ABSTRACT

**Background:** Health Informatics is an indispensable science in light of the massive reform healthcare has undertaken recently. **Objective:** Health Informatics is an indispensable science in light of the massive reform healthcare has undertaken recently. **Methods:** This descriptive multiphase study used a questionnaire to assess the need and applied a competency-based postgraduate curriculum to collect the required competencies as well as their proficiency levels. **Results:** Eighty percent of the respondents agreed that the current training should be advanced. 73.7% of the respondents agreed that this certificate would improve the level of knowledge, and it would impact on the delivery of healthcare positively (78.9%). For the required competencies, 10 competencies scored 1.75 and above, 22 scored between 1.5 and 1.75 and 22 scored below 1.50. The expert panel came to an agreement that the competencies with 1.5 and above should be included. **Discussion:** The findings emphasize the need to establish PG diploma in comply with previous studies that unveiled the need to provide education and training in Health Informatics. Only the required competencies were included as the program is one-year long. The selected competencies were validated and presented by the panel. **Conclusion:** A PG diploma in Health Informatics is a key element in the evolution of healthcare services, therefore, a competency-based framework was provided and validated by experts. **Keywords:** Education, postgraduate certificate, Health Informatics.

1. BACKGROUND

Health Informatics is the science of studying health data management and information technology systems. It is a multidisciplinary science in which healthcare knowledge is integrated with information technology, leadership and management, and the psychosocial determinants of collecting, sorting, processing, utilizing and maintaining data in the healthcare arena. According to the U.S. National Library of Medicine, Health Informatics is "the interdiscipli- nary study of the design, development, adoption, and application of IT-based innovations in healthcare services delivery, management, and planning” (1).

With the current need for transformation in the healthcare field, employing information technology can contribute to delivering effective, efficient, safe, and patient-centric care (2, 3). Therefore, every healthcare provider, nowadays, has to deal with health information systems. A nonexclu- sive list of those systems includes: the Electronic Health Record (EHR) systems, Laboratory Information System (LIS), Pharmacy Information System (PIS), Radiology Information System (RIS), Enterprise Resource Planning (ERP), Computerized Provider Order Entry (CPOE), Decision Support Systems (DSS). The impact of using information systems in the healthcare industry in Saudi Arabia revealed positive and anticipated results (4). Neverthe- less, potential barriers to successful im- plementation of information technology project in Saudi Arabia were asse- ssed by a study conducted by Aldosari (2017 (5)). The study concluded that the lack of training along with stakehol- ders’ poor knowledge in Health Informatics are potential barriers. Thus, suc- cessful utilization of information sys- tems in healthcare requires equipping professionals with the knowledge and
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2. OBJECTIVE

To assess the need for a postgraduate certificate in Health Informatics and identifies the recommended knowledge and skill sets (competencies) for building a postgraduate program in Health Informatics and the proficiency levels for each required competency.

3. METHODS

A multicenter cross-sectional study was carried out in three cities, namely Riyadh, Jeddah and AlAhsa and included participants who hold or pursue a postgraduate degree in Health Informatics. The study used a validated questionnaire to explore the need and the required knowledge and skills (competencies) as well as the proficiency levels. The required competencies were investigated through a scoring sheet based on the widely accepted competency framework by CAHIIM 2012 curriculum requirements for Health Informatics Master's Degree.

A purposive sampling technique was used as the selected participants are familiar with the field of Health Informatics field, have or pursue a postgraduate degree in relevant domains to Health Informatics, had relevant work experiences, and/or received training in health information systems. To serve the three objectives of the study, the data collection was conducted through a self-administered survey, which was adopted to collect data relating to the need assessment for establishing postgraduate certificate in Health Informatics. The survey had three parts: first part was collecting demographic data on the respondents. The second part consisted of a five-point Likert scale to collect data on the different aspects of need assessment (8). The survey was validated by three experts to assess the face validity. An internal reliability was tested through conducting a pilot study. The survey was reliable as the Cronbach’s alpha is 0.837.

The goal of the third part of the survey was to determine the inclusion or exclusion of competency-related items based on their relevance to the Health Informatics practice. Participants were asked, first, four demographics questions: background (Health Sciences or Information Technology specialist), qualifications, number of years working in Health Informatics, and age category. The participants were asked to select “include” or “exclude” next to each competency item. The Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) curriculum requirements for Health Informatics Master’s Degree was used. Competencies were organized into four categories:

Facet I. Information Systems – concerned with issues such as information systems analysis, design, implementation, and management. (23 competencies)
Facet II. Informatics – concerned with issues such as the structure, function and transfer of information, socio-technical aspects of health computing, and human-computer interaction. (13 competencies)
Facet III. Information Technology – concerned with issues such as computer networks, database and systems administration, security and programming. (13 competencies)
Facet IV. Additional desired course(s) content. (In case the participant wants to add something not mentioned in the CAHIIM 2012 curriculum requirements for Health Informatics Master’s Degree).

After selecting the required competency, the participants had to assign a level of practice to each competency: beginner, competent, and Informatics expert. Participants were instructed to select the lowest level of the required competency level. Furthermore, the convenience of the program was assessed in this round by examining the convenience of the proposed delivery approach.

Data analysis was performed according to the aim of each part of the survey. In Part A, the responses of each question were analyzed by the descriptive statistics (frequencies, Mean, Standard Deviation) and inferential statistical analysis to compare means like T-test and ANOVA. In the second part, each proposed competency was classified as “include” or “exclude.” If >50% of respondents selected “exclude,” the competency was eliminated. Then, data were evaluated to reach an agreement on assigning each competency to the lowest appropriate level of practice. Data were analyzed in numerical format, where 1 is equated to the novice level, 2 equals competent, and 3 equals Informatics expert. The competency level was determined based on the ranking of the majority for each competency.

Prior to carrying out the study, IRB approval was received from KAIMRC and a cross-sectional informed consent was collected from each participant at the beginning of the survey.

4. RESULTS

Out of the 167 distributed questionnaires, only 114 returned with response rate of 68%. Upon screening the responses, no variable has 5% or more missing cases. (Maximum is 3 out of 114, equal to 3 % in 3 variables), and three missing variables were identified only in two cases. Examining whether those
variables were at random led to failing to reject the null hypothesis, which states that the missing variables were completely at random. (Little’s MCAR test: Chi-Square = 2444.378, DF = 2580, Sig. = .972). As most of the responses were ordinal data in the form of a 5-point Likert scale, median-based imputation was used to replace missing values, as it is more comprehensive compared to mean-based imputation.

**Socio-demographic and IT knowledge of respondents**

The sample size was 114, where 81 (71%) were female; 65 (57%) were 20-29 years old; 45 (39.5%) were 30-39 years old; majority (81.6%) have 10 years or less of experience; work as physicians (8.8%), pharmacists (15.8%), nurses (14%) and Information Science and Technology specialists (16.7%). 80 respondents (70.2%) were currently enrolled in the Master of Health Informatics program and had a postgraduate degree.

In terms of Health Informatics Knowledge, 41% of the respondents received formal education, 5% obtained their HI knowledge through training by either workshops or conferences, 16% through self-guided learning, and 37% through mixed approaches. Finally, frequency of using Health Information Systems (HIS) revealed that 65.7% of the respondents use HIS always or frequently, while 32.4% apply rarely or never. Table 1 shows a detailed description of the respondents’ sociodemographic profile and their characteristics:

**Table 1. Respondents Sociodemographic Profile**

| Measure | Item                      | Frequency | Percentage |
|---------|---------------------------|-----------|------------|
| Gender  | Male                      | 81        | 71         |
|         | Female                    | 33        | 29         |
| Age     | 20-29                     | 65        | 57         |
|         | 30-39                     | 45        | 39.5       |
|         | 40-49                     | 3         | 2.6        |
|         | 50 and above              | 1         | 0.9        |
| Experience | <9                       | 92        | 80.7       |
|         | 10-19                     | 21        | 18.5       |
|         | 20 and above              | 1         | 0.9        |
| Specialty | Medicine                 | 10        | 8.8        |
|         | Dentistry                | 6         | 5.3        |
|         | Pharmacy                 | 18        | 15.8       |
|         | Nurse                    | 16        | 14         |
|         | Information Technology   | 19        | 16.7       |
|         | and Sciences             |           |            |
|         | Health Informatics       | 11        | 9.6        |
|         | Other                    | 29        | 25.4       |
| Health Informatics Knowledge | Formal Education | 47        | 41.2      |
|         | Training through Workshops and Conferences | 6     | 5.3     |
|         | Self-guided              | 18        | 15.8       |
|         | Mixed Approach           | 43        | 37.7       |
| Frequency of using Health Information Systems | Always     | 42        | 36.8      |
|         | Frequently               | 33        | 28.9       |
|         | Rarely                   | 11        | 9.6        |
|         | Never                    | 26        | 22.8       |

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The second part of the survey aimed to assess the need for Health Informatics PG diploma. In relation to the current level of HI education, 45.6% of the respondents agreed (Agree or Strongly Agree) that current training level is appropriate, 37.7% of the respondents expressed that the received training was comprehensive, and 38.6% deemed sufficient. On average, 35.4% of the respondents responded that the current level of education is satisfactory (m= 3.08 on a scale of 1 to 5, SD=1.16). Finally, 80.7% of the respondents suggested that the level of current training should be advanced.

As for the requirements and objectives of the PG Program, 55.3% of the respondents agreed that a Bachelor of Health Sciences should be a prerequisite to the HI-PG certificate; 66.7% agreed that PG certificate shall meet the needs of busy professionals, and cover the essential knowledge pertinent to HI (73.3%).

In terms of the perceived impact of the proposed PG Certificate on the knowledge aspects, 73.7% of the respondents agreed that PG certificate would enhance the level of Knowledge and consolidate the level of required competencies (m=4.05 on a scale of 1 to 5, SD = 0.88). The perceived impact on the HI practice revealed that 80.2% of the respondents agreed that PG certificate would have a positive impact on the delivery of healthcare (78.9%), quality of healthcare (78.9%), healthcare efficiency (86%), enhance the use of HIS (81.6%), and minimize the barriers to adopting HIS (75.5%). (The average impact recorded is 4.02 ±0.92 on a scale of 1 to 5).

Overall, 73.7% of the respondents’ facet indicated that PG certification is an essential requirement for Health Informatics in KSAU-HS.

**First Phase:**

Inferential analysis was conducted to see the relationship between the mean scores of each variable and outcome of the study. When we compared the scores with gender, no statistically significant differences were found in the scores of each variable between male and female. With reference to age, experience, and academic qualifications, a one-way ANOVA analysis was conducted to assess possible differences in the responses. The results of the ANOVA analysis also revealed statistically non-significant differences in responses to the need for postgraduate diploma based on the mentioned variables.

Furthermore, qualitative measures are indispensable tools for assessing users’ attitudes toward EHR. The following section covers responses to open-ended questions 16 and 17. The respondents’ comments reflected the pressing need for PG diploma in HI as it helps acquire considerable knowledge in a shorter period of time compared to the current approach adopted in HI programs in the country (82% of the responses). Another finding disclosed the respondents’ concern over the failure to achieve official recognition of the proposed PG diploma form the government (6% of the responses).

**Second Phase- A:**

In this part, the respondents were asked to determine the inclusion or exclusion of each competency items of the Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) curriculum requirements for Health Informatics Master’s degree based on their relevance to the Health Informatics practice. The lowest level of proficiency required: 1= novice, 2 = competent, and 3 = expert). Based on the survey, 10 competencies scored 1.75 and above, 22 competencies scored between 1.5 and 1.75, and 22 competencies scored below 1.50. The following tables illustrate the responses to each competency item:

| Measure | Item | Frequency | Percentage |
|---------|------|-----------|------------|
| Gender  | Male | 81        | 71         |
|         | Female | 33        | 29         |
| Age     | 20-29 | 65        | 57         |
|         | 30-39 | 45        | 39.5       |
|         | 40-49 | 3         | 2.6        |
|         | 50 and above | 1      | 0.9        |
| Experience | <9       | 92        | 80.7       |
|         | 10-19 | 21        | 18.5       |
|         | 20 and above | 1     | 0.9        |
| Specialty | Medicine     | 10       | 8.8        |
|         | Dentistry | 6        | 5.3        |
|         | Pharmacy   | 18       | 15.8       |
|         | Nurse      | 16       | 14         |
|         | Information Technology and Sciences | 19 | 16.7 |
|         | Health Informatics | 11 | 9.6 |
|         | Other      | 29       | 25.4       |
| Health Informatics Knowledge | Formal Education | 47 | 41.2 |
|         | Training through Workshops and Conferences | 6 | 5.3 |
|         | Self-guided | 18 | 15.8 |
|         | Mixed Approach | 43 | 37.7 |
| Frequency of using Health Information Systems | Always | 42 | 36.8 |
|         | Frequently | 33 | 28.9 |
|         | Rarely | 11 | 9.6 |
|         | Never   | 26       | 22.8       |
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Second Phase- B:

A panel of experts was consulted for the required competencies. The panel consisted of two faculties in the Health Informatics Department and two experts working in the field of Health Informatics. The expert panel came to an agreement that the competencies with 1.5 and above should be included. Furthermore, they recommended adding three competencies from those scored below 1.5. Namely,

- Clinical data standards theory and development (scored 1.43)
- Clinical data and clinical process modeling (scored 1.32)
- Principles of data representation (scored 1.46)

The expert panel recommended the following Postgraduate diploma curriculum (Table 4):

5. DISCUSSION

This study aimed at assessing the need for establishing a competency-based postgraduate certificate in Health Informatics to equip the healthcare team with the essential knowledge and skills in an efficient way. The findings of the study reveal that there is a need to establish postgraduate certificate in Health Informatics. This finding complies with previous studies that unveil the need to provide education and training in health informatics field (9, 10). To assure full utilization of the proposed diploma, the respondents noted that a bachelor’s degree is obligatory for potential candidates as the certificate courses rely on previous knowledge obtained from health-related domains or information technology and sciences.

The respondents have positively perceived the impact of the PG diploma on the knowledge aspects that may improve the level of knowledge and consolidate the level of required competencies. In relation to the aspects of the future HI practice, the majority of the respondents agreed that PG certificate would have positive impact on the quality, delivery and efficiency of healthcare; would enhance the use of HIS, and minimize the barriers to adopting HIS. This is in line with other studies in the literature. Altuwajri, (2010) asserted the positive impact of HI program on both domains: knowledge and future practice related to utilizing HIS in healthcare. Since the program is only one-year long, it is expected that not all CAHIM competency-based frameworks for the master program are included. Relevant competencies should be selected and included in this one-year PG diploma. The selected competencies are believed to serve the main purpose of HI academic programs discussed by Nelson and Staggers (2016). Furthermore, the selected competencies were validated and presented by the expert panel in the form of study plan and proposed courses. The panel emphasizes the need for establishing specific Diploma Learning Outcomes (DLOs) as well as Course Learning Outcomes (CLOs) reflecting and mapping with the agreed competencies.

Limitations and Future Research

This descriptive, one-institution study highlights the need to conduct a comprehensive nationwide study to assess this innovative solution to the shortfall in health informatics workforce. It would also be wise to seek the policy makers’ opinions towards establishing this postgraduate program and to explore the convenience of the proposed program (Evening time, Weekends, etc...).

Recommendations

It is recommended to execute the proposed Diploma in the Health Informatics Department at KSAU-HS. We suggest establishing specific Diploma Learning Outcomes (DLOs) and conducting a progress test toward the proposed DLOs at the end of the program. It is also recommended to use proper assessment approaches (Formative, Summative and a standard setting approach) to assess the achieved learning out-
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| Health Informatics Master's Degree Curriculum Facets | The lowest level of proficiency required |
|-----------------------------------------------------|----------------------------------------|
|                                                     | 1 = novice level                        |
|                                                     | 2 = competent,                          |
|                                                     | 3 = expert level                        |
| Facet I. Information Systems – concerned with such issues as information systems analysis, design, implementation, and management. | |
| Healthcare delivery systems, organization, governance and workflow | 1.82 |
| Health information systems characteristics, strengths and limitations | 1.85 |
| Electronic health records and personal health records | 1.95 |
| Patient rights and associated regulations | 1.75 |
| Privacy and confidentiality of patient health information | 2.0 |
| Information security practices | 1.77 |
| Personnel management, negotiation, communication skills, business ethics, leadership and governance | 1.77 |
| Facet II. Informatics – concerned with such issues as the structure, function and transfer of information, socio-technical aspects of health computing, and human-computer interaction. | |
| Medical decision-making: principles, design, implementation | 1.85 |
| Principles of health information systems data storage design, including patient-centered | 1.75 |
| Principles of research and clinical literature research | 1.77 |
| Facet III. Information Technology – concerned with such issues as computer networks, database and systems administration, security and programming. | |
| Health information systems assessment methods and tools | 1.70 |
| Quality assessment including total quality management, data quality, and identification of best practices for health information systems | 1.70 |
| Health IT standards | 1.64 |
| Use of healthcare terminologies, vocabularies and classification systems | 1.69 |
| Health information exchanges (HIE) | 1.70 |
| Management of information systems including life cycle analysis, system design, planning methods and tools | 1.71 |
| Evidence-based systems and tools (such as PubMed, Up-to-date) | 1.51 |
| Workflow process re-engineering | 1.52 |
| Strategic planning | 1.53 |
| Project planning and management | 1.72 |
| Change management | 1.52 |
| Finance and budgeting and cost-benefit analysis for information systems | 1.57 |
| Assessment of commercial vendor products and software applications | 1.73 |
| Policy development and documentation | 1.53 |
| Systems thinking and theory | 1.32 |
| Cognitive support (i.e. clinical decision support) | 1.60 |
| Facet II. Informatics – concerned with such issues as the structure, function and transfer of information, socio-technical aspects of health computing, and human-computer interaction. | |
| Systems testing and evaluation | 1.54 |
| System integration tools | 1.59 |
| Networking principles, methods, design | 1.57 |
| Electronic data exchange | 1.74 |
| Health Information technology: systems architecture, database design, data warehousing | 1.58 |
| Technical security applications and issues | 1.50 |
| Virtual network applications and storage (such as cloud computing) | 1.52 |
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6. CONCLUSION

The study shows how most of the participants agreed on the need to establish certificate programs that can ease the health informatics workforce shortage. A framework for PG diploma in Health Informatics was provided and validated by experts. Once the program is executed, a study to assess the achieved learning outcomes should be sought to direct and align the outcomes with the market needs.

- Author’s Contribution: Abdullah Alanazi, Mohamud Mohamud and Bakheet Aldosari. gave substantial contributions to the conception or design of the work in acquisition, analysis, or interpretation of data for the work. Abdullah Alanazi, had a part in article preparing for drafting or revising it critically for important intellectual content. Alanazi, Mohamud and Aldosari gave final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
- Conflicts of interest: There are no conflicts of interest.
- Financial support and sponsorship: None.

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