

Faculty and Students' Perspective of Health Informatics Programs in Saudi Arabia

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Background: Health Informatics is a discipline that deals with the acquisition, storage, retrieval and use of health data, information, and technologies for the purpose of improving healthcare quality. It involves the application of information science methods to analyse health information for improved problem solving and healthcare delivery. The use of information system applications in healthcare is increasingly popular and includes the use of applications like medical records, order entry, medical knowledge provision, imaging, as well as guidelines and other types of decision support.

Aim: To examine health informatics undergraduate programs in Saudi Arabian government universities.

Methods: This study follows a quantitative, descriptive cross-sectional design using a self-reported, electronic questionnaire. The data was collected using an online questionnaire via Google Forms. Probability stratified random sampling was utilized.

Result and Conclusion: Findings revealed a response rate at 79% (n=184) of students and 67% (n=38) of faculty members. Variation was detected in the level of agreement toward the examined six variables. Both students and faculty members express same level of agreement toward all variables. A significant correlation was determined between facilities and other variables such as students' involvement, research, admission and curriculum. Similarly, there is a significant relationship between students' involvement and curriculum with research, demission, faculty members role and outcomes.

Keywords: health informatics, bachelor's in health informatics, Saudi universities, education, curriculums

Introduction

Health Informatics (HI) is a discipline that deals with the acquisition, storage, retrieval and use of health data, information and technologies for the purpose of improving healthcare quality.^{1,2} It involves the application of information science methods to analyse health information for improved problem solving and healthcare delivery.³ The use of information system applications in healthcare is increasingly popular and includes the use of applications like medical records, order entry, medical knowledge provision, imaging, as well as guidelines and other types of decision support.⁴

HI, also called medical informatics, is an interdisciplinary field that cuts across various disciplines including information science, computer science and health care. It is complemented by related fields with similar areas of focus. For instance, biomedical informatics, which refers to the storage, retrieval and use of biomedical information, data and knowledge.³ Bioinformatics, on the other hand, is the application of technology to the biological sciences in order to acquire, analyse, store and visualize biological data. Similarly, clinical informatics is the application of information technology to problems in clinical care. With regard to management of health data, the term health information management is often used. It refers to the management of health data and information as captured in medical or health records. With health records becoming increasingly electronic, health information management tends to overlap with aspects of HI.^{3,5}

The growing interest in the area of HI and the demand for expertise in this field have given rise to an expansion of educational opportunities with degrees at all levels.^{3,5,6} This has also led to the revision of the HI or medical informatics education structure in 2010 by the International Medical Informatics Association (IMIA). The changes are aimed at meeting the educational needs of a wide range of health professionals, from medicine, nursing and healthcare

management to dentistry, pharmacy, public health, health record administration and informatics. It is also developed for the purpose of dedicated programs in biomedical and HI.⁷

Education in informatics is available at community college level, baccalaureate, master's and doctoral levels. At community college level, training programs are aimed at preparing workers for technical duties under the supervision of an expert. Academic programs usually consist of coursework in information science, including one health or biomedical domain. There is also strong computational emphasis present throughout the curriculum.³ Other common focus areas in HI educational programs include evidence-based medicine, disease management, complex medicine and population health management.⁵

Interested students may come from a health or medical professional background, seeking knowledge and skills in information science and technology. On the other hand, they may already possess knowledge and skills in information science and technology, but lack preparation or knowledge in the health sciences.³ HI experts, also known as health informaticians or informaticists, are trained to carry out research in HI, and serve as intermediaries between technical personnel and physicians and nurses. They can also be involved in the design and development of systems. They may also support medical staff in determining requirements for new applications.⁴

The Bachelor of HI degree offered at the Saudi governmental universities is a four-year-long program that consists of courses in health-care informatics, health-care administration, and clinical informatics. During their studies, students also have the opportunity to specialize in a particular field of health informatics that best represents their interests and helps them achieve their desired career goal. Students gain a strong understanding of information systems and health informatics, as well as how to apply these concepts to health care. Finally, Saudi governmental universities are fully supervised, monitored and regulated by the Saudi Ministry of Educational (MoE).^{8,9}

This study aims to examine health informatics undergraduate programs in Saudi Arabian governmental universities.

To compare health informatics programs in Saudi Arabian governmental universities

To determine the differences between students and faculty members perspectives about undergraduate programs in health informatics

To identify the main strengths and weaknesses of undergraduate programs in health informatics in Saudi Arabia

What this study adds

- This study provides comprehensive insight about HI programs in SA from two different populations.
- This study presents a useful data collection tool to evaluate bachelor programs, especially health programs where core internship program is embedded.
- This study also provides useful guide for policymakers in education, program tutors, and curriculum designers.
- This study includes several indicators about the level of HI programs quality and weaknesses

Methods and Materials

This study follows quantitative, descriptive cross-sectional design using self-reported, electronic questionnaire composed of pre-defined items and response options.¹⁰⁻¹² To achieve the study aim, I designed a specific online questionnaire using google forms. The utilized questionnaire is divided into three main sections. The first was a letter that explained the nature of the study, the significance of their involvement and their right to withdraw at any moment. Furthermore, the letter described how their responses would be handled and how their participation would be kept anonymous. The second part of the questionnaire seeks demographic information about the participants, specifically gender, age, and university name. The third part of the questionnaire is divided into six main themes each theme represents a significant factor to evaluate bachelor programs. These factors were determined from previous similar published studies. The determined factors are Facilities,^{13,14} students' involvements,¹⁵ curriculum,^{14,16,17} research,^{14,18} admission,¹⁹⁻²¹ roles of faculty staff,^{14,22-24} outcome,^{25,26} and internship,²⁷⁻²⁹ for full list of items see [Table 1](#). Participants were asked to rate each question on a scale from "strongly disagree" to "strongly agree." as follows: Strongly Disagree (1); Disagree (2); Neutral (3); Agree (4); and Strongly Agree (5). Although two data collection instruments were disrupted, they are very similar. The only difference between them was the demographic questions to ensure the appropriateness of such a questionnaire

Table 1 Name of the Selected Universities and Selection Criteria

Selected Universities	Inclusion Criteria	Exclusion Criteria
Qassim University	Saudi governmental universities	Private universities
Hail University	Health Informatics programs	Private colleges
Jazan University	Bachelor's degree	Postgraduate degrees
Saudi Electronic University	Bachelor's degree with internship programs	Health information management
King Faisal University	Male and female	Health information management and technology
	Students from all levels	Bachelor's degree without internship programs
	Faculty members from all positions	Biomedical informatics programs

to the targeted populations. For instance, students were asked about their level of study, while faculty members were asked about their position.

Questionnaire Validity

The preliminary instrument was subjected to review by expert panels, which included external experts such as head of academic department, heads of students affairs and academic department, faculty members. The purpose of the expert panels was to assess the questionnaire's content, ensure its relevance to the target population, and evaluate the clarity and understandability of the questions. Based on their feedback, demographic questions such as participant gender and level of involvement were added, and adjustments were made to the Likert scale response options to reduce them from eight to seven.

Following the review and feedback from the expert panels, a pilot study was conducted with a small group of project team members (n=9) at Qassim University. The participants were selected based on criteria such as different position levels, departments, and nationalities. The aim of the pilot study was to gather feedback on the questionnaire's quality, including readability, comprehensiveness, appropriateness, and clarity. Participants were asked specific questions to assess their understanding of the questionnaire and provide suggestions for improvement.

Each participant in the pilot study completed the first draft of the questionnaire and provided comments and feedback on the process, questionnaire administration time, and clarity of the questions. The responses from the pilot study indicated that no additional questions needed to be included or excluded. Overall, the questionnaire was deemed relatively clear and easy to complete. Minor spelling, grammar, and numbering modifications were made based on the feedback to enhance clarity and readability. The pilot study was conducted over a two-week period in September 2022. Volunteer feedback was incorporated into the final version of the questionnaire, as the modifications required were minor.

Population and Sampling

In this research, the targeted population consists of all undergraduate students (n=589) and faculty members (n=66) enrolled in the HI programs at Saudi governmental universities n=5. Probability stratified random sampling was utilized.^{30,31} Therefore, five governmental universities have been selected as seen in [Table 2](#). The selection of the universities was made through several inclusion and exclusion criteria (see [Table 1](#)). Based on a sample size calculation with 95% confidence level and 5% margin of error, a questionnaire was distributed to 233 students and 57 faculty members.

Data Analysis

All questionnaire data was coded in numerical groups and entered into IBM SPSS, Version 29. Initially, the reliability test was performed using Cronbach's alpha. Following that, an early descriptive analysis of the questionnaire data was

Table 2 Distribution of Participants Based on Gender, Age, Faculty Staff Position, Students Level of Study, and University Name

Faculty Members			Students		
Gender					
Female	15	39.5	Male	70	38.0
Male	23	60.5	Female	111	60.3
Total	38	100.0	Total	181	98.4
Age					
18 to 24	2	5.3	18 to 20	102	55.4
25 to 34	12	31.6	21 to 25	79	42.9
35 to 44	13	34.2	26 to 30	3	1.6
45 to 54	6	15.8	Total	184	100.0
55 to 64	5	13.2			
Total	38	100.0			
Faculty staff position			Current level of study		
Teaching assistant	11	28.9	Foundation year	29	15.8
Lecture	13	34.2	First year	16	8.7
Assistant professor	6	15.8	Second year	33	17.9
Associated professor	8	21.1	Third year	16	8.7
Total	38	100.0	Internship year	67	36.4
			Recently graduate	23	12.5
			Total	184	100.0
University Name					
Qassim University	6	15.8	Qassim University	41	22.3
Hail University	9	23.7	Hail University	40	21.7
Jazan University	10	26.3	Jazan University	49	26.6
Saudi Electronic University	9	23.7	Saudi Electronic University	30	16.3
King Faisal University	4	10.5	King Faisal University	24	13.0
Total	38	100.0	Total	184	100.0

performed. Moreover, inferential statistics were performed to determine any significant differences between groups or correlation between variables.

Result

Initially, Cronbach's alpha test show that data collection instrument was statistically reliable $\alpha=0.84$. Findings reveal a response rate at 79% ($n=184$) of students and 67% ($n=38$) of faculty members.

Table 2 presents information on the distribution of faculty members and students based on various factors. In terms of gender, the faculty members consist of 15 females (39.5%) and 23 males (60.5%), while the student population includes

111 females (60.3%) and 70 males (38.0%). This indicates a higher representation of female students compared to faculty members, with a slightly higher proportion of male faculty members. Regarding age, faculty members span a wider range of ages. Among them, 2 (5.3%) are in the 18 to 24 age group, 12 (31.6%) are aged 25 to 34, 13 (34.2%) are aged 35 to 44, 6 (15.8%) fall in the 45 to 54 age range, and 5 (13.2%) are aged 55 to 64. On the other hand, the student population is predominantly younger, with 102 (55.4%) falling in the 18 to 20 age range, 79 (42.9%) in the 21 to 25 range, and only 3 (1.6%) in the 26 to 30 range.

Examining faculty staff positions, there are 11 teaching assistants (28.9%), 13 lecturers (34.2%), 6 assistant professors (15.8%), and 8 associate professors (21.1%). For the students, their distribution across different levels of study includes 29 (15.8%) in the foundation year, 16 (8.7%) in the first year, 33 (17.9%) in the second year, 16 (8.7%) in the third year, 67 (36.4%) in the internship year, and 23 (12.5%) who have recently graduated. Lastly, the table presents the distribution of faculty members and students among various universities. Among the faculty members, Qassim University has 6 (15.8%), Hail University has 9 (23.7%), Jazan University has 10 (26.3%), Saudi Electronic University has 9 (23.7%), and King Faisal University has 4 (10.5%). Comparatively, the students are distributed as follows: Qassim University with 41 (22.3%), Hail University with 40 (21.7%), Jazan University with 49 (26.6%), Saudi Electronic University with 30 (16.3%), and King Faisal University with 24 (13.0%).

Table 3 provides descriptive statistics regarding students' perceptions of various aspects related to their academic program in Health Informatics (HI). A total of 184 students participated in the survey, with a few missing responses

Table 3 Descriptive Statistics of Student's Responses

Descriptive Statistics Students			
	N		Median
	Valid	Missing	
The university has access to most of the data basis and data centres for research	184	0	2.0000
Students benefited from analysis software that provided by the University	184	0	4.0000
All research facilities are available include labs, reading rooms at the library, and wide range wide books at the library.	180	4	4.0000
The university provide printing and data analysis services.	169	15	4.0000
Students benefited from the internet services and research centres that provided by the University.	180	4	4.0000
The school cover all expense required to attend and participation in conferences.	181	3	4.0000
Students are able to access journals and data basis from home.	184	0	4.0000
The most advanced technology are used to deliver the courses.	184	0	3.0000
Bachelor programs in HI encourage to figure the community issues	182	2	4.0000
Faculty members and students are involved in the evaluation of Bachelor programs in HI	184	0	4.0000
Students participate with the academic department to develop the syllabuses at the end of the year	181	3	4.0000
Students concern and Complaints are taken seriously and resolve	175	9	4.0000
The school give their students the opportunity to choose their supervisors and the dissertations topics.	173	11	4.0000
Learning methods relay on a critical thinking approached	176	8	4.0000
Group discussion is a part of the teaching methods in class	176	8	4.0000
Group work is available to produce a group project	177	7	4.0000
Content of bachelor programs in HI considers the students research needs	179	5	4.0000
Syllabuses help to improve students research skills	177	7	4.0000
The content of bachelor programs in HI syllabuses in line with students disciplines	176	8	3.5000
Students benefited from the syllabus in writing the research project	176	8	3.0000
Department provide courses with a consideration of the program needs	173	11	2.0000
Syllabuses help to improve students' ability for critical thinking	176	8	3.0000
Tests used vary between substantive and editorial	184	0	3.0000
Students asked to prepare a scientific report on curricula topics	184	0	4.0000
Research assistants are available to support the students to provide the required articles and resources	182	2	4.0000

(Continued)

Table 3 (Continued).

Descriptive Statistics Students	N		Median
	Valid	Missing	
	All required information and resources are available to support students in their research.	182	
The period of study in your college is longer than other colleges	177	7	4.0000
There is a balance in the admission between different disciplines	179	5	4.0000
There is typical entry requirement	184	0	4.0000
Faculty staff encourage their students for discussion and critical thinking	184	0	2.0000
Faculty staff always available for advice and guidance.	184	0	3.0000
Students received recommendation and advice from the faculty staff to improve their research.	184	0	4.0000
The school invite specialist faculty staff from outside the University to benefit from their experiences on regular basis	184	0	4.0000
Faculty staff use the most recent journals and articles in their curricula.	179	5	4.0000
The faculty staff present the courses in scientific way which comply with postgraduate courses and their goals.	184	0	3.0000
The faculty staff emphasise on the using multiple sources in their curricula	181	3	4.0000
The faculty staff link the curricula with the reality of the society and culture.	184	0	4.0000
The number of the faculty staff is commensurate with number of postgraduate students according to the global standard.	184	0	4.0000
The faculty staff at the school has sufficient experiences to deliver the courses in simple way.	179	5	4.0000
Clear criteria are available to evaluate the faculty staff.	184	0	4.0000
Bachelor programs in HI meet the student aspirations	176	8	4.0000
Bachelor programs in HI contribute to achieve the community needs?	184	0	4.0000
Bachelor programs in HI graduated competencies in HI	184	0	4.0000
Internships duration	184	0	3.0000
Internships program improves the students' skills and competences	181	3	4.0000
Internships programs prepare students to the market	181	3	4.0000
Internships program cover all skills required to get appropriate job in HI	181	3	3.0000
Internships program duration is sufficient for undergraduate level	181	3	5.0000
Internships programs reflect all thought courses in the bachelor's degree in HI	182	2	4.0000

across different items. The responses were measured on a Likert scale, with values ranging from 0 to 5, and the median values are reported.

Overall, the data indicates positive perceptions of the academic program. For instance, students highly valued the university's access to data bases and data centers for research (median: 2.00) and the availability of analysis software provided by the university (median: 4.00). They also acknowledged the presence of comprehensive research facilities, including labs and reading rooms at the library, along with access to a wide range of books (median: 4.00). The university's provision of printing and data analysis services (median: 4.00) and the availability of internet services and research centers (median: 4.00) were also positively perceived.

Furthermore, the academic program was praised for its focus on research and community engagement. Students indicated that the program encouraged them to address community issues (median: 4.00) and involved both faculty members and students in the evaluation of bachelor programs (median: 4.00). The program also emphasized the importance of student input, as students participated in developing syllabi (median: 4.00) and were given the opportunity to choose their supervisors and dissertation topics (median: 4.00). Additionally, the program was recognized for fostering critical thinking skills through learning methods and group discussions (median: 4.00).

Students expressed satisfaction with the availability of resources and support for their research projects. They reported that all required information and resources were available to support their research (median: 4.00), and research assistants were accessible to provide necessary articles and resources (median: 4.00). The program's emphasis on scientific reports and the encouragement of students to prepare them (median: 4.00) further supported research skills

development. Moreover, internships were seen as beneficial, contributing to the improvement of students' skills and competences (median: 4.00) and preparing them for the job market (median: 4.00).

Table 4 presents descriptive statistics regarding faculty members' perceptions of various aspects related to the academic program in Health Informatics (HI). The data include responses from 38 faculty members, with no missing values reported. The responses were measured on a Likert scale, ranging from 0 to 5, with the median values provided.

Table 4 Descriptive Statistics of Faculty Members Responses

Descriptive Statistics Faculty Members			
	N		Median
	Valid	Missing	
The university has access to most of the data basis and data centres for research	38	0	2.0000
Students benefited from analysis software that provided by the University	38	0	3.0000
All research facilities are available include labs, reading rooms at the library, and wide range wide books at the library.	38	0	4.0000
The university provide printing and data analysis services.	38	0	3.0000
Students benefited from the internet services and research centres that provided by the University.	38	0	4.0000
The school cover all expense required to attend and participation in conferences.	38	0	4.0000
Students are able to access journals and data basis from home.	38	0	4.0000
The most advanced technology are used to deliver the courses.	38	0	3.0000
Bachelor programs in HI encourage to figure the community issues	38	0	4.0000
Faculty members and students are involved in the evaluation of Bachelor programs in HI	38	0	4.0000
Students participate with the academic department to develop the syllabuses at the end of the year	38	0	4.0000
Students concern and Complaints are taken seriously and resolve	38	0	4.0000
The school give their students the opportunity to choose their supervisors and the dissertations topics.	38	0	4.0000
Learning methods relay on a critical thinking approached	38	0	4.0000
Group discussion is a part of the teaching methods in class	38	0	4.0000
Group work is available to produce a group project	38	0	4.0000
Content of bachelor programs in HI considers the students research needs	38	0	4.0000
Syllabuses help to improve students research skills	38	0	4.0000
The content of bachelor programs in HI syllabuses in line with students disciplines	38	0	4.0000
Students benefited from the syllabus in writing the research project	38	0	3.0000
Department provide courses with a consideration of the program needs	38	0	3.0000
Syllabuses help to improve students' ability for critical thinking	38	0	4.0000
Tests used vary between substantive and editorial	38	0	3.5000
Students asked to prepare a scientific report on curricula topics	38	0	4.0000
Research assistants are available to support the students to provide the required articles and resources	38	0	4.0000
All required information and resources are available to support students in their research.	38	0	4.0000
The period of study in your college is longer than other colleges	38	0	3.0000
There is a balance in the admission between different disciplines	38	0	4.0000
There is typical entry requirement	38	0	4.0000
Faculty staff encourage their students for discussion and critical thinking	38	0	2.0000
Faculty staff always available for advice and guidance.	38	0	4.0000
Students received recommendation and advice from the faculty staff to improve their research.	38	0	4.0000
The school invite specialist faculty staff from outside the University to benefit from their experiences on regular basis	38	0	4.0000
Faculty staff use the most recent journals and articles in their curricula.	38	0	4.0000
The faculty staff present the courses in scientific way which comply with postgraduate courses and their goals.	38	0	3.0000
The faculty staff emphasise on the using multiple sources in their curricula	38	0	4.0000
The faculty staff link the curricula with the reality of the society and culture.	38	0	4.0000
The number of the faculty staff is commensurate with number of postgraduate students according to the global standard.	38	0	4.0000

(Continued)

Table 4 (Continued).

Descriptive Statistics Faculty Members			
	N		Median
	Valid	Missing	
The faculty staff at the school has sufficient experiences to deliver the courses in simple way.	37	1	4.0000
Clear criteria are available to evaluate the faculty staff.	38	0	4.0000
Bachelor programs in HI meet the student aspirations	38	0	4.0000
Bachelor programs in HI contribute to achieve the community needs?	38	0	4.0000
Bachelor programs in HI graduated competencies in HI	38	0	4.0000
Internships duration	38	0	2.0000
Internships program improves the students' skills and competences	38	0	5.0000
Internships programs prepare students to the market	38	0	4.0000
Internships program cover all skills required to get appropriate job in HI	38	0	3.5000
Internships program duration is sufficient for undergraduate level	38	0	4.0000
Internships programs reflect all thought courses in the bachelor's degree in HI	38	0	5.0000

Overall, faculty members displayed positive perceptions of the academic program. They acknowledged the university's access to data bases and data centers for research (median: 2.00) and the availability of analysis software provided by the university (median: 3.00). Faculty members also recognized the presence of comprehensive research facilities, including labs, reading rooms at the library, and a wide range of books (median: 4.00). They further acknowledged the university's provision of printing and data analysis services (median: 3.00) and the availability of internet services and research centers (median: 4.00).

Faculty members highlighted the program's emphasis on research, community engagement, and student involvement. They noted that bachelor programs in HI encourage students to address community issues (median: 4.00) and involve both faculty members and students in program evaluations (median: 4.00). Faculty members also indicated that students participate in the development of syllabi (median: 4.00) and have the opportunity to choose their supervisors and dissertation topics (median: 4.00). Moreover, faculty members emphasized the use of critical thinking in learning methods (median: 4.00) and the inclusion of group discussions (median: 4.00) and group work for project production (median: 4.00).

Faculty members acknowledged the program's focus on improving students' research skills and meeting their research needs through syllabi (median: 4.00). They also recognized the availability of research resources and support for students (median: 4.00) and the involvement of research assistants (median: 4.00) in providing necessary articles and resources. Furthermore, faculty members appreciated the program's linkages with the reality of society and culture (median: 4.00) and the use of recent journals and articles in the curricula (median: 4.00).

Regarding internships, faculty members considered them to be of sufficient duration for undergraduate level (median: 4.00) and recognized their effectiveness in improving students' skills and competences (median: 5.00). They also indicated that internships prepare students for the job market (median: 4.00) and cover the skills required to obtain appropriate jobs in HI (median: 3.50). Additionally, faculty members noted that internships reflect the courses taught in the bachelor's degree program in HI (median: 5.00).

Table 5 shows that faculty members have a mean score of 3.11, while students have a mean score of 3.29 on facilities and faculty members have a mean score of 3.41, whereas students have a mean score 3.51 on students' involvement. Similarly, faculty members and students have a mean score 3.33 on curriculum and faculty members have a mean score of 3.55, while students have a mean score of 3.51 on research. Furthermore, faculty members have a mean score of 3.39, though students have a mean score of 3.58 on admission and faculty members have a mean score of 3.43, while students have a mean score of 3.35 on role of faculty staff. Similarly, faculty members have a mean score of 3.64, although students have a mean score of 3.79 on the outcome and faculty members have a mean score of 4.06, whereas students have a mean score of 3.75 on internship program.

Table 5 Descriptive Statistics (Faculty = 38, Students = 184)

Variables	Participants	Mean	Std. Deviation
Facilities	Faculty	3.11	0.660
	Student	3.29	0.405
Students' Involvement	Faculty	3.41	0.799
	Student	3.51	0.560
Curriculum	Faculty	3.33	0.549
	Student	3.33	0.501
Research	Faculty	3.55	0.828
	Student	3.51	0.836
Admission	Faculty	3.39	0.945
	Student	3.58	0.776
Roles of Faculty Staff	Faculty	3.43	0.560
	Student	3.35	0.555
Outcome	Faculty	3.64	0.807
	Student	3.79	0.508
Internship Program	Faculty	4.06	0.402
	Student	3.75	0.424

The correlation table (see Table 6) provides depicts the relationships between various variables in the context of facilities, faculty, and students. Each cell in the table represents the correlation coefficient between two variables, with values ranging from -1 to $+1$. The higher the absolute value of the coefficient, the stronger the correlation between the

Table 6 Correlations Between Variables

Variables		1	2	3	4	5	6	7	8
Facilities	Faculty	–							
	Students								
Students' Involvement	Faculty	0.77**	–						
	Students	0.48**							
Curriculum	Faculty	0.73**	0.82**	–					
	Students	0.36**	0.71**						
Research	Faculty	0.58**	0.62**	0.58**	–				
	Students	0.46**	0.60**	0.55**					
Admission	Faculty	0.04	0.17	0.16	0.61**	–			
	Students	0.55**	0.40**	0.34**	0.55**				

(Continued)

Table 6 (Continued).

Variables		1	2	3	4	5	6	7	8
Roles of Faculty Staff	Faculty	0.49**	0.57**	0.63**	0.62**	0.58**	–		
	Students	0.43**	0.57**	0.52**	0.56**	0.45**			
Outcome	Faculty	0.43**	0.53**	0.56**	0.41*	0.27	0.81**	–	
	Students	0.33**	0.64**	0.69**	0.48**	0.42**	0.71**		
Internship Program	Faculty	0.21	0.16	0.14	0.31	0.14	0.15	–0.01	–
	Students	0.15*	0.35**	0.38**	0.33**	0.10	0.45**	0.39**	

Notes: **Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

variables. The first row of the table represents the facilities aspect, with “Faculty” indicating the correlation between faculty and the other variables. In the second row, “Students” denotes the correlation between students and the other variables.

Moving along the table, we observe that “Faculty” and “Students” are positively correlated across multiple dimensions. The correlation coefficient of 0.77** suggests a strong positive relationship between faculty and students’ involvement. This implies that when faculty members are actively engaged, students tend to participate more. Similarly, in terms of curriculum, faculty and students’ correlation coefficient is 0.73**, indicating a strong positive association between the two groups in shaping the curriculum. Regarding research, both faculty and students exhibit positive correlations, suggesting that their involvement in research activities is interconnected. The coefficients of 0.58** and 0.55**, respectively, demonstrate moderate positive relationships between faculty and students in this area.

The correlation between faculty and students in the admission process is relatively weaker. While faculty members have a minor positive correlation (0.17) with students in admission, students’ correlation coefficient is slightly higher (0.40**). This suggests that students may have a greater impact on the admission process compared to faculty. The roles of faculty staff show a positive relationship with both faculty and students, as indicated by the correlation coefficients ranging from 0.49** to 0.63**. This suggests that when faculty staff have defined roles and responsibilities, both faculty and students benefit from clearer structures and expectations. Moving on to outcomes, there is a positive correlation between faculty and students, suggesting that faculty members play a role in influencing student outcomes. The correlation coefficients of 0.43** and 0.53** indicate a moderate positive association between faculty and students in terms of outcomes. Finally, the correlation coefficients for the internship program reveal a relatively weak relationship between faculty and students. While faculty members show minimal positive correlations (0.21 and 0.16), students exhibit a slightly stronger positive correlation (0.35** and 0.38**) with the internship program. This implies that students’ involvement in internships may be more influential than faculty members’ engagement in this aspect.

As seen in [Table 7](#), the comparative analysis of the table reveals that the variables “Curriculum” and “Outcome” exhibit significant differences between groups. The “Curriculum” variable demonstrates a relatively high F-value of 4.288 ($p = 0.001$), indicating a statistically significant difference between groups. This suggests that the curriculum plays a meaningful role in explaining the variability observed in the data. Similarly, the “Outcome” variable shows a noteworthy F-value of 6.194 ($p = 0.000$), signifying a significant difference between groups. This implies that the outcomes achieved by these groups have a substantial impact on the observed variability.

On the other hand, the variables “Facilities”, “Students’ Involvement”, “Research”, “Admission”, “Roles of Faculty Staff” and “Internship Program” do not exhibit significant differences between groups. These variables have relatively lower F-values and higher p-values, indicating that there is no statistically significant variation between the groups in relation to these variables. This suggests that these variables have a limited impact on the observed variability in the data.

As seen in [Table 8](#) the “Students’ Involvement” variable, significant mean differences are observed between different universities. For instance, comparing “Hail University” and “Saudi Electronic University” shows a mean difference of

Table 7 Comparisons Between Mean Scores of Variables Among Students in Terms of Current Level of Study

		Sum of Squares	df	Mean Square	F	Sig.
Facilities	Between Groups	0.955	5	0.191	1.171	0.325
	Within Groups	29.019	178	0.163		
	Total	29.974	183			
Students' Involvement	Between Groups	2.909	5	0.582	1.898	0.097
	Within Groups	54.560	178	0.307		
	Total	57.469	183			
Curriculum	Between Groups	4.936	5	0.987	4.288	0.001
	Within Groups	40.976	178	0.230		
	Total	45.912	183			
Research	Between Groups	2.563	5	0.513	0.727	0.604
	Within Groups	125.415	178	0.705		
	Total	127.978	183			
Admission	Between Groups	3.202	5	0.640	1.065	0.382
	Within Groups	107.075	178	0.602		
	Total	110.277	183			
Roles of Faculty Staff	Between Groups	0.616	5	0.123	0.393	0.853
	Within Groups	55.763	178	0.313		
	Total	56.379	183			
Outcome	Between Groups	7.007	5	1.401	6.194	0.000
	Within Groups	40.271	178	0.226		
	Total	47.278	183			
Internship Program	Between Groups	1.038	5	0.208	1.156	0.333
	Within Groups	31.981	178	0.180		
	Total	33.020	183			

0.44 ($p = 0.008$), indicating that students' involvement significantly varies between these two institutions. Similarly, comparing "Hail University" and "King Faisal University" yields a mean difference of 0.45 ($p = 0.013$), suggesting significant differences in students' involvement levels between these universities.

In terms of the "Curriculum" variable, significant mean differences are also observed across universities. For example, comparing "Qassim University" and "Saudi Electronic University" reveals a mean difference of 0.35 ($p = 0.022$), indicating significant differences in the curriculum between these institutions. Comparing "Jazan University" and "Saudi Electronic University" also shows a mean difference of 0.35 ($p = 0.016$), emphasizing the variation in curriculum across these universities. Moving on to the "Roles of Staff" variable, significant mean differences are observed between different universities as well. Comparing "Qassim University" and "Saudi Electronic University" yields a mean difference of 0.45 ($p = 0.005$), indicating significant differences in the roles of staff between these institutions. Similarly, comparing "Hail University" and "Saudi Electronic University" shows a mean difference of 0.38 ($p = 0.025$), suggesting significant variations in staff roles between these universities.

Table 8 Comparisons Between Mean Scores of Variables Among Students and Faculty Members in Terms of University Names

Variable	(I) Group	(J) Group	Mean Difference (I-J)	Sig.
Students' Involvement	Hail University	Saudi Electronic University	0.44	0.008
		King Faisal University	0.45	0.013
Curriculum	Qassim University	Saudi Electronic University	0.35	0.022
		King Faisal University	0.38	0.020
	Jazan University	Saudi Electronic University	0.35	0.016
		King Faisal University	0.38	0.015
Roles of Staff	Qassim University	Saudi Electronic University	0.45	0.005
		King Faisal University	0.42	0.019
	Hail University	Saudi Electronic University	0.38	0.025
	Jazan University	Saudi Electronic University	0.35	0.037
Outcome	Qassim University	Saudi Electronic University	0.48	0.000
		King Faisal University	0.49	0.001
	Hail University	Saudi Electronic University	0.40	0.005
		King Faisal University	0.41	0.009
	Jazan University	Saudi Electronic University	0.37	0.008
		King Faisal University	0.38	0.014
Internship Program	Qassim University	King Faisal University	0.39	0.002
	Hail University	King Faisal University	0.43	0.001

For the “Outcome” variable, significant mean differences are observed across universities. Comparing “Qassim University” and “Saudi Electronic University” reveals a mean difference of 0.48 ($p = 0.000$), emphasizing significant differences in outcomes between these institutions. Comparing “Hail University” and “King Faisal University” shows a mean difference of 0.41 ($p = 0.009$), indicating significant variations in outcomes between these universities. Lastly, in the “Internship Program” variable, significant mean differences are observed between “Qassim University” and “King Faisal University”, with a mean difference of 0.39 ($p = 0.002$). Additionally, comparing “Hail University” and “King Faisal University” yields a mean difference of 0.43 ($p = 0.001$), indicating significant differences in the internship programs between these institutions.

Discussion

While the existing literature lacks comprehensive studies on health informatics (HI) in Saudi Arabian governmental universities, this study aims to address this gap by introducing a tool for data collection and analysis. The study examined several variables, including academic aspects (student involvement, academic outcomes, research participation) and logistical factors (facilities, admission, staff, and internships). The findings revealed positive correlations between college facilities and other academic and logistical variables, indicating that better facilities enhance students' academic capabilities.

Furthermore, significant correlations were observed among all six variables, as well as between each academic variable and each logistical variable. This highlights the interrelation and interdependency of these variables, emphasizing that changes in one variable can impact the others, leading to cumulative effects, either positive or negative.

Consequently, universities should prioritize a combination of academic excellence and logistical pillars to ensure overall high student satisfaction.

Demographic analysis showed a predominance of female students, mainly under 20 years old and in foundational or first-year programs. Younger students appeared more eager to participate in academic studies. Moreover, students from various universities responded similarly, indicating consistent reactions to the study, while no significant differences were found among faculty staff demographics.

Interestingly, no significant differences were observed between students and faculty staff across all six variables, indicating that being a student or faculty member did not significantly influence their responses. Only curricula and outcome satisfaction demonstrated variations among students in different academic years. Third-year students had lower beliefs about curricula, possibly due to exposure to the work field through internships, realizing the need for additional practical skills beyond the curriculum. On the other hand, first-year students had higher outcome expectations, assuming their undergraduate years would sufficiently prepare them for the work field.

These findings align with existing literature on HI's role in facilitating electronic health information management.^{3,5} The study's results also revealed varying degrees of satisfaction among students across different universities. For instance, Hail University students showed high levels of student involvement, while Qassim University students expressed greater satisfaction with outcomes. These variations indicate differing priorities among students, with Qassim students valuing staff roles and internship programs.

The limitations of this study include the use of self-reported methods, and while self-reported methods could be the only accessible tool for data collection, they constitute a potential threat to the internal validity of the study, as Heppner and Wampold³² showed how participants' responses could be biased, or that participants become ashamed to provide accurate information. For instance, students might show social desirability bias when asked about how effective an educational program was, and they might exaggerate the benefits of the programs for fear of feeling not adequate enough to comprehend the program courses. In some instances, students might also guess the study's objectives and give skewed information as a result, which might either confirm or challenge the researcher's hypothesis.

Suggestions for future research include controlling the independent variables of the study through semi-structured one-on-one interviews that tackle variables such as student involvement and academic outcomes yet without ascribing any sense of liability or responsibility to the students or staff, which could make them more at ease to reveal their honest inputs. An inductive thematic analysis could be introduced in addition to this quantitative cross-sectional study, as mixed-methods research design would produce more insights into both the qualitative and quantitative aspects of the research question.

Conclusion

This study investigated the health informatics academic programs in Saudi Arabian governmental universities, and in particular, how HI undergraduate programs compare in different Saudi Arabian schools, including Hail University, Jazan University, and Qassim University. The aim of the study was to evaluate HI programs in Saudi Arabian governmental universities, as well as identifying the main strengths and weaknesses of undergraduate HI programs, introducing new insights in Saudi Arabian HI with a useful tool for data collection that could be used for further future research in education field and curriculum designers. The results, in accordance with the current but little literature on HI, show significant correlation between all six variables measured, suggesting that all variables are interrelated and must be perceived as such. As these exploratory results were consistent over all Saudi Arabian colleges included in the study, and for both students and faculty staff members, further research should continue to investigate HI programs in order to have a comprehensive view from which Saudi Arabian schools could move towards developing their academic and logistic facilities while being aware of how impactful such facilities are on both students and staff.

Abbreviations

HI, Health Informatics; IMIA, International Medical Informatics Association; MoE, Ministry of Education; SPSS, Statistical Package for the Social Sciences.

Data Sharing Statement

The datasets used and analysed in the current study are available from the corresponding author upon reasonable request.

Ethical Approval and Consent to Participate

All methods in this study were performed in accordance with the declaration of Helsinki and were approved by the Institutional Review Board (IRB) of Qassim University No. 23-32-10. All participants provided informed consent to participate. In the case of the questionnaire-based study, all participants were informed of the voluntary nature, confidentiality, and aim of the study and the nature of their participation before they participated in the study.

Acknowledgments

Researchers would like to thank the Deanship of Scientific Research, Qassim University For the support of this project

Funding

This project is fully funded by Qassim University

Disclosure

The author declares that they have no competing interests

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