

There are also options to receive the professional training in HI in the provinces of Alberta (University of Alberta), British Columbia (University of Victoria), Manitoba (University of Winnipeg), and Nova Scotia (Dalhousie University). For example, University of Alberta proposes the largest amount of HI programs to receive a Bachelor's, Master's and PhD degrees. Université de Sherbrooke is among several Canadian higher educational institutions where French is the language of instruction (Gaudet et al., 2013). The thorough analysis of HI programs in the Canadian higher education sector showed a variety of the programs' titles. Apart from *Health Informatics* as the most prevalent one, HI program titles may include: *Health Informatics Technology*, *Applied Health Information Science*, *eHealth*, *eHealth Research*, *Applied Health Services Research*, *Health Systems*, *Health Industry Specialization in Information Technology*, etc. (Covvey & Fenton, 2015–2016).

It is a notable fact that both technical and medical faculties of the Canadian higher educational institutions enroll students on HI programs. There are even cases when several faculties are engaged in the process of the professional training in HI. For example, in McMaster University the Faculty of Health Sciences, Faculty of Engineering, and DeGroote School of Business provide academic disciplines within *e-Health* Master's program ("*eHealth – MSc eHealth Program*", 2018). The *Health Information Science* Master's program in Western University is offered due to the

collaboration of the Faculty of Health Sciences and Faculty of Information and Media Studies (“[Health Information Science](#)”, 2018). It tends to confirm that HI as a speciality in the higher education system has a multidisciplinary nature.

In our research of the current state of the professional training in HI in Canada, a special focus is maintained on how the professional training in HI is organized. It is built on the principles of degree education and life-long learning that enable future HI professionals to receive various qualifications on all levels of the Canadian higher education system. Thus, it is possible to receive HI diplomas or certificates in non-degree granting institutions or Bachelor’s, Master’s and PhD degrees – at universities. Such a structure of the Canadian higher education provides the connection of its all levels in order to meet a HI professional’s needs in additional qualifications, skills upgrading, and career enhancement. The system of the professional training in HI in Canada is also built on the principle of connecting the theory and practice as well as using applied learning. It means that HI programs are aimed at providing students with practical experience and developing their professional competency by direct problem solving. Therefore, a number of HI programs are cooperative ones, i.e. oriented on combining the terms of study and paid internship in real working setting. Some HI programs also combine on-site and distance learning or provide exclusively distance-learning options ([Gaudet et al., 2013](#)).

The conducted research demonstrates that the most common reason of the professional training in HI declared by the majority of HI programs is economic expediency induced by the Canadian labour market’s demand on professionals competent in healthcare informatization. This goal is further specified depending on a program type. Broadly speaking, the goal of HI diploma, certificate and Bachelor’s programs consists in training HI practitioners that would practically implement Canada’s healthcare informatization policy. In their turn, HI Master’s and PhD programs are mainly aimed at broadening theoretical basis and developing new theories and knowledge in HI. These programs provide the training of HI scholars, academia, and managers in the sphere of healthcare informatization.

The study into the specifics of the HI program content development enables to relieve the following tendencies. Firstly, the content of HI diploma and certificate programs is focused on studying a particular aspect of the healthcare informatization and searching for effective ways of its implementation. It causes the narrow specification of these programs and their applied focus. Secondly, HI Bachelor’s programs provide the study of a wide range of HI problems ranging from theoretical design of medical information systems to their creation, installation, approbation, and assessment. These programs provide the basic training that enables HI professionals either to work in various spheres of HI products application or to continue their education for Master’s and PhD degrees. The variety of disciplines in HI Bachelor’s curriculum helps students to understand the depth of HI knowledge and exercise options of its application.

Thirdly, HI Master’s and PhD programs are oriented on the training with scientific focus. Their task is to provide the HI basis and specialized knowledge as

well as develop professional skills and analytical approaches necessary for further development of HI theoretical and practical knowledge. HI programs on these levels of the higher education provide the training of scholars that conduct HI researches and thereby promote the development of progressive ideas and search for innovative solutions to effectively use ICT in the healthcare system. In Canada, the professional training in HI content encompasses three cycles of professional training – information sciences, health sciences, and management. Within the mentioned cycles, academic disciplines in HI curriculums are generally organized into the following thematic groups – *Information technology, Information management, Clinical and health sciences, Canadian health system, Project management, Organizational and behavioural management, and Analysis and evaluation* (“[Health Informatics](#)”, 2012).

Canada’s experience of the professional training in HI shows that there are different combination of academic disciplines within the given cycles and thematic groups depending on a level of the higher education, type of a program and its specific focus. Nevertheless, the theoretical and practical acquisition of academic disciplines within the mentioned cycles by future HI specialists is aimed at developing HI core professional competencies as a launching pad for further professional development.

Conclusions

The overview of the healthcare informatization initiatives in Canada demonstrates that at its initial stages the computer technology penetrated into the provincial and territorial healthcare institutions slowly and unevenly. The computerization policy was decentralized, and this did not promote the effective medical information exchange. Thus, at the beginning of the 2000s, Canada set course for the centralized healthcare informatization, which required the qualified workforce. It became a catalyst for the development of professional training in health informatics in Canada.

A retrospective analysis of the the professional training in HI development in Canada led to differentiating the pre-institutional and institutional phases in its history. In the pre-institutional phase (the 1960s – 1980), there were no programs of the professional training in HI. This phase provided a basis for the development of HI as a science and speciality in Canada. The institutional phase (1981 – till present time) of the the professional training in HI development covers more than 35 years. It is characterized by the birth of HI as a speciality in the Canadian higher education system; the conceptualization of the professional training in HI; rapid increase in the number of HI professional programs in the mid 2000s; the unification of scientific and methodological framework for training HI professionals, and searching for mechanisms to ensure the quality of the professional training in HI in Canada.

The current state of the professional training in HI in Canada is outlined. The analysis of the organizational aspect of the studied problem demonstrates that the professional training in HI is built on the principles of life-long learning, practice-orientation, combination of terms for the study and paid work as well as on-site and

distance learning. The non-degree granting institutions provide HI diploma and certificate programs aimed at training HI practitioners in particular spheres of the healthcare informatization. The goal of HI Bachelor's programs is professional training of multi-skilled experts in theoretical and practical aspects of the ICT introduction into the healthcare system. Master's and PhD programs in HI provide training of scholars and academia that would boost further researches into medical information technologies and popularize the professional training in HI.

The content of the professional training in HI in Canada is generalized. Its development depends on a program type and aim of the professional training in HI. HI education content is mainly focused on the theoretical and practical learning of academic disciplines within three core knowledge domains – information sciences, health sciences, and management. They develop HI core professional competency for solving a wide range of healthcare informatization problems. We should conclude that HI is a young speciality in the system of higher education in Canada. Nowadays, it develops quickly. The existing syllabi of the professional training in HI provide a wide spectrum of possibilities for realization of the personal potential in a career related with healthcare informatization in Canada.

References

- Bickenbach, J.** (2003). Functional Status and Health Information in Canada: Proposals and Prospects. *Health Care Financing Review*, 24 (3), 89–102. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4194826/>
- Advisory Committee on Health Infostructure. (2000). *Blueprint and Tactical Plan for a Pan-Canadian Health Infostructure*. Ottawa: Health Canada.
- Buckeridge, D.** (1999). *Health Informatics in Canada: Definitions, Education, and Path Ahead*: Report. Canada: University of Toronto.
- Canada Health Act. (1984). *Government of Canada*. Retrieved from <http://laws-lois.justice.gc.ca/eng/acts/c-6/FullText.html>.
- Canada's Higher Education and Career Guide*. (2018). Retrieved from <http://www.canadian-universities.net/>
- Covvey, H., & Fenton, S.** (2013–2014). *Survey of Health Informatics Programs and Health Information Management Programs in Canada*. National Institutes of Health Informatics.
- Covvey, H., & Fenton, S.** (2015–2016). *Survey of Health Informatics Programs and Health Information Management Programs in Canada*. National Institutes of Health Informatics.
- Covvey, H.D., Zitner, D., & Bernstein, D.R.** (Eds.). (2001). *Pointing the Way: Competences and Curricula in Health Informatics: Applied Health Informatics (AHI), Research and Development Health Informatics (RDHI) and Clinician Health Informatics (CHI)*. Version 1.0. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.630.8414&rep=rep1&type=pdf>.
- CPHIMS-CA Canadian Supplemental Examination Candidate Handbook*. (2013). Toronto: COACH. Retrieved from <https://docplayer.net/14991700-Cphims-ca-canadian-supplemental-examination-candidate-handbook.html>.
- eHealth – MSc eHealth Program. (2018). *McMaster University*. Retrieved from <https://ehealth.mcmaster.ca/>

- Gaudet, J., Delle, A., Bird-Gayson, T., McKibbin, A., Satoglu, S., Heathcote, L. et al.** (2013). *Health Informatics Education in Canada: Landscape of an Emerging Academic Discipline*. Toronto: COACH. Retrieved from https://www.academia.edu/11632747/Health_Informatics_Education_in_Canada_Landscape_of_an_emerging_academic_discipline.
- Girard, R., & Crewson, H.** (2005). Early History of Health Informatics in Manitoba. In S.A. Huesing (Ed.), *From Mainframe to Mainstream: The Evolution of COACH and Health Informatics in Canada* (pp. 47–49). Toronto: COACH.
- Goel, V., & Royce, D.** (2003). Health Evidence Application and Linkage Network (HEALNet): Accomplishments and Impacts 1995–2002. *Canadian Society for the Study of Higher Education: Professional File*. Retrieved from https://csshescees.files.wordpress.com/2014/03/pf_23_goelroyce.pdf.
- Health Informatics Professional Career Matrix*. (2013). Retrieved from <https://digitalhealthcanada.com/wp-content/uploads/2017/12/HIP-Career-Matrix.pdf>.
- Health Informatics Professional Core Competences*. (2012). Retrieved from <https://digitalhealthcanada.com/wp-content/uploads/2019/07/Health-Informatics-Core-Competencies.pdf>.
- Health Information Science. (2018). *Western University*. Retrieved from http://grad.uwo.ca/prospective_students/programs/program_NEW.cfm?p=68.
- Huesing, S.A.** (Ed.). (2005). *From Mainframe to Mainstream: The Evolution of COACH and Health Informatics in Canada*. Toronto: COACH.
- Kushniruk, A., Lau, F., Borycki, E., & Protti, D.** (2006). The School of Health Information Science at the University of Victoria: Towards an Integrative Model for Health Informatics Education and Research. *Yearbook of Medical Informatics*, 45 (01), 159–165. doi: 10.1055/s-0038-1638477. Retrieved from <https://www.thieme-connect.de/products/ejournals/pdf/10.1055/s-0038-1638477.pdf>.
- Lau, F., & Bell, H.** (2003, February). A pan-Canadian Health Informatics Education Strategy. *AMIA Annual Symposium Proceedings* (pp. 386–390).
- Newsham, D., & Clement, H.** (2015). Celebrating 40 Years of COACH: A Dash through the Decades. *Healthcare Information Management and Communications Canada*, 29 (2), 50–56. Retrieved from <http://www.healthcareimc.com/main/celebrating-40-years-of-coach-a-dash-through-the-decades/>
- Romanow, R.J.** (2002). Information, Evidence and Ideas. *Building on Values: The Future of Health Care in Canada* (pp. 75–90). Saskatoon: Commission on the Future of Health Care in Canada. Retrieved from <http://publications.gc.ca/collections/Collection/CP32-85-2002E.pdf>.
- Welcome to the School of Health Information Science: Undergraduate handbook*. (2012). Victoria: University of Victoria.