

What Industry Wants: An Empirical Analysis of Health Informatics Job Postings

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Abstract

Objectives To describe the education, experience, skills, and knowledge required for health informatics jobs in the United States.

Methods Health informatics job postings ($n = 206$) from Indeed.com on April 14, 2020 were analyzed in an empirical analysis, with the abstraction of attributes relating to requirements for average years and types of experience, minimum and desired education, licensure, certification, and informatics skills.

Results A large percentage (76.2%) of posts were for clinical informaticians, with 62.1% of posts requiring a minimum of a bachelor's education. Registered nurse (RN) licensure was required for 40.8% of posts, and only 7.3% required formal education in health informatics. The average experience overall was 1.6 years (standard deviation = 2.2), with bachelor's and master's education levels increasing mean experience to 3.5 and 5.8 years, respectively. Electronic health record support, training, and other clinical systems were the most sought-after skills.

Conclusion This cross-sectional study revealed the importance of a clinical background as an entree into health informatics positions, with RN licensure and clinical experience as common requirements. The finding that informatics-specific graduate education was rarely required may indicate that there is a lack of alignment between academia and industry, with practical experience preferred over specific curricular components. Clarity and shared understanding of terms across academia and industry are needed for defining and advancing the preparation for and practice of health informatics.

Keywords

- ▶ informatics
- ▶ medical informatics
- ▶ job description
- ▶ employment
- ▶ health workforce
- ▶ workforce
- ▶ training and education requirements
- ▶ clinical informatics
- ▶ nurse
- ▶ informatics specialists

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Background and Significance

The rapid growth in the adoption of health informatics in practice and industry has spurred growth in jobs related to implementing, using, and learning from technology in health care settings.^{1,2} Health informatics is an emerging, interdisciplinary field that has multifaceted career paths and educational programs for professionals from different backgrounds. Given that health informatics is a common place within the health and health care industries, it is critical for academia and industry to reach shared understanding of informatics definitions, and informatics knowledge, skills, and competencies, needed to best equip the health informatics workforce.³

The education, experience, skills, and knowledge of health informaticians and their relationship to industry needs have been described in previous studies.⁴⁻⁷ Gadd et al developed a comprehensive survey to understand what health informaticians do and the specific skills they utilize, and delivered an extensive delineation of practice (DoP) for informatics.⁴ To further understand the clinical informatics subspecialty (CIS), Silverman et al conducted a similar survey of CIS physicians, also concluding with a DoP.⁵ This study also investigated the structural components of the field, the financial implications of training, as well as the anticipated influence on the industry.⁵ Internationally, competency frameworks for health informatics have been defined.⁸ Davies et al exhorted academics to collaborate with industry to ensure that current curricula met industry needs.⁸ For executive positions within informatics, studies of responsibilities, education, and skills have been undertaken to understand the qualities necessary for the various informatics-related roles. For example, chief clinical informatics officer and chief research informatics officer roles were analyzed in an effort to delineate the knowledge and skills, and a framework was developed to support employee recruitment.^{9,10} These types of studies revealed the desired qualifications for health informatics leaders, and are an important step in continuing toward further delineating the field of informatics.^{9,10}

Certification is a way to ensure that informaticians have requisite skills to perform in the workforce.^{4,11} Nursing informatics certification first became available as a board certification (RN-BC) in 1992, requiring an examination at the bachelor of science in nursing level.¹² In 2013, the board certification in clinical informatics (CI) physician subspecialty became available during a time of increased use of electronic health records (EHRs) and increased need for “informatics-savvy” physicians.^{13,14} For nonphysician informaticians, certification in the future American Medical Informatics Association (AMIA) Health Informatics Certification (AHIC) may soon be available. The AHIC is designed for a range of informatics professionals to certify their knowledge and abilities.¹⁵

Definitions

The following definitions were used in this study¹⁶⁻²²:

- **Informatics:** The study and application of abstract properties of representations of data and the tools to extract

information from data. Informatics may be applied within diverse contexts including health and health care.¹⁶

- **Biomedical informatics:** The use of biomedical data for scientific inquiry and decision-making, considered the core discipline supporting applied research and practice in several disciplines including health informatics.¹⁷
- **Health informatics (HI):** The use of analysis, design, implementation, and evaluation of information systems to improve processes and outcomes, driven by computer and cognitive sciences, to support improved health outcomes.¹⁸
- **Clinical informatics (CI):** An informatics domain focused on the delivery of health care which utilizes computer systems and informatics principles with applications to a range of specialties.¹⁹
- **Nursing informatics (NI):** A field integrating nursing practice, knowledge, and wisdom with informatics to support the continuation of technology expansion in the nursing and health care environments.²⁰
- **Public health informatics (PHI):** The discipline encompassing surveillance, preparedness, and emergency response, in addition to increasing the health of groups of people and is closely related to population health informatics.^{17,21}
- **Health information management (HIM):** Involves the protection and use of medical information in the field of health and healthcare to enhance the quality of care.²²

Objectives

The purpose of this study was to analyze the education, experience, skills, and knowledge required for health informatics jobs in the health care industry in the United States. In a field with many terms and competencies still being developed and defined, this analysis was designed to uncover “What Industry Wants.”

Methods

This study is a cross-sectional analysis of job postings active on the job search site Indeed.com (Indeed, Austin, TX) on April 14, 2020. Indeed.com returned job posts aggregated from various websites, including health-related job boards. A search for informatics positions in health care returned 314 matches. A health sciences librarian constructed a query in the advanced job search interface to search the job title field for variations of the following terms: health informatics, healthcare informatics, clinical informatics, medical informatics, nurse informatics, and physician informatics (see ► Fig. 1 for complete search strategy, and Supplementary Material [available in the online version] for search terms). We limited the search to health informatics positions in the United States and retrieved 314 job posts, which we exported from Indeed into an Excel (Microsoft Corporation, Redmond, WA) spreadsheet for analysis. We conducted an initial review to identify duplicate records and expired posts. We assessed the remaining 296 posts. Due to the intent to focus on general health informatics skill sets, posts for informatics

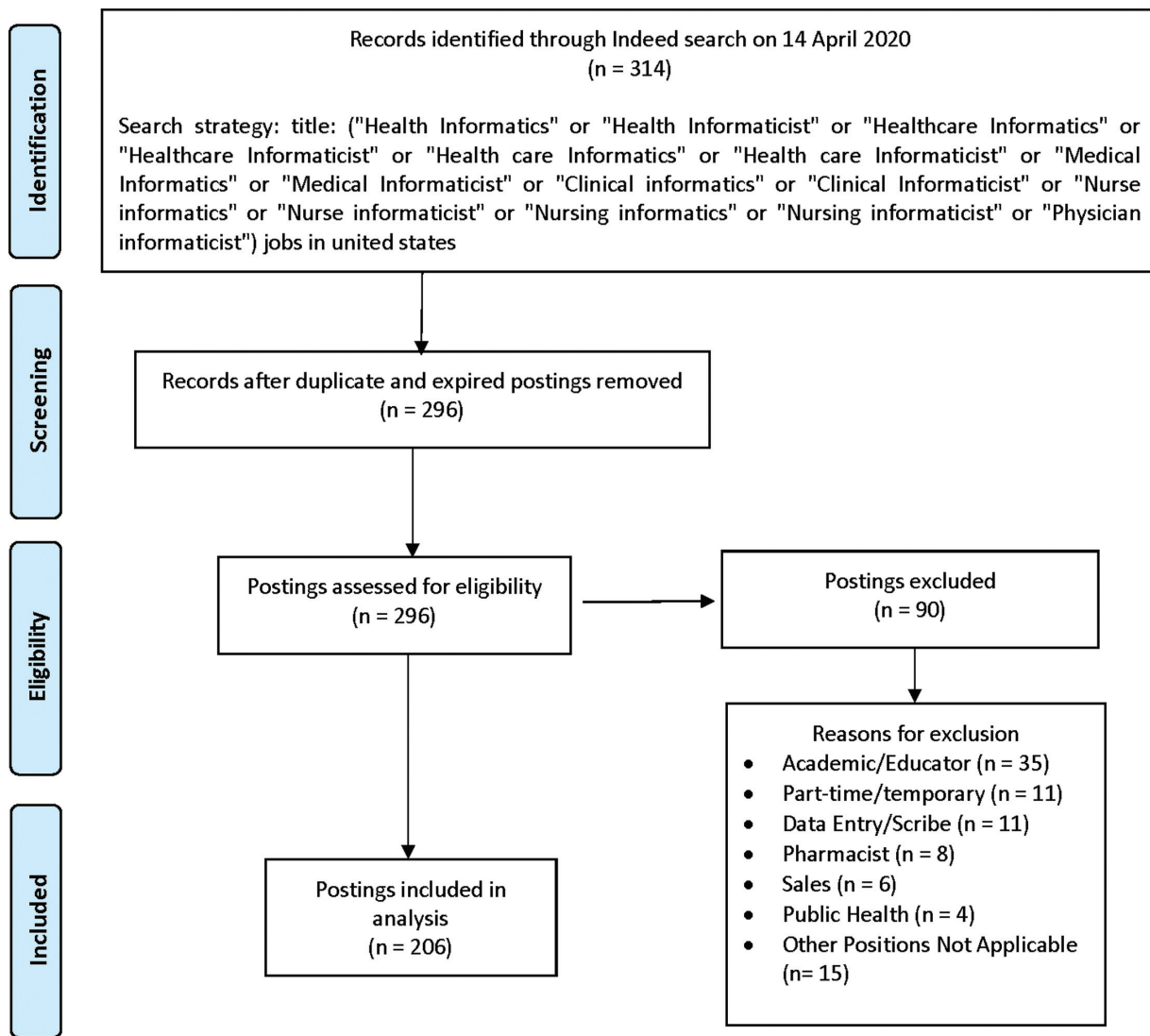


Fig. 1 Search flow diagram.

subspecialties such as academic positions, pharmacists, public health, data entry, and scribes were removed, as were temporary/part-time positions, leaving 206 posts included in the study (→ Fig. 1). Jamovi (The jamovi project, Sydney, Australia, version 1.2.27) was used for statistical analysis.

Data Abstraction

We derived the data iteratively during preliminary abstraction, and it was finalized through consensus among authors, consisting of three academic faculty with backgrounds in nursing, biomedical, and health informatics, two health sciences librarians, and an informatics graduate student researcher, using spreadsheets. After consensus was reached, the first author reanalyzed all posts based on the consensus rules developed by all authors in the interpretation of the posts. The attributes of interest were chosen based on current literature and relevance to the field of health informatics, including the content available within the posts.^{4,7} The data abstraction included the following attributes:

- Organization type and job title
- Degree required and degree preferred, including requirement or preference for certifications and professional licensure (e.g., registered nurse (RN) licensure).
- “Hard” skills (administration/leadership, change management, computer skills, data analysis, EHR support, health policy and standards, other clinical systems, process improvement, programming, project management, training, and workflow analysis)
- “Soft” skills (communication, problem solving, and critical thinking)
- Years of experience in leadership, clinical, informatics/technology, and analytics (required and preferred)
- Specific EHR experience (free text for type)

We based the data abstraction on the informatics knowledge, skills, and competencies identified by Fenton et al.⁷ and Gadd et al.⁴ A total of 12 “hard” and three “soft” skills spanned the domain categories presented by Gadd et al.⁴ Data for all attributes were abstracted from each job post if

available. The findings were then summarized by using descriptive and inferential statistics to identify the most common job requirements for the field. A Pearson's Chi-square test was administered to understand if the presence or absence of knowledge and skills in the posts is significant between those with and without RN licensure.

Results

Attributes of Posts

A sample of 206 job postings (posts) resulted from the search strategy. The majority of posts were from health systems, required at least a bachelor's degree, and one or more years of experience. In general, the amount of experience required increased with the seniority level of the post. A surprising finding emerged from the analysis in that 84 (40.8%) posts required RN licensure and an additional 46 (22.3%) preferred RN licensure; and most of these were not identified by the post title. Only six (2.9%) posts required MD/DO, and four (1.9%) posts preferred MD/DO. No other professions were named. ▶ **Table 1** details the distributions of attributes for the posts overall and by RN licensure.

Organization Types

Health systems (50.0%) were the most frequent type of organization, followed by hospitals (16.5%), and consulting firms (8.7%). For each organization type, RN licensure was required in 25 to 50% of posts (▶ **Table 1**).

For health system organizations, 63.1% of posts required a bachelor's degree and 69.2% of those additionally required RN licensure. Mean experience required was 3.2 years (standard deviation [SD] = 2.0), with clinical experience being the most common type (M = 1.9 years, SD = 2.2). Specific EHR experience was noted for 50.5% of posts.

For hospital settings, 70.6% of posts required a bachelor's degree and 45.8% of those additionally required RN licensure. Mean experience required was 3.1 years (SD = 1.7) with informatics and technology experience being the most common type (M = 2.0 years, SD = 2.2). Specific EHR experience was noted for 38.0% of posts.

For consulting organizations, 22.2% of posts required a master's degree and 50.0% of those additionally required RN licensure. Mean experience required was 2.9 years (SD = 2.4), with clinical experience being the most common type (M = 1.5 years, SD = 2.2). Specific EHR experience was noted for 50.0% of posts.

Education

The majority (62.1%) of posts required a minimum of a bachelor's education. Graduate-level education was required for only 3.9% of the total job posts analyzed; although of those requiring a bachelor's degree, 34.1% preferred a master's education. More than two-thirds of bachelor-level posts required RN licensure. Formal informatics education at any level was required for 15 (7.3%) posts, with 12 of these requiring a minimum of a bachelor's and three a minimum of a master's degree, while informatics education was preferred for an additional 32 (15.5%) posts. A masters in health

Table 1 Sample descriptive statistics (n = 206)

	n	Overall (%)	RN require (%)
Organization type			
Health system	103	50.0	43.7
Hospital	34	16.5	50.0
Consulting	18	8.7	33.3
Vendor	15	7.3	46.7
Payer/insurance company	8	3.9	25.0
Home care	5	2.5	20.0
Clinic	4	1.9	50.0
Government	4	1.9	50.0
Physician group	4	1.9	25.0
Other	11	5.4	9.1
Total	206	100	
Degree required			
Associate degree	42	20.4	59.5
Bachelor's and above	126	61.2	37.3
Master's and above	6	2.9	66.7
Doctoral degree	2	1.0	
Not listed	30	15.3	26.7
Total	206	100	
Degree preferred			
Associate degree	1	0.5	
Bachelor's and above	52	25.1	44.4
Master's and above	50	23.7	25.5
Doctoral degree	3	2.3	
Not listed	100	48.4	10.6
Total	206	100	
Experience			
< y	28	13.6	
1–2 y	48	23.3	
3–4 y	69	33.5	
5–6 y	45	21.8	
7–8 y	13	6.3	
9–10 y	3	1.5	
Total	206	100	
Specific EHR experience			
Epic	45	21.8	
Cerner	24	11.7	
MEDITECH	6	2.9	
Other	15	7.3	
Not listed	116	56.3	
Total	206	100	

Abbreviations: EHR, electronic health record; RN, registered nurse.

informatics degree was required for one post and preferred for 14 (6.5%) posts.

Experience

Overall, increasing education requirements also required more years of experience. On average, posts required 1.6 years ($SD = 2.2$) of informatics or related experience. For posts that required an associate degree, 59.5% required 2 to 3 years of total experience, with an average of 2.4 years ($SD = 1.5$), and most (81.0%) between 0 and 3 years. For the bachelor's level, the average years of experience were 3.5 ($SD = 2.1$) with 90.5% requiring no more than 5 years of experience. Master's level posts required at least 3 years of experience, with half requiring at least 7 years ($M = 5.8$, $SD = 1.8$). Experience using SQL was mentioned in 30 posts (14.6%) and was required in 18 of those (8.7%).

Job Titles

For posts with "health informatics" in the title ($n = 26$), 88.5% required a bachelor's degree, with 11.5% of those requiring RN licensure. A master's degree was required in one post and preferred in eight (34.8%). Posts that required a bachelor's degree ($n = 23$) required an average of 3.6 years ($SD = 2.2$) of experience. Examples of health informatics-titled roles were quality data analyst health informatics, health informatics analyst II, and health informatics specialist.

For posts with "clinical" in the title ($n = 157$), 55.4% required a bachelor's degree, with 43.9% of those requiring RN licensure. A master's degree was required in five posts and preferred in 33.3%. Posts that required a bachelor's degree ($n = 87$) required an average of 3.4 years ($SD = 1.9$) of experience. Examples of clinical-titled roles were clinical informatics specialist, clinical informatics analyst, and clinical nurse informatics specialist.

For posts with "senior" in the title ($n = 25$), 72.0% required a bachelor's degree, with 22.2% of those requiring RN licensure. None of these posts required a minimum education of a master's degree, though it was preferred in 44.4% of posts. Posts that required a bachelor's degree ($n = 18$) required an average of 3.5 years ($SD = 2.1$) of experience. Examples of senior-titled roles were senior clinical informatician, medical informatics analyst, senior, and epic senior clinical informatics specialist.

For posts with "director" in the title ($n = 11$), 45.5% required a bachelor's degree, with 18.2% of those requiring RN licensure. A master's degree was required in one of the posts and preferred in four (36.4%). Posts that required a bachelor's degree ($n = 5$) required an average of 6.7 years ($SD = 2.9$) of experience. Examples of senior-titled roles were director of research and medical informatics, director of health informatics, and regional technology director. Interestingly, only 27.3% requested years of leadership experience, but the skill most noted for these posts was leadership/administration.

Certifications

About a fourth (23.8%) of posts required or preferred various certifications; many did not specify the certifying body or

certification. Informatics certification, national certification in informatics, and certification in the area of specialty were common. Certifications in clinical informatics, nursing informatics, health informatics, and solely informatics were all mentioned, in addition to others, many of which were vague and/or unspecific.

Among the 84 posts requiring RN licensure, four required certifications, one being from American Nurses Credentialing Center. When RN licensure was preferred in posts, eight listed preferred certifications such as national certification in informatics, certification in nursing informatics, and certification in clinical informatics.

Skills

Assessment of 12 informatics skills, including analysis of skills for posts with and without RN licensure requirement, is shown in [Table 2](#). Overall, EHR support skills, training, and other clinical systems were the most commonly required across all education and experience levels. RN licensure was most commonly associated with requirements for skills in EHR support, health policies/standards, and project management, and least often with requirements for programming skills. EHR support, change management, and programming skills differed significantly, with higher percentages of these skills found in posts with RN licensure requirement ([Table 2](#)).

Distribution of skills required by job title and RN licensure is shown in [Fig. 2A-D](#). All skills were required in the sample, with differential requirements by title and RN licensure. Specialist level posts ([Fig. 2A](#)) required more skills than analysts and informaticians on average, with half of specialist posts requiring RN licensure. Analyst level posts ([Fig. 2B](#)) required more programming (23.1%), data analysis (55.8%), and project management (30.8%) skills, and least commonly required RN licensure (21.2%). In comparison, informatician level posts ([Fig. 2C](#)) were the most common type that did not require RN licensure, and noted skills in EHR support, and training, and lacked the need for administration/leadership skills.

For less common posts including managers, consultants, and coordinators, the most frequently required skills were computer skills, data analysis, and project management. Manager, director, and executive posts required most of the skills. The trainer and scientist ($n = 5$) posts required a narrower skill set and were among the few titles that did not include some posts requiring RN licensure.

Discussion

We analyzed the education, experience, skills, and knowledge required for health informatics jobs in the United States, based on health care industry job postings. Most posts were for clinical informaticians, and required a minimum of a bachelor's education and 1 to 2 years' experience. RN licensure was required for many posts, and few required formal education in health informatics. EHR support, training, and knowledge of clinical systems were the most sought-after skills.

Table 2 Required skills

	Overall (%)	RN required (%)	Chi-square, <i>p</i> -Value (df = 1, n = 206)
Hard skills			
EHR support	50.5	61.9	7.40, <i>p</i> < 0.01
Change management	23.8	32.1	5.46, <i>p</i> = 0.02
Programming	12.1	20.0	5.09, <i>p</i> = 0.02
Training	49.0	43.6	0.64, <i>p</i> > 0.05
Other clinical systems	44.2	45.2	0.07, <i>p</i> > 0.05
Computer skills	40.8	42.9	0.25, <i>p</i> > 0.05
Data analysis	39.3	32.1	3.06, <i>p</i> > 0.05
Project management	35.9	39.3	0.70, <i>p</i> > 0.05
Workflow analysis	35.4	39.3	0.92, <i>p</i> > 0.05
Process improvement	33.5	33.3	0.01, <i>p</i> > 0.05
Health policy/standards	22.8	26.2	0.92, <i>p</i> > 0.05
Administration and leadership	16.5	10.7	3.45, <i>p</i> > 0.05
Soft skills			
Communication	55.8	59.5	0.79, <i>p</i> > 0.05
Problem solving	34.5	35.7	0.10, <i>p</i> > 0.05
Critical thinking	18.4	23.8	2.71, <i>p</i> > 0.05

Abbreviations: EHR, electronic health record; RN, registered nurse.

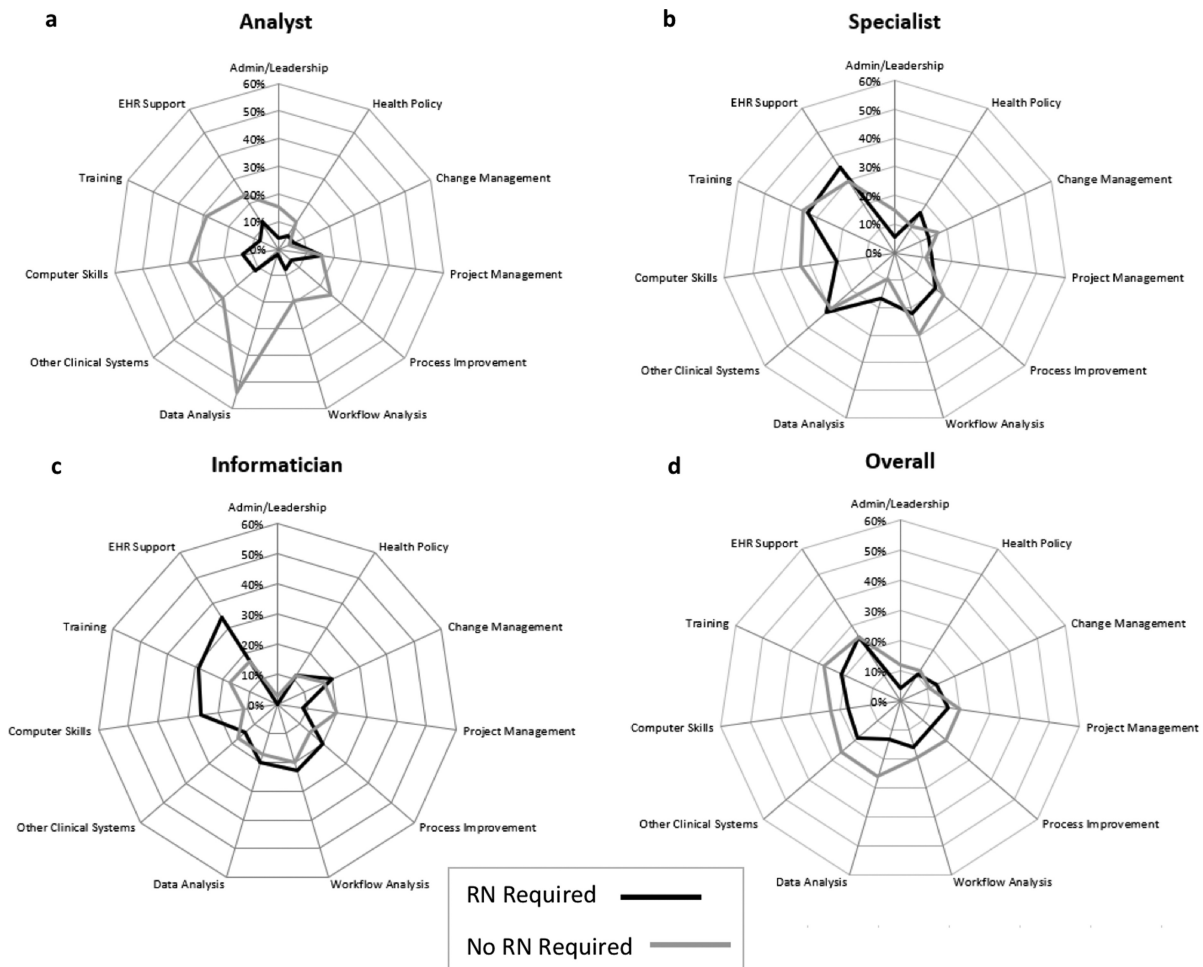


Fig. 2 Skills and job types by registered nurse licensure.

The finding that many of the posts required RN licensure was surprising but is consistent with previous literature which described the dual expertise in clinical and technical arenas as a primary benefit of informatics nurses.^{3,23} Informatics nurses often have established relationships with the clinical team and an understanding of clinical workflow use cases.^{3,20,23} Further, education in nursing has included a strong emphasis on evidence-based practice principles and informatics.²³ Additionally, job titles for most posts requiring RN licensure were clinical informatician, as opposed to nursing informatician, which is surprising considering that certification in nursing informatics has been available to nurses since 1992, well before the HITECH act of 2009.¹² This finding affirms that a clinical background as well as informatics training may be important for a large number of available informatics positions as we have observed in this sample; not necessarily requiring the additional step to become certified in nursing informatics.

The finding that EHR support and other clinical systems knowledge were frequently required skills aligned with the literature regarding cornerstone skills for informaticians.^{1,3,4,6,7} The technical skills required focused more on EHR implementation and training, as opposed to back-end programming for most job levels, especially for specialists. The finding that EHR skills were common in posts with and without RN licensure requirement aligns with Zeng, who described a changing EHR landscape, with new roles developed, and the current health care workforce transitioning to fill these positions; and underscored the importance of these skills.² Specifically, clinical informaticians are expected to have a thorough understanding of workflows and the process for implementing and supporting them, which was corroborated in our analysis.² These findings reaffirm that jobs and skills related to the continued expansion of EHRs, and continuous process improvement and management of EHR systems were in demand and should be emphasized in training programs.

Imprecise definitions for informatics titles, skills, and levels must be addressed. As we analyzed the posts, we found that terms and their definitions may be used and understood differently in academia versus health care industry workplaces. While academic informatics has worked diligently to define the field and make definitions widely available, these definitions may not be widely used in the workplace.^{4,5,11} This concern aligns with previous findings that clinical, medical, and health informatics posts were found to have indistinguishable skills, education, and experience requirements.^{3,11} As a further case in point, requirements for certifications were varied and often not named, which further demonstrates a need for a shared understanding of the terms that were necessary to conduct this analysis. To achieve shared understanding, both academic and industry settings must strive to reach consensus around these terms and their definitions. It is incumbent upon our academic leadership to invite workforce partners to join in this important consensus making, with both sides contributing to the conversation.

The finding that only a very small percentage of the posts required informatics education was surprising. The majority of the posts that preferred a master's in informatics required a bachelor's in nursing. This mirrors the comparison de-

scribed in an editorial by Fridsma¹¹ citing previous work by Gadd et al⁴ and Silverman et al,⁵ which demonstrated the striking similarities in knowledge and skills among academically trained health informaticians and that of the CIS. CIS and health informaticians having a shared knowledge base and skill set suggests that informatics nurses are equipped to advance technology efforts in health care at a level at least equivalent to that of academically trained informaticians.

Further analysis of the health informatics workforce is needed and should build on the findings from this study. The attributes and definitions of this study would enable parallel studies focusing on informatics job availability and requirements for informatics leadership positions, public health informatics, and academic informatics roles.

Limitations

The limitations of this study were similar to other observational studies in that the data may be biased due to the selection of a single job posting site for a specified timeframe. Our focus on Indeed.com as opposed to other job posts sites stemmed from our desire to look at health care and related industries as opposed to academia, and this may impact the generalizability of the study. Future studies may include informatics-specific job posting sites such as those from AMIA, American Nursing Informatics Association, and Healthcare Information and Management Systems Society to build a more complete picture of the full range of informatics professions. To ensure the focus on health informatics, our search terms may have inadvertently excluded posts that could have been applicable, such as the exclusion of eight pharmacy and four public health informatics posts. While two team members reviewed all abstracted data three times, it is still possible that the data may be biased due to variations in terms used by the hiring organization and our interpretations of these terms. It is possible that job requests could fluctuate seasonally or over time, and that some recruiting vendors may specialize in certain areas. Future analysis should include a larger sample size using a longitudinal study design, expanding across multiple job posting sites. Finally, while there is some overlap of health informatics with other similar fields such as health information management, it was beyond the scope of this study to examine this overlap.⁶

Conclusion

This cross-sectional study examined health informatics job posts to understand industry needs for health informatics-related knowledge, skills, and competencies. Bachelor's degrees were the most frequently required education in the job posts evaluated, along with practical experience in the field. Informatics-specific education requirements were rare. Posts overall required EHR support, training, and knowledge of other clinical systems skills; and differentially required other skills by education and licensure. Findings affirmed the importance of a clinical background for professionals in health informatics positions, which commonly required RN licensure and clinical experience. Industry and academia alike should adhere to shared definitions of commonly used terms to

ensure shared understanding and the mutual benefit of preparing graduates to meet industry needs.

Clinical Relevance Statement

The results of this study allow an understanding of the skills, education, and experience required in health informatics job posts. Many health informatics job postings required clinical background, and in many cases, RN licensure.

Multiple Choice Questions

- The most commonly required education level for health informatician job posts is:
 - Associate degree
 - Bachelor's degree
 - Master's degree
 - Doctorate degree

Correct Answer: The correct answer is option b. A bachelor's degree was the most common education requirement for informatician job posts, requested in 61.2% of posts.

- Clinical informatician posts accounted for what percentage of all posts that required RN licensure?
 - 0–25%
 - 26–50%
 - 51–75%
 - 76–100%

Correct Answer: The correct answer is option d. 82.1% of all posts that required RN licensure had the term clinical in the title.

Protection of Human and Animal Subjects

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Conflict of Interest

None declared.

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