Mapping the literature of nursing informatics

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Objective: This study was part of the Medical Library Association's Nursing and Allied Health Resources Section's project to map the nursing literature. It identified core journals in nursing informatics and the journals referenced in them and analyzed coverage of those journals in selected indexes.

Method: Five core journals were chosen and analyzed for 1996, 1997, and 1998. The references in the core journal articles were examined for type and number of formats cited during the selected time period. Bradford's Law of Scattering divided the journals into frequency zones.

Results: The time interval, 1990 to 1998, produced 71% of the references. Internet references could not be tracked by date before 1990. Twelve journals were the most productive, 119 journals were somewhat productive, and 897 journals were the least productive. *Journal of the American Medical Informatics Association* was the most prolific core journal. The 1998 journal references were compared in CINAHL, PubMed/MEDLINE, Science Citation Index, and OCLC Article First. PubMed/MEDLINE had the highest indexing score.

INTRODUCTION

Health care informatics has been defined as, "the integration of health sciences, computer science, information science, and cognitive science to assist in the management of health care information" [1]. Under health care informatics, specialties divide into smaller subgroups: medical informatics, health informatics, dental informatics, and nursing informatics. Medical informatics, a term used since the mid-1970s, refers to information technologies that concern patient care and the medical decision-making process [2]. Health informatics refers to educational technology for health care clients or the general public. Medical, dental, and nursing informatics overlap in a number of areas, for example, information retrieval, ethics, patient care, decision support systems, human-to-computer interactions, information systems, imaging, computer security, computerized patient records, and computer assisted instruction [1].

Nurses have worked in informatics roles for over twenty-five years, but the phrase "nursing informatics" was not seen in the literature until 1984. Since 1984, nursing informatics has established itself as a specialty in the nursing field. In 1985, Hannah defined nursing informatics as the "use of information technologies in relation to those functions, within the purview of nursing that are carried out by nurses when performing their duties" [3]. This definition was meant to cover all aspects of information technology, used by nurses, that related to patient care, health care administration, nursing practice, or nursing education. In 1989, Graves and Corcoran defined nursing informatics as "a combination of computer science, information science and nursing science designed to assist in the management and processing of nursing data, information and knowledge to support the practice of nursing and the delivery of nursing care" [4].

In 1994 and 1995, the American Nurses Association (ANA) published the *Scope of Practice in Nursing Informatics* and *Nursing Informatics Standards of Practice*, respectively. The 1994 pamphlet defined nursing informatics as "the specialty that integrates nursing science, computer science and information science in identifying, collecting, processing and managing data and information to support nursing practice, administration, education, research and the expansion of nursing knowledge" [5]. The 1995 pamphlet described a generalist level of practice and performance for nursing informatics that is applied to nurses qualified by ex-

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perience or education to practice at that level [6]. The two pamphlets were combined into one document, *Scope and Standards of Nursing Informatics*, in October 2001. This publication defined nursing informatics as ''a specialty that integrates nursing science, computer science and information science to manage and communicate data, knowledge and nursing practice'' [7]. Rognehaugh defined nursing informatics as ''the use of any computer and information technologies that support any nursing function carried out by nurses in the performance of their duties'' [8]. Today, it is commonly accepted that nursing informatics means electronic information combined with nursing and any aspect of clinical practice, administration, research, or education.

A few nursing informatics courses are offered at the baccalaureate education level, but most programs and degrees are graduate and postgraduate level. Nurses with baccalaureate informatics education preparation are called informatics nurses. Those educated at the graduate level are known as informatics nurse specialists.

PROFESSIONAL ORGANIZATIONS

The professional nursing organizations' special interest groups for nursing informatics are the ANA Task Force on the Scope of Practice for Nursing Informatics, the Task Force to Develop Measurement Criteria for Standards for Nursing Informatics, and the National League for Nursing (NLN) Council of Nursing Informatics. The American Organization of Nurse Executives gives the specialty priority interest but has no formal working group. The American Medical Informatics Association (AMIA) sponsors the Nursing Informatics Working Group (NIWG) [9]. Information about NIWG is available on the AMIA Website, and it sponsors nrsing-l, an email discussion list for nurses practicing in the specialty. The International Medical Informatics Association (IMIA) has the Special Interest Group, Nursing Informatics (IMIA SIG-NI). There is also an American Nursing Informatics Association (ANIA). The Institute for Healthcare Informatics (IHI) was formed in the fall of 2001 by Drexel University's College of Information Science and Technology, the MCP Hahnemann University's School of Medicine, and the College of Nursing and Health Professions. The institute's purpose is to create a partnership between information technology, medicine, nursing, and related health care professions [1].

CERTIFICATION AND EDUCATION

The American Nurses Credentialing Center (ANCC) is the official certifying organization for informatics nurses. The prerequisites for certification include a baccalaureate or higher degree in nursing or a baccalaureate degree in a relevant field, an active registered nurse (RN) license in the United States, and 2 years of RN practice plus 2,000 hours of informatics nursing practice within the previous 5 years or 12 hours of academic credit in a graduate program in nursing informatics and 1,000 hours of nursing informatics practice within the previous 5 years. Thirty contact hours of continuing education within the previous 2 years are also required [10].

The education process for nursing informatics has evolved slowly and sporadically. In 1976, the first computer technology course was offered to nursing undergraduates at State University of New York at Buffalo [11]. Over the last twenty-five years, an increasing number of undergraduate and graduate nursing schools have added nursing informatics courses. Initially, many of the courses were electives in general computer literacy offered by other departments on campus. Sometimes, a course would be created and offered as part of the nursing curriculum by a nursing faculty member with computer expertise. Finally, nursing courses that applied computer skills to nursing practice were created [12]. Due to the uneven evolution of nursing informatics content, nurse educators recognized the need to establish content guidelines for newly created courses. In 1987, Ronald and Skiba wrote a nursing curriculum content guide for core competencies in computer literacy and nursing informatics [13]. A 1998 study by Carty and Rosenfeld found that fewer than one-third of the nursing schools included nursing informatics in their curricula. Only nineteen nursing schools offered a separate course in nursing informatics [14].

Even with a content guide, consensus was lacking among educators concerning what should be taught in a nursing informatics course and what core competencies could be judged by measurable outcomes. In 1998, a panel of nursing informatics experts from academia and the service sector met to develop a valid and reliable set of core nursing informatics competencies. A study to validate these nursing informatics competencies was completed in the fall of 2001 [15]. If nurse educators accept these competencies, a consensus for standardizing nursing informatics expertise may be reached.

The purpose of this study was to identify the core literature of nursing informatics and to determine which databases provided the most thorough indexing to that literature. A search of appropriate health sciences databases found that no bibliographic studies had been done to identify core material in nursing informatics.

METHODS

The study followed the common methodology described in detail in the project overview article [16]. Five journals were selected as source journals. The first choice was *CIN: Computers Informatics Nursing* (formerly, *Computers in Nursing*). It began publication in 1983 and is considered the primary journal covering the application of computer technology to contemporary nursing practice. The other four titles were selected after an extensive literature review that used the number of articles published on nursing informatics and the

Table 1
Cited format types by source journal and frequency of citations

| | No. citations in source journals | | | | | Citations | |
Cited format type	CIN	IJBC	IJMI	JAMIA	OJNI	Total	Frequency %
Journal articles	932	553	566	2,362	46	4,459	56.4%
Books	361	234	179	709	16	1,499	19.0%
Government documents	36	7	2	120	1	166	2.1%
Internet resources	33	1	12	159	0	205	2.6%
Miscellaneous	152	264	209	940	11	1,576	19.9%
Total	1,514	1,059	968	4,290	74	7,905	100.0%

CIN = *Computers in Nursing* (1996–1998) (title changed to *Computers Informatics Nursing* in 2002).
IJBC = *International Journal Bio-Medical Computing* (1996).
IJMI = *International Journal of Medical Informatics* (title change from *IJBC*) (1997–1998).
JAMIA = *Journal of the American Medical Informatics Association* (1996–1998).
OJNI = *Online Journal of Nursing Informatics* (1997–1998).

journal's main focus of informatics as criteria for selection. Many nursing informatics articles are published in nursing management, administration, education, and clinical journals, which is not unusual, because those areas are included in the definition of this interdisciplinary specialty. However, use of these titles as source journals would have skewed the study away from an informatics focus. They were discarded in favor of the *Journal of the American Medical Informatics Association* (*JAMIA*), first published in 1994 and sponsored by AMIA, previously mentioned as supporting a nursing informatics subgroup. *JAMIA* also provides online issues.

The literature search showed that foreign nursing informatics journal articles were most often published in the *International Journal of Medical Informatics* (*IJMI*). In 1997, this journal, which focused on computing, changed its name from *International Journal of Bio-Medical Computing* (*IJBC*), published from 1970 to 1996, to *IJMI*. The new editors of *IJMI* wanted to focus on the use of computers for communication and collaboration [17]. The two titles were treated separately in this study because of that different focus. The fifth journal choice was *Online Journal of Nursing Informatics* (*OJNI*), a peer-reviewed online journal published by Penn State University. This journal began publication in 1997 and provided an easily accessible electronic format to share all facets of nursing informatics. *CIN* was on the ''Brandon/Hill Selected List of Print Nursing Books and Journals'' [18]. *JAMIA* was on the ''Brandon/Hill Selected List of Books and Journals for the Small Medical Library'' [19]. These two titles, as well as *IJMI*, were also listed in the Web of Science, ISI's electronic database of scientific journal citations.

RESULTS

From 1996 to 1998, the full-length articles in the 5 source journals cited 7,905 references. Table 1 shows that the 3 years covered by *JAMIA* have the most citations in all formats, 4,290, followed by 3 years of *CIN* with 1,514. The 2 years of *IJMI* and 1 year of *IJBC* were equally represented at about 1,000. Two years of *OJNI* had 74 references. *OJNI* had only published 4 issues at the time of this study.

Journal references were the most common format. They accounted for 56% of the citations. Miscellaneous and book formats were the second-most frequent at 19% each. The miscellaneous category contained citations to informatics symposia and conference proceedings. The Annual Symposium on Computer Applications in Medical Care (SCAMC), the AMIA Symposium, MEDINFO, and the World Congress on Medical Informatics were the most frequently cited. These sources contain important information about nursing informatics. Internet sources (2.6%) and government documents (2.1%) were not significant sources of information.

Table 2 presents the publication dates of references by format type and time period. The 5-year interval, 1990 to 1995, had 56% of the total references. It was the most productive time period for books, journals, government documents, and miscellaneous sources. The most recent 8-year time interval, 1990 to 1998, accounted for 71% of the total references. Only 8% of the references were dated before 1980, indicating that the nursing informatics literature is new and growing. Forty-five percent of government document use was in 1990 to 1995. During that time period, the United States Congress passed the ''High-Performance Computing Act of 1991-Title I: High-Performance Computing and the National Research and Educational Network,'' directing the president to implement the National High-Performance Computing Program. There were no dates on 29.8% of Internet reference sources prior to 1990. A reference citation rule change allowed the tracking of more than 70% of Internet citations from 1990 forward.

In Table 3, the list of journal references is divided into 3 equal zones based on the percent of citations disbursed. Zone 1 with the 12 most productive journals contained 33.7% of the 4,459 citations. Zone 2 with 119 somewhat productive journals contained 33.5% of the citations, and Zone 3 with the 897 least productive journals contained 32.8% of the citations. The study examined a total of 1,028 cited journals.

Table 4 lists the Zone 1 and Zone 2 journal references and the thoroughness of citation coverage of these titles by CINAHL, PubMed/MEDLINE, and Sci-

Table 2
Cited format types by publication year periods

Publication year	Books		Government documents		Internet		Journal articles		Miscellaneous		Total citations	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1996–1998*	155	10.3%	58	34.9%	73	35.6%	602	13.5%	310	19.7%	1,198	15.1%
1990–1995	764	51.0%	75	45.2%	71	34.6%	2,531	56.8%	984	62.4%	4,425	56.0%
1980–1989	390	26.0%	21	12.7%	0	0	1,013	22.7%	204	12.9%	1,628	20.6%
1970–1979	104	6.9%	4	2.4%	0	0	221	5.0%	31	2.0%	360	4.6%
1960–1969	50	3.4%	2	1.2%	0	0	53	1.2%	10	0.6%	115	1.5%
Pre-1960	32	2.1%	0	0	0	0	24	0.5%	1	0.1%	57	0.7%
Not available	4	0.3%	6	3.6%	61	29.8%	15	0.3%	36	2.3%	122	1.5%
	1,499	100.0%	166	100.0%	205	100.0%	4,459	100.0%	1,576	100.0%	7,905	100.0%

* Includes in press materials.

ence Citation Index for 1998. These indexes were chosen because they indexed nursing, medicine, and science. OCLC ArticleFirst was the 4th choice because it was a general academic index. The indexing coverage scores reflected the strengths and weaknesses of indexing for nursing informatics. Zone 1 had 12 journal titles, and Zone 2 had 119. The number of citations ranged from 375 for the 1st source journal down to 5 citations for journal 131. Twelve titles in Zone 1 accounted for 1,501 of the 2,998 citations, and 119 titles in Zone 2 accounted for 1,497 citations. PubMed/MEDLINE had the highest average index score of 3.34, Science Citation Index scored 3.30, and CINAHL scored 1.13. OCLC ArticleFirst data indicated that the database contained citations for 117 or 89% of the 131 listed titles.

DISCUSSION

IJMI and *JAMIA* contained 5,258 references, and *CIN* and *OJNI* 1,588 references. The larger production of medical informatics articles skewed the study away from nursing informatics sources. Journals were the most cited reference format. The most prolific time period was 1990 to 1998, an indication that nursing informatics is a young and growing specialty. Some titles that might be expected to be in the study, due to the interdisciplinary nature of informatics, were more heavily indexed by social science, business, or computer science than by health sciences index services.

Bradford's Law of Scattering demonstrates that 12 journals are the most important sources of information, 119 are somewhat important, and 897 are least important to researchers' quest to keep up with the

literature. The 1,028 cited journals provided 4,459 references for the study.

Source journals represented among the top twelve titles include: *JAMIA, IJMI*, and *CIN*. All the source journals, except *OJNI*, are represented in Zone 1 or Zone 2. *Nurse Educators Microworld*, a historically significant title, appears in Zone 2 even though it ceased publication in 1994. It is an important resource journal for nursing informatics. Ten nursing journals are represented with ten or more citations in Zone 2.

The prolific article count in the medical journals ensures that the health sciences index, PubMed/MEDLINE, and science index, Science Citation Index, would have a higher percentage of journal indexing than the main nursing index, CINAHL. PubMed/MEDLINE has the best indexing of the journals in Zone 1 with a score of 3.92. Science Citation Index had the best indexing of journals in Zone 2 with a score of 2.99. OCLC ArticleFirst is an important database to consult for citations, because it included 88.5% of the significant journal titles listed in Table 4.

CONCLUSIONS

CINAHL is the index most nursing researchers, educators, and practitioners would logically use first. This study shows that PubMed/MEDLINE and Science Citation Index have higher citation scores than the other databases. Those indexes might be a better first choice for nurses in this field. Except for the reference citations in the two core nursing informatics journals, the total number of information sources from formats such as books, government documents, the Internet, and miscellaneous sources almost equals the number of citation sources from journals. Clinicians usually consider journals the most desirable information source due to their timeliness. Journals have made a strong showing in this study, but they may not be the best sources for nursing informatics. Journal articles about research in the specialty have only recently appeared in the literature. This recent appearance could be influenced by the nature of informatics literature. For example, descriptive, explanatory, introductory, and tutorial information topics have been the focus of much of the nursing informatics publishing in the past, and these topics

Table 3
Distribution by zone of cited journals and references

Zone	Cited journals		Cited journal references		
	No.	%	No.	%	Cumulative total
Zone 1	12	1.2%	1,501	33.7%	1,501
Zone 2	119	11.6%	1,497	33.5%	2,998
Zone 3	897	87.2%	1,461	32.8%	4,459
Total	1,028	100.0%	4,459	100.0%	4,459

Table 4
Distribution and database coverage of cited journals in Zones 1 and 2

Cited journal	Total citations	Bibliographic databases			
		CINAHL	PubMed	SCI	OCLC ArticleFirst
Zone 1					
1. J Am Med Inform Assoc	375	1	1	5	
2. Methods Inf Med	186	0	4	4	X
3. CIN: Comput Inform Nurs; continues Comput Nurs (1983–2000)	184	5	2	0	X
4. JAMA	155	1	3	4	X
5. Ann Intern Med	105	1	4	5	X
6. N Engl J Med	100	1	4	5	X
7. J Biomed Inform; continues Comput Biomed Res (1967–2000)	88	0	4	5	
8. Int J Med Inf; continues Int J Biomed Comput	77	0	5	5	
9. MD Comput	61	3	5	0	X
10. Med Care	61	0	5	5	X
11. Acad Med; continues J Med Ed	57	0	5	5	X
12. Medinfo	52	0	5	0	
Zone 1 average database coverage		1.00	3.92	3.58	8
Zone 2					
13. Artif Intell Med	51	0	5	5	X
14. Med Decis Making	50	0	2	5	X
15. J Med Libr Assoc; continues Bull Med Libr Assoc (1911–2001)	49	2	3	0	X
16. Comput Meth Prog Biomed	44	0	5	5	X
17. BMJ	41	0	4	5	X
18. Arch Intern Med	36	0	5	5	X
19. J Nurs Scholarsh; continues Image J Nurs Scholar (1983–1999)	34	5	4	0	X
20. J Nurs Educ	33	5	5	0	X
21. J Med Syst	31	0	3	0	X
22. Commun ACM	28	0	0	5	X
23. MIS Quarterly	27	0	0	4	X
24. Nurs Manage	24	5	4	0	X
25. Am J Public Health	23	4	4	5	X
26. J Fam Pract	23	0	5	4	X
27. Science	21	0	3	5	X
28. Management Science	20	0	0	5	X
29. J Gen Intern Med	19	0	4	5	X
30. Nurs Educ Microworld (1987–1994)	19	NA	NA	NA	
31. J Clin Monit Comput	18	4	4	0	X
32. J Nurs Adm	18	4	4	0	X
33. Lancet	18	1	3	5	
34. Radiology	18	0	1	5	X
35. SPIE	18	0	0	0	X
36. Acad Manage J	15	0	0	0	X
37. IEEE Trans Biomed Eng	15	0	0	5	X
38. J Adv Nurs	15	2	2	0	X
39. J Am Soc Info Sci	15	0	0	5	X
40. CMAJ: Can Med Assoc J	14	1	3	5	X
41. IEEE Trans Med Imaging	14	0	0	5	X
42. Int J Rad Oncol Biol & Physics	14	0	5	5	X
43. J Appl Psychol	14	0	2	5	X
44. Jt Comm J Qual Saf; formerly, Jt Comm J Qual Improv (1993–2002)	14	4	5	0	X
45. Am J Med	13	0	4	4	X
46. ANS: Adv Nurs Sci	13	5	4	0	X
47. IEEE Trans Patt Anal Mach Intell	13	0	0	5	X
48. Int J Hum Comput Stud; continues Int J Man Mach Study (1969–1993)	13	0	0	0	X
49. J Prof Nurs	13	5	4	0	X
50. Caring	12	5	3	0	X
51. Clin Chem	12	0	2	5	X
52. Circulation	12	0	1	5	X
53. Nurs Educ	12	5	5	0	X
54. Cancer	11	0	4	4	X
55. Electroencephalogr Clin Neurophysiol	11	0	5	3	X
56. Int Nurs Rev	11	5	5	0	X
57. Sloan Manag Rev	11	0	0	0	X
58. Am J Epidemiol	10	0	2	5	X
59. Cognit Sci	10	0	0	0	X
60. Diabetes Care	10	2	4	5	X
61. Health Serv Res	10	0	4	4	X
62. Huisarts Wet	10	0	0	0	
63. J Biomech	10	0	5	5	X
64. J Clin Epidemiol	10	0	5	5	X
65. Med Biol Eng Comput	10	0	3	5	X
66. MMWR	10	3	3	0	X
67. Nurs Education Prospect (2002–); continues Nurs Health Care & Nurs Health Care Prospect	10	3	2	0	X
68. Nurs Res	10	4	4	5	X
69. Am Heart J	9	0	4	5	X
70. Comput Biol Med	9	0	4	5	X

Table 4
Continued

Cited journal	Total citations	Bibliographic databases			
		CINAHL	PubMed	SCI	OCLC ArticleFirst
71. Comput Cardiol	9	0	0	5	X
72. Comput Educ	9	0	0	5	X
73. Crit Care Med	9	0	4	5	X
74. Educ Psychol Meas	9	0	0	5	
75. Gastroenterology	9	0	1	5	X
76. Harvard Bus Rev	9	0	2	0	X
77. IEEE Trans Inf Theory	9	0	0	5	X
78. IEEE Trans Syst Man Cybernetics	9	0	0	5	
79. Nurs Clin North Am	9	5	4	0	X
80. Nurs Times	9	5	4	0	
81. Phys Med Biol	9	0	4	5	X
82. Stat Med	9	0	4	5	X
83. Am J Health Syst Pharm; continues Am J Hosp Pharm (1958–1994)	8	0	4	5	X
84. Arch Fam Med	8	0	4	5	X
85. Biometrics	8	0	3	4	X
86. Educ Tech	8	0	0	0	X
87. Endoscopy	8	0	5	4	X
88. Intensive Care Med	8	0	3	5	X
89. Int J Tech Assess Health Care	8	0	4	5	X
90. J Neurosci Methods	8	0	5	4	X
91. Pediatrics	8	1	2	5	X
92. Sci Am	8	1	1	5	X
93. Am J Physiol	7	0	5	5	X
94. Healthcare Financ Manage	7	1	2	0	X
95. Healthcare Informatics	7	5	3	0	
96. IEEE Eng Med Biol Mag	7	0	0	5	X
97. Info Syst Res	7	0	0	0	
98. J Am Coll Cardiol	7	0	1	5	X
99. J Digital Imaging	7	1	3	5	X
100. Med Physics	7	0	4	5	X
101. Nurs Econ	7	5	3	0	X
102. Scand J Clin Lab Invest	7	0	5	4	X
103. Am J Infect Control	6	5	5	4	X
104. Ann Emerg Med	6	4	4	5	X
105. Arch Pediatr Adolesc Med (1994–); continues Am J Dis Child	6	1	4	5	X
106. Cancer Nurs	6	5	5	5	X
107. Chest	6	1	4	5	X
108. Comput Hum Behav	6	0	0	0	X
109. Comput in the Schools	6	0	0	0	X
110. Comput Med Imaging Graph	6	0	0	5	X
111. Fuzzy Sets Syst	6	0	0	5	X
112. Gastrointest Endosc	6	0	2	5	X
113. Gerontologist	6	2	2	0	X
114. Hosp Health Netw (1994–); continues Hospitals	6	1	3	0	X
115. IEEE Trans Softw Eng	6	0	0	5	X
116. Int J Nurs Terminol Classif; continues Nurs Diagn (1990–Apr/Jun 2002)	6	5	4	0	X
117. Soc Sci Med	6	2	3	0	X
118. West J Med	6	2	4	5	X
119. Admin Sci Q	5	0	0	0	X
120. Am J Nurs	5	5	3	0	X
121. Behav Inf Technol	5	0	0	5	X
122. Comput Security (France, 1997–1998)	5	0	0	5	
123. Ergonomics	5	1	3	5	X
124. Health Aff	5	2	4	5	X
125. Issues	5	5	0	0	
126. J Electrocardiol	5	0	4	3	X
127. J Health Soc Behav	5	1	3	0	X
128. J Manag Inf Syst	5	0	0	0	X
129. Nurs Adm Q	5	5	4	0	X
130. Oncol Nurs Forum	5	3	3	0	X
131. Public Health Reports	5	3	4	5	X
Zone 2 average database coverage		1.27	2.61	2.99	109
Average Zones 1 and 2		1.13	3.34	3.30	89%

Based on database coverage score: 5 (95%–100%); 4 (75%–94%); 3 (50%–74%); 2 (25%–49%); 1 (1%–24%); 0 (< 1%).
SCI = Science Citation Index.

are found most often in sources other than journals, such as books, government documents, proceedings, dissertations, and the Internet.

A possible reason for the equal focus on nursing informatics in other formats instead of published re-search findings in journals is that understanding must come before research studies can be done. Professionals' questions have been about what nursing informatics is rather than how nursing informatics is used to contain health care cost and increase the quality of

health care. The Annual Symposium of Computer Applications in Medical Care, AMIA Symposium, MEDINFO, and World Congress of Medical Informatics proceedings, hidden in the miscellaneous category of Table 1, are significant information sources for researchers in the nursing informatics specialty.

Nursing informatics is a developing field of study that is highly interdisciplinary. It is strongly connected to education, business, and computer science. Journals that focus on these topics are good choices for relevant material but were not used as source journals for this study. The most direct route to information connecting nursing informatics to research in clinical practice is through medical informatics, not nursing informatics. A study more directly linked to just mapping the nursing informatics articles would make an interesting comparison for a future study.

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