AN ANALYSIS

OF THE

MEDICAL INFORMATICS LITERATURE

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AN ANALYSIS OF NLM COVERAGE OF THE MEDICAL INFORMATICS LITERATURE

Purpose

In early 1985 the Selection and Acquisition Section undertook a citation analysis study of the medical informatics literature as part of a more comprehensive analysis in which the National Library of Medicine (NLM) is involved.

Specifically this project was intended to:

1. Characterize the medical informatics literature in general terms;

2. Evaluate the NLM collection and collection development practices for the medical informatics literature;

3. Provide preliminary data for an evaluation of NLM indexing coverage of the medical informatics literature;

4. Recommend any necessary changes in NLM collecting and indexing practices;

5. Develop a methodology for collection development studies in other subject areas.

The Collection Development Manual of the National Library of Medicine[1] defines medical informatics as the application of computer and information science to medicine and health services. Like other emerging disciplines whose boundaries are changing rapidly, the field presents special collection development and indexing coverage problems for NLM.

As is characteristic of work that is highly interdisciplinary, researchers may publish in or refer to the literature of disparate fields, not necessarily within the Library's normal scope and coverage bounds[2] for collecting biomedical literature. In addition, publication in emerging research and development areas is frequently skewed toward conference proceedings while conventional peer-reviewed journals, which meet NLM criteria for indexing, tend to be underrepresented.

Methodology

The study tested NLM's collecting and indexing coverage of the medical informatics literature by searching known items from a standard citation list against the Library's bibliographic databases. In general terms this was the methodology followed in the NLM-Drexel MBS Project.[3] As was the case in the NLM-Drexel studies, the emphasis was on the ultimate product available to users of Library services although internal processing mechanisms also were considered.

The standard citation list, or "list of documents designed to reflect the typical documents used in a professional field,"[4] was selected in consultation with three experts in the field of medical informatics, all of whom at that time were members of the NLM staff.[5] Each of the three independently identified the proceedings of three conferences as principal sources of information for developments in the field. These were the annual proceedings of the American Association for Medical Systems and Informatics (AAMSI Congress), the Symposium on Computer Applications in Medical Care (SCAMC), and the World Conference on Medical Informatics (MEDINFO). In addition the three identified Computers and Biomedical Research (New York) and

Methods of Information in Medicine (Stuttgart) as highly respected publications which were probably the longest-lived scholarly journals in the field.

The contents of the most recent of the three proceedings (MEDINFO-83, AAMSI-1984, SCAMC-1984) and the most recent available full year's run of the two journals[6] were then examined. Since the articles included covered a broad range of topics in the field of medical informatics and did not appear to be skewed toward any particular aspect of the field, these issues of the five titles were finally selected as the standard citation list or source (citing) publications for the study.

All reference lists of all articles in the three congresses (proceedings of congresses) and the year's run of the two journals are included in the sample pool yielding a total of 5850 citations. These were numbered sequentially from 0001 to 5850, and a random, non-stratified sample of ten percent was drawn using a table of random digits.[7] Since the table is a 5-digit table and the sample required only 4 digits, the last digit to the right was dropped. Any duplicate numbers were replaced by selecting the next entry in the random number table. In drawing the sample references to any published source (including "in press" citations) were accepted, but personal communications were excluded.

To facilitate data reduction and analysis, Technical Services Division staff in collaboration with OCCS designed a study database using Infodata's "Inquire" software. Data elements including bibliographic elements (e.g., author, title of citation, etc.) and study elements (e.g., scope, source of reference, etc.) were defined (Attachment A) and a data input form designed (Attachment B).

The 585 references in the final sample were analyzed and grouped by probable type of publication (e.g., journal, proceedings, or monograph)[8] to facilitate more logical searching in the various NLM databases. The references were then searched as "known items" in the NLM network files (CATLINE, SERLINE, MEDLINE) and internal processing databases (SERIALS, INPROC). For identification purposes all items not found in an NLM database also were searched in OCLC. Of the 585 citations a total of 11 or less than 2 percent were ambiguous or incomplete and could not be identified conclusively. Data for these items were coded as completely as possible, and they were assigned a status value of "n" for not found.

Where possible bibliographic and indexing data for serials, including journals and serial proceedings, were downloaded to the study database directly from existing NLM files.

Table 1 provides data on the number and type of citations derived from each of the five selected sources. A complete list of citations by source is given in Attachment C.

TABLE 1

Source of Sample Citations and Type of Publications Cited
(N=585)

SOURCE	Journals	Monos	Procs	Total	% (N=585)
Proceedings					
MEDINFO 83	132	67	49	248	42
SCAMC (1984)	95	48	25	168	29
AAMSI (1984)	29	6	27	62	11
Sub-Total	256	121	101	478	82%
Journals					
Computers and Biomedical Research (1983-4)	48	9	10	67	11
Methods of Information in Medicine (1984)	26	10	4	40	7
Sub-Total	74	19	14	107	18%
Total	330	140	115	585	100%

As shown above 82 percent of the study sample was derived from the three proceedings on the standard citation list. The two journals yielded the remaining 18 percent. Thus proceedings derived citations are over-represented in the sample.

Table 2 provides a rough breakdown of the number of items in the article reference list from which each study citation was derived. Slightly more than 2 percent of all citations appeared in articles with a reference list of three citations or less.

TABLE 2

Distribution of Citations By Length of Reference List

	3 Citations or Less	4 Citations or More
Journals	5	325
Monographs	4	136
Proceedings	5	110
	14	571

Characteristics of the Medical Informatics Literature

The 585 citations or 10 percent sample of 5850 references in current selected medical informatics publications were dispersed among 383 titles. Table 3 provides a breakdown of both citations and the titles (cited title) in which they appeared by type of publication - journal, monograph, or proceedings.

Although proceedings source documents contributed 82 percent of study citations, overall proceedings constituted only 20 percent of the sample. This is just over a third the number of journal citations with 56 percent and four-fifths the number of monographs citations with 25 percent.

TABLE 3

Distribution of Citations and Cited Titles By Publication Type

Publication Type	Citations	% (N=585)	Cited Titles	% (N=383)
Journals	330	56	183	48
Monographs	140	24	136	35
Proceedings	115	20	64	17
	585	100	383	100%

Table 4 below shows the frequency distribution of cited titles in the study. The highest frequencies were 26 and 17 postings for a single title each. They were followed by a gap in the 9 to 17 range. Overall the 21 most highly cited titles with a frequency of 4 or more accounted for 161 or 28 percent of all citations. In all 73 titles or 19 percent were cited two or more times accounting for 47 percent or nearly half of the total citations in the study. The remaining 53 percent were cited only once.

TABLE 4

Distribution of Citations Among Cited Titles

Citation Frequency	# Titles (N=383)	Cumulative Titles (N-383)	Cumulative Citations (N=585)	Cumulative % (N=585)
26	1	1	26	4
17	1	2	43	7
9	5	7	88	15
8	2	9	104	18
7	1	10	111	19
6	1	11	117	20
5	4	15	137	23
4	6	21	161	28
3	10	31	191	33
2	42	73	275	47
1	310	383	585	100%

Two proceedings, SCAMC with 26 postings and MEDINFO with 17, were the most highly cited titles, together accounting for 7 percent of all citations. These were followed by 12 journals with from 9 to 5 postings each and a third proceedings, the AAMSI Congress, with 5 postings. Another 6 journals were each cited four times.

TABLE 5

Titles Cited Four or More Times

Citations	Title	Type
26	SCAMC	P
17	MEDINFO	P
9	BIOMETRIKA	J
9	COMPUTERS AND BIOMEDICAL RESEARCH	J
9	LECTURE NOTES IN MEDICAL INFORMATICS	J
9	METHODS OF INFORMATION IN MEDICINE	J
9	NEW ENGLAND JOURNAL OF MEDICINE	J
8	LANCET	J
8	ONLINE	J
7	ANNALS OF INTERNAL MEDICINE	J
6	MEDICAL AND BIOLOGICAL ENGINEERING AND COMPUTING	J
5	AAMSI	P
5	BEHAVIOR RESEARCH METHODS AND INSTRUMENTATION	J
5	CIRCULATION	J
5	RADIOLOGY	J
4	AJR. AMERICAN JOURNAL OF ROENTGENOLOGY	J
4	AMERICAN JOURNAL OF HOSPITAL PHARMACY	J
4	ARTIFICIAL INTELLIGENCE	J
4	BIOMETRICS	J
4	COMMUNICATIONS OF THE ACM	J
4	ELECTROENCEPHALOGRAPHY AND CLINICAL NEUROPHYSIOLOGY	J

In addition to the five source publications for this study, the highly cited titles include journals such as Lecture Notes in Medical Informatics, which are primarily concerned with medical informatics, and also several of the premier general medical journals (e.g., Lancet, New England Journal of Medicine, Annals of Internal Medicine). In addition there is one general information science journal, Online.

The lowest citation frequencies occurred in the 136 monographs in the sample with only three titles providing multiple citations.

Attachments D, E, and F provide a rank order listing of journals, monographs, and proceedings, the scope of each title, whether or not in the NLM collection, and for journals the indexing status.

TABLE 6

Monographs with Multiple Citations

# Citations	Titles
3	Computer-Based Medical Consultations: Mycin
2	Artificial Intelligence and Pattern Recognition Consult
2	Computer Technology in the Health Sciences

As might be expected in a scientific discipline, 329 citations or 56 percent were to materials which were either in press or published from 1980 to the present. An additional 197 citations or 34 percent dated from the 1970s, 38 (6 percent) from the 1960s, and 9 (1.5 percent) from the 1950s. Publication dates could not be determined for 12 citations. The two oldest citations, both for journals, dated from 1952. The most frequently cited year was 1983 with 99 postings. Journal citations were somewhat more current than those for monographs with 59 percent to material published from 1980 forward compared to 51 percent in this time period for monographs. Not surprisingly proceedings were the most current of the material cited with 84 or 72 percent of citations to proceedings dating from the 1980s. A complete list of citations by year of publication is given in Attachment G.

English appears to be overwhelmingly the language of choice for medical informatics authors. As can be seen in Table 7, 542 or 93 percent of the citations were written in English. German was a distant second with 18 citations or 3 percent, followed by 11 citations from multilingual journals and a scattering in other languages.

TABLE 7

Distribution of Citations by Language

Language	# Citations (N=585)
English	542
German	18
Multilingual	11
Dutch	5
French	4
Spanish	2
Russian	2
Czech	1

For the items in the study sample, the United States was the primary country of publication with 395 or 68 percent of the citations published in this country. England was second with 57 citations or about 10 percent of

the total. The Netherlands with 50 accounted for just under 9 percent and West Germany with 38 for 6 percent.
Together these 4 countries accounted for 540 citations, 92 percent of the sample. The remaining 36 identified
citations were distributed among 17 countries, all European except for 3 citations to Cuban, 2 to Soviet and 2 to
Japanese publications. The place of publication could not be determined for 9 items. A complete listing is
provided in Attachment H.

Using Medical Subject Headings (MeSH) each citation to a title in the NLM collection was classified as to the
subject content of the overall title. The headings were not assigned specifically for this study but were derived
from the existing bibliographic record in CATLINE or SERLINE.

The 293 citations to all 160 journals in the collection whether indexed or not received 129 distinct MeSH
headings at the overall title or source level. These ranged from Medicine with a frequency of 54 to 63 headings
with 1 posting each. Headings with a frequency of 4 or more are given in the following table. There is a large
gap between Medicine at 54 postings and Information Retrieval Systems with a count of 26. However this is
consistent with the large number of journals including such titles as Lancet and the New England Journal of
Medicine classified under Medicine in SERLINE.

TABLE 8

Citations from Journals in NLM Collection
Source MeSH Headings with Frequency of 4 or More

# Citations	MeSH Headings
54	MEDICINE
26	INFORMATION RETRIEVAL SYSTEMS
23	BIOMETRY
17	COMPUTERS
17	COMPUTER ASSISTED INSTRUCTION
12	RESEARCH
9	AUTOMATIC DATA PROCESSING
9	PHYSIOLOGY
8	BIOMEDICAL ENGINEERING
8	NEUROLOGY
7	BIOPHYSICS
7	INTERNAL MEDICINE
7	NEOPLASMS
7	PUBLIC HEALTH
6	BLOOD CIRCULATION
6	CARDIOVASCULAR SYSTEM
6	RADIOLOGY
6	SCIENCE
5	BEHAVIOR
5	DIAGNOSIS, LABORATORY
5	NUCLEAR MEDICINE
5	PHARMACOLOGY
5	PSYCHIATRY
5	PSYCHOLOGY, EXPERIMENTAL
5	RADIOGRAPHY
4	AUTOMATION
4	DELIVERY OF HEALTH CARE
4	ELECTROENCEPHALOGRAPHY
4	ELECTRONICS, MEDICAL
4	NURSING
4	PHARMACY
4	PHARMACY SERVICE, HOSPITAL

The 201 citations from the 109 fully indexed journals were assigned 94 MeSH headings at the source level. These ranged from a frequency of 41 for Medicine to 46 headings with a frequency of 1.

TABLE 9

Citations from Fully Indexed Journals
Source MeSH Headings with Frequency of 4 or More

# Citations	MeSH Headings
41	MEDICINE
15	INFORMATION RETRIEVAL SYSTEMS
12	COMPUTER ASSISTED INSTRUCTION
11	RESEARCH
10	COMPUTERS
9	BIOMETRY
9	PHYSIOLOGY
8	NEUROLOGY
7	BIOMEDICAL ENGINEERING
7	INTERNAL MEDICINE
7	NEOPLASMS
6	BLOOD CIRCULATION
6	CARDIOVASCULAR SYSTEM
5	DIAGNOSIS, LABORATORY
5	NUCLEAR MEDICINE
5	PHARMACOLOGY
5	PUBLIC HEALTH
5	RADIOGRAPHY
5	RADIOLOGY
4	DELIVERY OF HEALTH CARE
4	ELECTROENCEPHALOGRAPHY
4	NURSING
4	PHARMACY
4	PHARMACY SERVICE, HOSPITAL
4	PSYCHIATRY

The citations from the 16 selectively indexed journals were assigned 17 MeSH headings ranging from Science with a frequency of 5 to 9 headings with a frequency of 1. Medicine occurred twice in this category.

TABLE 10

**Citations from Selectively Indexed Journals
Source MeSH Headings with a Frequency of 4 or More**

# Citations	MeSH Headings
5	SCIENCE
4	BIOMETRY
4	BIOPHYSICS

The 40 citations to the 39 monographs in the NLM Collection were assigned 54 headings ranging from Computers with 13 postings to 37 with single postings.

TABLE 11

**Citations to Monographs in NLM Collection
Source MeSH Headings with Frequency of 4 or More**

# Citations	MeSH Headings
13	COMPUTERS
8	INFORMATION SYSTEMS
5	DIAGNOSIS, COMPUTER ASSISTED
5	MEDICINE

The citations to proceedings in the collection received 43 MeSH Headings. Medicine was first with frequency of 46 followed by Computers at 36 and Information Retrieval Systems at 18.

TABLE 12

**Citations to Proceedings in NLM Collection
Source MeSH Headings with Frequency of 4 or More**

# Citations	MeSH Headings
46	MEDICINE
36	COMPUTERS
18	INFORMATION RETRIEVAL SYSTEMS
6	INFORMATION SYSTEMS

Citations to titles indexed by NLM were classified as to subject content at the article level, as well as at the overall title or source level.

To accomplish this, a maximum of three MeSH headings at the article level were selected from MEDLINE and added to the study database. On this basis, indexed articles were assigned a total of 197 MeSH headings. The headings with the highest frequency are shown in the following table.

TABLE 13

Citations to Indexed Articles
Article MeSH Headings with a Frequency of 4 or More

# Citations	MeSH Headings
36	COMPUTERS
14	INFORMATION SYSTEMS
8	MEDICINE
5	MEDICAL RECORDS
4	ELECTROCARDIOGRAPHY

No ad hoc assignment of MeSH headings was made to citations for titles not in the NLM collection. However, the majority of not-owned items in all three types (e.g., journals, monographs and congresses) appear to be in the subject areas of computers, information systems, automatic data processing, computer diagnosis, and computer-assisted instruction.

NLM Collection and Collection Development Practices

Each of the 585 study citations was searched in NLM's bibliographic databases and if not located, in OCLC to determine if it was "in the NLM collection" or "not in the NLM collection." For purposes of assessing NLM's collecting practices, the following categories of material were considered as in the NLM collection: cataloged items, items in process (e.g., in cataloging), and items on order. Items which were not owned, not on order, not identified, owned but in the staff library or a staff office and not available to the public, or items held by other libraries within the Regional Medical Library Network were considered as "not in the NLM collection."

Table 14 and Table 15 show overall NLM collecting performance from the point of view of the researcher in medical informatics.

TABLE 14

Citations in NLM Collection vs. Not Owned
(N=585)

Type	In NLM		Not Owned		Totals	
	# Citations	% of Type	# Citations	% of Type	# Citations (N=585)	% of Type
Journals	293	89	37	11	330	50
Monographs	40	29	100	71	140	7
Proceedings	94	82	21	18	115	16
	427		158		585	73

Overall the worker in medical informatics could have obtained 73 percent of the sample citations from the NLM collection. It should be noted that 425 of the 427 citations in the Library were to titles which had been cataloged and were available for use. Only two citations were to titles in processing, and none were on order. The researcher had an 89 percent chance of finding a desired journal citation and an 82 percent chance at citations to proceedings.

Although the availability in the NLM collection of monographic citations was significantly lower at 29 percent, they accounted for only 24 percent of total citations.

TABLE 15

Cited Titles in NLM Collection vs. Not Owned
(N=379)

Type	In NLM		Not Owned		Totals	
	# Titles	% of Type	# Titles	% of Type	Titles (N=383)	% Title in NLM
Journals	160	87	23	13	183	42
Monographs	39	29	97	71	136	10
Proceedings	44	69	20	31	64	11
	243		140		383	63%

Overall 63 percent of the cited titles were in the NLM collection compared to 73 percent of the citations. The percentage of journal titles in the collection was 87, about the same as the percent of journal citations owned (89 percent). The percent of monographic titles in the collection (29 percent) was the same as the citation percentage. Only in proceedings did the percentage of titles in the collection (69) differ significantly from the percent of citations (82) in the collection.

NLM coverage improves significantly if one considers only highly cited titles or titles with multiple citations. All but one of the 21 most frequently cited publications are in the NLM Collection. (See Table 5) The single

exception is the journal <u>Online</u> which was cited 8 times. NLM owns 60 or 83 percent of the 73 titles cited more than once. These 73 titles account for 275 citations of which NLM owns 247 or 89 percent.

TABLE 16

Multiple Citations
In Collection vs. Not Owned

	In NLM	Not Owned	Total
Journals	187	21	208
Monographs	2	5	7
Proceedings	58	2	60
	247	28	275

The following table assesses coverage of the sample citations against the "in scope" guidelines which appear in the 1985 NLM Collection Development Manual.[9]

TABLE 17

Distribution of Sample Citations
By Scope of Cited Title

Type	Level C	Level R	Level B	Not In Scope	Citations
Journals	240	15	18	57	330
Monographs	59	3	0	78	140
Proceedings	93	1	3	18	115
	392	19	21	153	585

In all 432 citations or 74 percent of the total appeared in publications judged in scope for the NLM collection at the comprehensive (C), research (R) or basic levels (B).

Fifty-seven journal citations or 17 percent appeared in out of scope publications compared to 55 percent for monographs and less than 2 percent for proceedings.

TABLE 18

Distribution of Citations in NLM
By Scope

Type	Level C	Level R	Level B	Not In Scope	Citations
Journals	240	15	18	20	293
Monographs	36	3	0	1	40
Proceedings	87	1	3	3	94
	363	19	21	24	427

TABLE 19

Distribution of Citations not in NLM
By Scope

Type	Level C	Level R	Level B	Not In Scope	Citations
Journals	0	0	0	37	37
Monographs	23	0	0	77	100
Proceedings	6	0	0	15	21
	29	0	0	129	158

NLM Indexing Coverage

Information about indexing coverage of titles in the NLM collection (e.g., journals or proceedings which are cataloged as serials) was downloaded to the study database directly from SERLINE. A project to update the indexing tags for titles in SERLINE was completed in March 1985 based on the latest available information from the following indexing services: Excerpta Medica (EM), Science Citation Index (SCI), Biological Abstracts (BA), Psychological Abstracts (PA) and Chemical Abstracts (CA). Thus data on overlap between these services and NLM are available for titles in the NLM collection, but no attempt was made in this initial study to analyze indexing coverage of titles not owned by the Library.

Table 20 provides data on the NLM indexing status for the 330 citations to journals in the study sample. In all, 201 citations or 61 percent of journal citations are from titles fully indexed by NLM; 24 or 7 percent from titles selectively indexed and 105 or 32 percent from titles not indexed. NLM does not own 23 of the titles in the last category. These 23 titles, for the most part in the areas of computer and information science, were all judged out of scope for the NLM collection. Together they represent 37 citations or 6 percent of the total sample.

TABLE 20

Citations to Journals
NLM Indexing Status

Status	Titles (N=183)	Citations (N=330)	% (N=330)	(% N=585)
Fully Indexed (FI)	109	201	61	34
Selectively Indexed (SI)	16	24	7	4
Not Indexed (NI)	58	105	32	18

The following table shows the distribution of indexed journal citations in NLM databases. Of 225 citations, 96 percent are available in MEDLINE, the remainder may be found in HEALTH or POPLINE.

TABLE 21

NLM Database Distribution of Journal Citations

Database	# Citations (N=225)	% (N=225)	# Titles (N=125)
MEDLINE	216	96	117
HEALTH (HLI)	8	4	7
POPLINE	1	---	1
	225	100%	125

Of the 216 MEDLINE citations all but five are published in Index Medicus. These represent three titles. All three appear in the International Nursing Index, and two of the three in the Hospital Literature Index.

Table 22 provides more detailed information on the indexing status of journal titles cited four or more times.

TABLE 22

Journal Titles Cited Four or More Times

Fully Indexed Titles (FI)

# Citations	Title	Scope Category
9	Computers and Biomedical Research	C
9	Methods of Information in Medicine	C
9	New England Journal of Medicine	C
8	Lancet	C
7	Annals of Internal Medicine	C
6	Medical and Biological Engineering and Computing	C
5	Circulation	C
5	Radiology	C
4	AJR. American Journal of Roentgenology	C
4	American Journal of Hospital Pharmacy	C
4	Biometrics	R
4	Electroencephalography and Clinical Neurophysiology	C

Selectively Indexed Titles (SI)

# Citations	Title	Scope Category
4	Biometrics	R

Not-Indexed Titles (NI)

# Citations	Title	Scope Category
9	Biometrika	R
9	Lecture Notes in Medical Informatics	C
8	Online	N
5	Behavior Research Methods and Instrumentation	B

4	Artificial Intelligence	N
4	Communications of the ACM	N

See Attachment I for a similar listing of all journal titles.

Since it is not NLM policy to index monographic works, no monographs were included in the indexing analysis. Of the 64 proceedings titles in the study, NLM classes 47 as monographs and 17 as serials. NLM indexes only three of the 17 serials; two are fully indexed, one is selectively indexed.

TABLE 23

Proceedings Titles Indexed by NLM

# Citations	Title	Indexing Status	Scope
1	Federation Proceedings	FI	R
1	Proceedings of the Western Pharmacological Society	FI	C
1	Scanning Electron Microscopy	SI	B

The following table provides a list of both monographic and serial proceedings with multiple citations. None are indexed by NLM. Together these 11 titles account for 67 citations or 11 percent of the sample.

TABLE 24

Proceedings Titles with Multiple Citations
Not Indexed By NLM

# of Citations	Title	Scope	In NLM	Type
26	SCAMC Proceedings	C	Y	S
17	Medinfo	C	Y	S
5	AAMSI Congress	C	Y	S
5	International Joint Conference on Artificial Intelligence	N	N	M
2	ACM National Conference, Proceedings	N	N	M
2	Annual Conference on Rehabilitation Engineering Proceedings	C	Y	S
2	Application of Optical Instrumentation in Medicine (Proceedings SPIE)	C	Y	S
2	International Congress Series	C	Y	S
2	Medical Management and Computing	C	Y	M
2	Pattern Recognition in Practice	C	Y	M
2	World Congress of Nuclear Medicine and Biology	C	Y	M

Table 25 shows the indexing overlap of journals cited 4 or more times.

TABLE 25

Indexing Overlap of Journal Titles Cited Four or More Times

# of Citations	Title	Indexed In					
9	Biometrika		SCI	BA			
9	Computers and Biomedical Research	IM	SCI	BA	EM	CA	
9	Lecture Notes in Medical Informatics						
9	Methods of Information in Medicine	IM	SCI	BA	EM		
9	New England Journal of Medicine	IM		BA	EM	CA	PA
9	Lancet	IM	SCI	BA	EM	CA	
8	Online			BA		CA	
7	Annals of Internal Medicine	IM	SCI	BA	EM	CA	
6	Medical and Biological Engineering and Computing	IM	SCI		EM	CA	
5	Behaviour Research Methods and Instrumentation			BA			PA
5	Circulation	IM	SCI	BA	EM	CA	
5	Radiology	IM	SCI	BA	EM	CA	
4	AJR. J. Roentgenology	IM		BA		CA	
4	American Journal of Hospital Pharmacy	IM	SCI	BA	EM	CA	
4	Artificial Intelligence						
4	Biometrics	IM	SCI	BA			
4	Communications of ACM						
4	Electroencephalography and Clinical Neurophysiology	IM		BA	EM	CA	PA

Conclusions

NLM technical services staff conducted a study of the medical informatics literature based on a sample derived from an expert generated list of five source publications in the field. Because the reference list was small and there is as yet no corroborating data to verify its validity as representative of the universe of medical informatics literature, it is not possible to assign an accurate confidence level to the results of this study. Rather it should be regarded as providing preliminary data for testing in future studies.

The focus was on NLM performance against the sample. No attempt was made to assess its collection against those of other research or health science libraries. Some data were available on other indexing services' coverage of serials in the NLM collection, but in this study no attempt was made to search other databases to determine coverage for titles which the Library does not own. Conclusions and recommendations should be viewed in the light of the aforementioned points.

1. The study appears to show some clustering of the medical informatics literature in a few highly cited proceedings and journal titles, but these publications include the source titles for the study, and this may skew the results. In general, publications still appear to be scattered among a broader range of titles and subject areas than would be expected in a mature discipline.

2. Contrary to expectation, the study does not demonstrate that the preponderance of research papers cited are appearing in proceedings. Although proceedings sources provided 80 percent of the sample citations, only 20 percent of them were published in proceedings compared to 56 percent for journals and 24 percent monographs. Since comparable data for other fields were not available, no firm conclusion can be drawn.

3. The study appears to demonstrate that overwhelmingly medical informatics workers are writing in English and publishing in the United States.

4. Overall a worker in medical informatics could obtain 73 percent of the sample citations in the NLM collection. The odds are better for journals (89 percent) and proceedings (82 percent), and worse for monographs (29 percent). The latter, however, constitute only 24 percent of the sample.

5. In acquiring material for the collection, NLM appears to be generally following the guidelines set forth in the 1985 NLM Collection Development Manual. However the guidelines for the acquisition of computer and information science appear to be applied more strictly for monographs and monographic congresses than for journals and serial congresses. The Library collection contains all journal titles judged in scope plus about 11 judged out of scope. These include titles such as the International Journal of Systems Science, the Journal of Documentation, and Artificial Intelligence. In the area of monographs, the Library had acquired only 1 title which could be considered out of scope, IEEE Standard Dictionary of Electrical and Electronic Terms. It had acquired 84 percent of those judged in scope, and failed to acquire 23 titles or 16 percent judged in scope. Most of these were in the areas of computers and information systems as related to medical records, diagnosis or medical instruction. In the area of proceedings NLM had failed to acquire 6 in scope titles or 10 percent of the sample spread among a variety of topics. Three out of scope items concerned with artificial intelligence had been acquired.

6. The 1985 Collection Development Guidelines cover the "medical" portion of medical informatics, but do not provide for acquisition of the methodological or general materials in computer and information science and artificial intelligence which a researcher in the field may require.

7. The worker in medical informatics has a 68 percent chance of retrieving journal citations from the study sample in the NLM databases including MEDLINE, POPLINE and HEALTH. The chance of

finding printed citations in <u>INDEX MEDICUS</u> is equally good at 67. However the chances of finding citations to proceedings are only 2 percent.

8. Based on the study results a worker in medical informatics would need to consult online databases such as Microcomputer Index or Computer Databases to retrieve citations to computer and information science literature.

9. NLM is selectively indexing both general titles such as <u>Science</u> and <u>Nature</u> and specialty journals such as <u>Biometrics</u> and the <u>Journal of Clinical Computing</u>.

10. The most highly cited medical informatics publications in the study are proceedings which NLM does not index.

11. The medical informatics study was the first of its kind undertaken by the Technical Services Division. Some refinements in methodology and techniques should be made preparatory to additional studies.

Recommendations

1. Reassess the Library's policy on coverage of basic works in artificial intelligence which are now considered out of scope. Begin collecting at the basic information level.

2. Bring journal selection practices for computer and information science journals in line with the [Collection Development Manual.](#)

3. Review in scope monographs and proceedings not owned by NLM for possible acquisitions. Attempt to categorize material or potential sources of information about the material in order to assure more complete coverage in the future.

4. Review NLM Classification and MeSH vocabulary to determine if medical informatics topics are adequately covered.

5. Review highly cited journals and serial proceedings for possible indexing.

6. Review selectively indexed specialty journals for possible full indexing.

7. Perform follow-up study to determine consistency of indexing of study citations.

NOTES

[1] National Library of Medicine (U.S.) Collection Development Manual of the National Library of Medicine, Bethesda, Maryland, 1985, p. 66.

[2] See the NLM Collection Development Manual for a detailed discussion of the scope and coverage of literature acquired for the Library's collection.

[3] Griffith, Belver C.; White, Howard D.; Drott, M. Carl; and Saye, Jerry D. An analysis of the National Library of Medicine's (NLM) Handling of the Medical Behavior Sciences' (MBS) Literatures: Some Research Tests of Methods for Evaluating Bibliographic Databases. NLM-Drexel MBS Project, Executive Summary, Philadelphia, PA: Drexel University, College of Information Studies, 1983. NO1-LM-23501.

[4] Ibid. p. 13.

[5] The three researchers who selected the standard citation list were Dr. Donald A.B. Lindberg, Director NLM; Dr. Lawrence Kingsland, Electronics Engineer, Lister Hill National Center of Biomedical Communications (LHNCBC); and Dr. Dennis Fryback, Expert (LHNCBC).

[6] Included in the standard citations list were the following:

   AAMSI Congress 84: proceeding of the 3rd Congress on Medical Informatics.
       Edited by Donald A. B. Lindberg, Morris F. Collen. Bethesda, MD :
       American Associations for Medical Systems and Informatics, 1984.
       (AAMSI Congress)

   Computers and Biomedical Research. New York : Academic Press.
       Vol. 16, no. 5, Oct. 1983
                 no. 6, Dec. 1983
       Vol. 17, no. 1, Feb. 1984
                 no. 3, Jun. 1984
                 no. 4, Aug. 1984
                 no. 5, Oct. 1984

   MEDINFO 83: Proceedings of the fourth World Conference on Medical
       Informatics, Amsterdam, August 22-27, 1983. Edited by Jan H. Van
       Bemmel, Marion J. Ball, and Ove Wigertz. Amsterdam, New York :
       North Holland Pub. Co., 1983. (MEDINFO)

   Methods of Information in Medicine. Stuttgart, New York : Schattauer.
       (Vol. 23, nos. 1, 2, 3, 4, 1984)

   Proceedings of the Eighth Annual Symposium on Computer Applications
       in Medical Care, Washington, D.C., Nov. 4-7, 1984. New York:
       Institute of Electrical and Electronics Engineers; Long Beach, Calif.:
       IEEE Computer Society Publications Office, 1984 (SAMC)

[7] Practical Statistics in Experimental Design, Dallas Publishing House, 1959, pp. 6-9.

[8] In an attempt to approach the medical informatics literature from the point of view of the researcher in the field rather than the librarian, publications in the sample were divided into three categories--journals, monographs, and proceedings. Journals were defined as serials other than newspapers and other than the proceedings of congresses or meetings. Monographs were defined as a separate treatise on a single subject or class of subjects excluding the proceedings of a congress. Proceedings were defined as the published record of a meeting usually of a society or organization. To determine in which category to place a title, the NLM cataloging record was consulted. If no NLM record was found, the OCLC record, if available, was consulted. The definitions used, strictly speaking, are not correct from a bibliographic point of view.

[9] See pages 15 to 17 of the NLM Collection Development Manual for a description of the NLM collecting levels.

MEDINFO DATABASE
FIELD DEFINITION TABLE

DATA ELEMENT MNEMONIC	DESCRIPTION OF DATA ELEMENT
CITATION	Full citation from sample
CITTI	Title from citation
TI	Title from source database
PUB	Publisher
CITYR	Year(s) of publications
CA	Call number
MHSOURCE	MeSH from source record (no subheadings)
MHART	MeSH from article record (no subheadings)
LA	Language
CY	Country of publication
IT	Item type
UI	Unique identifier
DB	Database where found
DBUI	Database unique identifier
INDEX	Indexed or not in MEDLARS
INDEXPOL	Indexing policy followed
AI	Abstracting/Indexing Sources
REF	Number of references in original bibliography
SCOPE	In/out of scope and level
STATUS	In process, etc., status
REFSOURC	Original source of reference
CONGRESS	Monograph or Serial
SAMPNO	Sample Number
NOTES	General notes

DATA INPUT SHEET - MEDINFO FILE

FIELDS	VALUES
Columns1-8	Columns 10-72
UI	
SAMPNO	
CITATION	
CITTI	
MHART	
MHSOURCE	
TI	
PUB	
CITYR	
CA	
CY	
LA	
IT	
CONGRESS	
INDEX	
INDEXPOL	
AI	
SCOPE	
STATUS	
REF	
REFSOURCE	
NOTES	

END

- Listing Of 585 Citations in Sample
**(1) SAMPLE CITATIONS FOUND IN
MEDINFO "83"**

Abrams, H.L. The "Overutilization" of X-rays. N Engl J Med 300 (1979) 1213-1216.

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9	Biometrika	R	Yes	S	N
9	Computers and Biomedical Research	C	Yes	S	F
9	Lecture Notes in Medical Informatics	C	Yes	S	N
9	Methods of Information in Medicine	C	Yes	S	F
9	New England Journal of Medicine	C	Yes	S	F
8	Lancet	C	Yes	S	F
8	Online	N	No	S	N
7	Annals of Internal Medicine	C	Yes	S	F
6	Medical and Biological Engineering and Computing	C	Yes	S	F
5	Behavior Research Methods and Instrumentation	B	Yes	S	N
5	Circulation	C	Yes	S	F
5	Radiology	C	Yes	S	F
4	AJR. America Journal of Roentgenology	C	Yes	S	F
4	American Journal of Hospital Pharmacy	C	Yes	S	F
4	Artificial Intelligence	N	Yes	S	N
4	Biometrics	R	Yes	S	S
4	Communications of the ACM	N	Yes	S	N
4	Electroencephalography and Clinical Neurophysiology	C	Yes	S	F
3	American Journal of Medicine	C	Yes	S	F
3	Archives of Ophthalmology	C	Yes	S	F
3	Byte	N	No	S	N
3	Computer Programs in Biomedicine	C	Yes	S	F
3	International Journal of Man-Machine Studies	N	Yes	S	N
3	Journal of Chronic Diseases	C	Yes	S	F
3	Journal of Medical Systems	C	Yes	S	F
3	Journal of Physiology	C	Yes	S	F
3	Nursing Outlook	C	Yes	S	F

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2	American Journal of Clinical Pathology	C	Yes	S	F
2	American Journal of Physiology	C	Yes	S	F
2	American Journal of Psychiatry	C	Yes	S	F
2	Biophysical Journal	C	Yes	S	S
2	British Medical Journal	C	Yes	S	F
2	Business Computing	N	No	S	N
2	Cancer	C	Yes	S	F
2	Comprehensive Psychiatry	C	Yes	S	F
2	Computers in Nursing	C	Yes	S	F
2	Health Education	C	Yes	S	F
2	Hepatology	C	Yes	S	F
2	Hospital and Community Psychiatry	C	Yes	S	F
2	IEEE Trans. Automatic Control	N	No	S	N
2	IEEE Transactions on Information Theory	N	No	S	N
2	IEEE Transactions Pattern Analysis Machine Intelligence	N	No	S	N
2	JAMA	C	Yes	S	F
2	Journal of Applied Physiology	C	Yes	S	F
2	Journal of Clinical Computing	C	Yes	S	S
2	Journal of Family Practice	C	Yes	S	F
2	Journal of Medical Education	C	Yes	S	F
2	Journal of the Royal Statistical Society, Series B. (Methodological)	N	Yes	S	N
2	Kybernetik	B	Yes	S	S
2	MD Computing	C	Yes	S	N
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2	Revista Cubana de Administracion de Salud	C	Yes	S	N
2	Science	B	Yes	S	S
2	Softalk	N	No	S	N
2	Surgery	C	Yes	S	F
2	Technometrics	N	Yes	S	N
2	Vital and Health Statistics. Series 10: Data from the National Health Survey	C	Yes	S	F
1	AAMSI News	N	No	S	N
1	Accident Facts	R	Yes	S	N
1	ACR Bulletin	C	Yes	S	N
1	ACTA Cytologica	C	Yes	S	F
1	Advances in Neurology	C	Yes	S	F
1	AI Magazine	N	No	S	N
1	American Heart Journal	C	Yes	S	F
1	American Journal of Cardiology	C	Yes	S	F
1	American Journal of Epidemiology	C	Yes	S	F
1	American Journal of Mental Deficiency	C	Yes	S	F
1	American Journal of Optometry and Archives of American Academy of Optom	C	Yes	S	F
1	Anesthesiology	C	Yes	S	F
1	Annales de Physique Biologique et Medicale	C	Yes	S	N
1	Annals of Clinical and Laboratory Science	C	Yes	S	F
1	Annals of the Medical Section of the Polish Academy of Sciences	C	Yes	S	F
1	Annals of the New York Academy of Sciences	B	Yes	S	S
1	Annual Report - SRI International	B	Yes	S	N
1	Annual Report 1981; Biosciences Information Service	N	No	S	N
1	Annual Review of Medicine	C	Yes	S	F
1	Application of Optical Instrumentation in Medicine	C	Yes	S	N

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1	Applied Optics	B	Yes	S	N
1	Archives Internationales de Pharmacodynamie et de Therapie	C	Yes	S	F
1	Archives of Internal Medicine	C	Yes	S	F
1	Archives of Otolaryngology	C	Yes	S	F
1	Archives of Physical Medicine and Rehabilitation	C	Yes	S	F
1	Arthritis and Rheumatism	C	Yes	S	F
1	Avtomatika I Telemeekhanika	N		S	N
1	Biochemical Journal	C	Yes	S	F
1	Biochimica et Biophysica ACTA	C	Yes	S	S
1	Biomedizinische Technik	C	Yes	S	F
1	Biopolymers	C	Yes	S	S
1	Birth Defects Original Article Series	C	Yes	S	F
1	British Journal of Preventive and Social Medicine	C	Yes	S	F
1	Bulletin of the New York Academy of Medicine	C	Yes	S	F
1	Canadian Medical Association Journal	C	Yes	S	F
1	CID Electr. y Proc. Datos en Cuba	N		S	N
1	Circulation Research	C	Yes	S	F
1	Clinical and Laboratory Haematology	C	Yes	S	F
1	Clinical Cardiology	C	Yes	S	F
1	Clinical Genetics	C	Yes	S	F
1	Clinical Immunology and Immunopathology	C	Yes	S	F
1	Clinics in Laboratory Medicine	C	Yes	S	F
1	Computer Journal	N	No	S	N
1	Computers in Biology and Medicine	C	Yes	S	F
1	Continuing Medical Education Newsletter	C	Yes	S	N
1	Controlled Clinical Trials	C	Yes	S	F
1	Critical Care Medicine	C	Yes	S	F

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1	Diabetes	C	Yes	S	F
1	Ergonomics	B	Yes	S	S
1	Experimental Neurology	C	Yes	S	F
1	Fertility and Sterility	C	Yes	S	F
1	Hospital Progress	C	Yes	S	F
1	Hospitals	C	Yes	S	F
1	IEEE Engineering in Medicine and Biology Magazine	C	Yes	S	N
1	IEEE Transactions on Biomedical Engineering	C	Yes	S	F
1	IEEE Transactions on Communications	N	No	S	N
1	Infoletter, Newsletter of GTE Telenet Medical Information Network	N	No	S	N
1	Informatie	N	No	S	N
1	Informatik-Spektrum	N	No	S	N
1	Information and Records Management	N	Yes	S	N
1	Information Processing and Management	N	No	S	N
1	Inquiry	C	Yes	S	F
1	Instructional Science	N	No	S	N
1	International Journal of Computer and Information Sciences	N	Yes	S	N
1	International Journal of Rehabilitation Research. Internationale Zeits	C	Yes	S	F
1	International Journal of Systems Science	N	Yes	S	N
1	Journal of Applied Physiology: Respiratory, Environmental and Exercise	C	Yes	S	F
1	Journal of Biomechanical Engineering	C	Yes	S	F
1	Journal of Biomechanics	C	Yes	S	F
1	Journal of Computer Based Instruction	N		S	N
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1	Journal of Nursing Administration	C	Yes	S	F
1	Journal of Nursing Education	C	Yes	S	F
1	Journal of Pediatrics	C	Yes	S	F
1	Journal of Pharmacokinetics and Biopharmaceutics	C	Yes	S	F
1	Journal of the American Statistical Association	B	Yes	S	S
1	Journal of the National Cancer Institute	C	Yes	S	F
1	Mathematical Biosciences	R	Yes	S	N
1	Medical and Biological Engineering	C	Yes	S	F
1	Medical Care	C	Yes	S	F
1	Medical Informatics	C	Yes	S	F
1	Medical Journal of Australia	C	Yes	S	F
1	Medical Radiography and Photography	C	Yes	S	F
1	Medical Record and Health Care Information Journal	C	Yes	S	S
1	Medicine and Computer	C	Yes	S	N
1	Medizinische Informatik und Statistik	C	Yes	S	N
1	Mental Health Service System Reports. Series FN: Information Systems	C	Yes	S	N
1	Mikroskopie	B	Yes	S	F
1	MLO: Medical Laboratory Observer	C	Yes	S	S
1	Modern Healthcare (Long Term Care)	C	Yes	S	N
1	NHRC Report	C	Yes	S	N
1	Nurse Educator	C	Yes	S	F
1	Nutrition Reviews	C	Yes	S	F
1	PC Week	N	No	S	N
1	Pediatrics	C	Yes	S	F
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1	Progress in Clinical and Biological Research	C	Yes	S	F
1	Progress in Neurological Surgery	C	Yes	S	N
1	Psychiatric Annals	C	Yes	S	N
1	Psychiatry in Medicine	C	Yes	S	F
1	Respiratory Care	C	Yes	S	S
1	Scandinavian Journal of Gastroenterology	C	Yes	S	F
1	Side Effects of Drugs	C	Yes	S	N
1	Simulation and Games	N	No	S	N
1	Sloan Management Review	N	Yes	S	S
1	Social Science Research	B	Yes	S	N
1	Systems, Objectives, Solutions	N	No	S	N
1	Topics in Health Care Financing	C	Yes	S	F
1	Update, Computers in Medicine	C	Yes	S	N
1	Vital and Health Statistics. Series 13: Data from the National Health S	C	Yes	S	F
1	Western Journal of Medicine	C	Yes	S	F
1	WHO Chronicle	C	Yes	S	F
1	WHO Regional Publications European Series	C	Yes	S	N
1	World Health Organization Technical Report Series	C	Yes	S	F
1	World Hospitals	C	Yes	S	F
1	Zeitschrift fur Arztliche Fortbildung	C	Yes	S	F

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3	Computer-Based Medical Consultations: MYCIN:	C		M	N
2	Artificial Intelligence and Pattern Recognition Consult-1	N		M	N
2	Computer Technology in the Health Sciences	C	Yes	M	N
1	"A System's Approach to Applying Pattern Recognition to Medical Diagnos	N		M	N
1	"Changes in the Role and Environment of EDP"	N		M	N
1	"Computer System Design for Interactive Pattern Recognition"	N		M	N
1	"Data Med System"	N		M	N
1	"Multiple-Input Describing Functions and Nonlinear System Design	N		M	N
1	"On-Line Pattern Analysis and Recognition System (OLPARS)" Rome Air Deve	N		M	N
1	"The Ghost Graphical Output System. Part 1: The User Image."	N		M	N
1	"Unsupervised Learning"	N		M	N
1	A Standard Layer Model.	N		M	N
1	Abt. Med. Informatik, Med. Hochschule Hannover, 1973	C		M	N
1	Acid Base Physiology in Medicine: A Self Instruction Program	C	Yes	M	N
1	Advances in Fuzzy Set Theory and Applications	N		M	N
1	Aktuelle Methoden der Information in Dermedizin	C		M	N
1	Applied Numerical Methods for Digital Computation with Fortran	N		M	N
1	Artificial Intelligence with Statistical Pattern Recognition	N		M	N
1	Basic	N		M	N
1	Basic Principles of Nursing Care	C	Yes	M	N
1	Biostatistics Case Book	R	Yes	M	N
1	CAI: Its Use in the Classroom	N		M	N
1	Carbohydrate Metabolism	C	Yes	M	N
1	CIM-O: Classification Internationale Des Maladies: Onocologie	C		M	N
1	Clinical Decision Analysis.	C	Yes	M	N
1	Clinical Methods	C	Yes	M	N
1	Color Sciences	N		M	N

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1	Communications and Networking for the IBM PC	N		M	N
1	Computer Applications in Health Care	C	Yes	M	N
1	Computer Network Applications in Health Care Services of Uppsala County	N		M	N
1	Computer-Assisted Eye Examination.	C	Yes	M	N
1	Curriculum 78, Recommendations for the Undergraduate Program in Compute	N		M	N
1	Data Models	N		M	N
1	Data Processing in the Hospital of the Georg-August-University	N		M	N
1	Delphi Critique.	N		M	N
1	Der Bettenbedarf im Fachgebiet Urologie in der DDR	C		M	N
1	Dictionary of the Rheumatic Diseases. Volume 1: Signs and Symptoms.	C		M	N
1	Digital Image Processing	N		M	N
1	Directie Verkeersveiligheid, Hoe Verder met de Invors-Gedachte	N		M	N
1	Distributed Computer Systems - Impact on Management, Design and Analysi	N		M	N
1	Do Aged Medicare Patient Receive More Costly Routine Nursing Services?	C		M	N
1	Emerging Perspectives on the General Professional Education of the Phys	N		M	N
1	Engineering Statistics	N		M	N
1	European Experience in Standardisation on Definition and Measurement of	C		M	N
1	Fetal Growth in Humans.	C	Yes	M	N
1	File Manager: Technical and Users Manuals	N		M	N
1	Final Report Program Management Abstracts,	N		M	N
1	Functie Specificatie Apotheek Systeem (in OPBUW), Internal Report.	N		M	N
1	Gipokineziia	C	Yes	M	N
1	Health Data & Information Management	C	Yes	M	N
1	Heart Disease	C	Yes	M	N
1	Hospital Computer Systems	C	Yes	M	N
1	Hospital Computer Systems.	C	Yes	M	N
1	HRM Software. Product Description.	N		M	N

MONOGRAPHS (EXCLUDING OFFICE COPIES) IN THE MEDINFO STUDY

Total # Citations	Title of Monographs	Scope	NLM Collection	Type	Indexed
1	Human Problem Solving	R	Yes	M	N
1	IBM, More About Computers	N		M	N
1	Identifying People in the Past	N		M	N
1	IEEE Standard Dictionary of Electrical and Electronic Terms	N	Yes	M	N
1	In Search of Excellence	N		M	N
1	Induktive Logik und Wahrscheinlichkeit	N		M	N
1	Information System Design Methodologies.	N		M	N
1	Information Systems for Health Services.	C		M	N
1	Innovations and Organizations	N		M	N
1	Institutionalizing Change: A Total-System Design of Health Professions	C		M	N
1	Interactive Data Analysis	N		M	N
1	International Classification of Procedures in Medicine	C	Yes	M	N
1	Initial Project Objectives and Evaluation Criteria	N		M	N
1	Introduction to Medical Decision Making	C	Yes	M	N
1	Kleine Kinderen Grote Problemen, Graduate Report	N		M	N
1	L'Ordinateur Individuel.	N		M	N
1	Lecture Notes in Control and Information Science	N		M	N
1	Less is More: The Informational Value of a Summary Medical Record Syste	C		M	N
1	Logic and Data Bases	N		M	N
1	Managing Computers in Health Care	C	Yes	M	N
1	Managing in Turbulent Times.	N		M	N
1	Manuel de la Classification Statistique Internationale des Maladies, Tr	C	Yes	M	N
1	Measures and Indicators for Evaluation of Innovations in the Health Car	C		M	N
1	Medical Record Linkage	C	Yes	M	N
1	Medical Technology and the Health Care System	C	Yes	M	N
1	Microcomputers and Physiological Simulation	C	Yes	M	N
1	Miniaturized Electronic Circuits	N		M	N

MONOGRAPHS (EXCLUDING OFFICE COPIES) IN THE MEDINFO STUDY

Total # Citations	Title of Monographs	Scope	NLM Collection	Type	Indexed
1	Modern Control Theory	N		M	N
1	Monitoring Quality of Nursing Care	C	Yes	M	N
1	Multicompartment Models for Biological Systems	R	Yes	M	N
1	MUMPS Language Standard	N		M	N
1	National Priorities for Health: Past, Present and Projected	C	Yes	M	N
1	Natural Language Information Processing: A Computer Grammar of English	N		M	N
1	Nursing Diagnosis, Application to Clinical Practice	C	Yes	M	N
1	Nursing: Concepts of Practice	C	Yes	M	N
1	Organ Sources of Serum Isoenzymes: An Interpretive Display.	C		M	N
1	Organism's Reliability under Hypokinesia.	C		M	N
1	Osborne 1 User's Reference Guide.	N		M	N
1	PDP-11 Macro-11 Reference Manual	N		M	N
1	Plato Staywell Tm. Product Description.	N		M	N
1	Polarcardiography	C	Yes	M	N
1	Principles of Applied Biomedical Instrumentation	C	Yes	M	N
1	Principles of Artificial Intelligence.	N		M	N
1	Prototypes and Production Rules: A Knowledge Representation for Compute	N		M	N
1	Reference Model of Open Systems Interconnection, ISO/TC97/SC16/N537	N		M	N
1	Report of the ACM Committee of Curriculum for Health Computing Educatio	N		M	N
1	Report to Congress: Hospital Prospective Payment for Medicare	C		M	N
1	Requirements for ADA Programming Support Environment - "Stoneman"	N		M	N
1	SAS User's Guide	N		M	N
1	SLIPS-A Database System for Computer Storage and Analysis of Phonologica	N		M	N
1	Software Engineering with ADA	N		M	N
1	Software Reliability: Principles and Practice.	N		M	N
1	SPSS Statistical Package for the Social Sciences	N		M	N
1	Statement of El Camino Hospital Before the Council on Wage and Price St	N		M	N

MONOGRAPHS (EXCLUDING OFFICE COPIES) IN THE MEDINFO STUDY

Total # Citations	Title of Monographs	Scope	NLM Collection	Type	Indexed
1	Statistical Methods of Rates and Proportions.	N		M	N
1	Studium des Diplomininformatikers, Fachrichtung	N		M	N
1	Survey of Microcomputer Use in Southern Nursing Education. Report of Fi	C		M	N
1	System Program TIBIS	N		M	N
1	Systematized Nomenclature of Medicine.	C	Yes	M	N
1	Technology in Mental Health Care Delivery Systems.	C	Yes	M	N
1	The Codasyl Approach to Database Management	N		M	N
1	The Community General Hospital	C	Yes	M	N
1	The Computerized Birth Defects Information System, Directories,	C		M	N
1	The Construction and Use of Written Simulation	N		M	N
1	The Emerging Self-Help Healthcare Market: Microcomputer Applications	C		M	N
1	The Five-Year Outlook on Science and Technology 1982	C	Yes	M	N
1	The Growth of Medical Information Systems in the United States	C	Yes	M	N
1	The Scientific Approach to Disease: Specific Entity and Individual Sick	C		M	N
1	The Teacher and the Computer	N		M	N
1	The Unix Programming Environment	N		M	N
1	The ZOG Approach to Man-Machine Communication, Report CS-79-148	N		M	N
1	Theory for a Medical Decision Making and Consulting System	C		M	N
1	Theory of Optimal Experiments	N		M	N
1	University Education in Medical Information in Amsterdam	C		M	N
1	Use of Computers in Biology and Medicine	C	Yes	M	N
1	Using Computers in Nursing.	C	Yes	M	N
1	Values Clarification: A Handbook of Practical Strategies for Teachers A	N		M	N
1	Vergleich ADF/ADS PCS. Internal Report	N		M	N
1	Visicalc for Science and Engineering.	N		M	N
1	Webster's Third New International Dictionary	N		M	N
1	What's In Your Lunch? TM Product Description	N		M	N
1	Worterbuch der Medizine von Zetkin-Schaldach	C	Yes	M	N

PROCEEDINGS IN THE MEDINFO STUDY

Total # Citations	Title of Proceedings	Scope	NLM Collection	Type	Indexed
26	SCAMC - Symposium on Computer Applications in Medical Care	C	Yes	S	N
17	MEDINFO (IFIP World Series on Medicinal Informatics)	C	Yes	S	N
5	American Association for Medical System and Informatics Congress (AAMSI)	C	Yes	S	N
5	International Joint Conference on Artificial Intelligence	N		M	N
2	ACM (Association for Computing Machinery) National Conference (SIGGRAPH)	N		M	N
2	Annual Conference on Rehabilitation Engineering	C	Yes	S	N
2	Application of Optical Instrumentation in Medicine (Proceedings SPIE - Society of Photo-Optical Instrumentation Engineers)	C	Yes	S	N
2	International Congress Series	C	Yes	S	N
2	Medical Management and Computing	C	Yes	M	N
2	Pattern Recognition in Practice	C	Yes	M	N
2	World Congress of Nuclear Medicine and Biology	C	Yes	M	N
1	AAAS Selected Symposium (Artificial Intelligence in Medicine)	B	Yes	S	N
1	ACM Conference on Friendly Systems	N		M	N
1	AMIA Congress on Medicinal Informatics	C	Yes	M	N
1	Analysis of Diagnostic Data with Application to Diagnosis of Ce	C		M	N
1	COMPCON-82	N		M	N
1	Computer and Physician Prognosis in Rheumatic Heart Disease	C		M	N
1	Computer in Doctor's Office	C	Yes	M	N
1	Computers and Electronic Services in Psychiatry	C	Yes	M	N
1	Conference on Computer Applications in Radiology and Computer/Aided Analysis of Radiological Images	C	Yes	M	N
1	Conference on Models and Techniques of Cognitive Rehabilitation	C	Yes	M	N
1	Conference on Simulation in Health Care Delivery Systems; 3rd Annual SCS Multiconference	C	Yes	M	N
1	Controversies in Rehabilitation for Neurological Trauma and Disease	C		M	N
1	Cybernetics and Systems Research	B	Yes	M	N

PROCEEDINGS IN THE MEDINFO STUDY

Total # Citations	Title of Proceedings	Scope	NLM Collection	Type	Indexed
1	Data Protection in Health Information Systems - Consideration and Guidelines	C	Yes	M	N
1	Decision Making and Medical Care	C	Yes	M	N
1	Federation Proceedings	R	Yes	S	F
1	Health System Modeling and the Information System for the Coordination	C	Yes	M	N
	Proceedings of the II ASA Biomedical Conference	C	Yes	M	N
1	Hospital Statistics in Europe	C	Yes	M	N
1	Impact of Computer Technology on Drug Information	C	Yes	M	N
1	Impact of Computers on Nursing	C	Yes	M	N
1	Information Processing of Medical Records	C	Yes	M	N
1	International Conference on the Adjuvant Therapy of Cancer	C	Yes	S	N
1	International IFIP/IFAC Prolamat Conference	N	Yes	S	N
1	International Symposium on Pulse-Cyophorometry	C	Yes	M	N
1	International Symposium on the Planning of Radiology Departments	C	Yes	M	N
1	Machine Intelligence	N	Yes	S	N
1	Medical Technology, Urban Institute Conference	C	Yes	M	N
1	National Conference on the Classification of Nursing Diagnoses	C	Yes	M	N
1	New Frontiers of Electrocardiology	C	Yes	M	N
1	Nursing Information Systems	C	Yes	M	N
1	Online	N		S	N
1	Patient Centered Health Systems	C	Yes	M	N
1	Proceedings, Annual Meeting of the American Society of Clinical Oncology	C	Yes	S	N
1	Proceedings of ASAC Conference 1982	N		M	N
1	Proceedings of the American Association of Artificial Intelligence	N	Yes	M	N
1	Proceedings of the IEEE	N		M	N
1	Proceedings of the MUMPS Users Group National Meeting	N		M	N
1	Proceedings of the Ninth Annual Society of Management Information System	N		M	N
1	Proceedings of the SIGBIO Symposium on Health Computing Careers	C	Yes	M	N
1	Proceedings of the Western Pharmacology Society	C	Yes	S	F
1	Proceedings of the 15th Hawaii International Conference System Science	N		M	N

PROCEEDINGS IN THE MEDINFO STUDY

Total # Citations	Title of Proceedings	Scope	NLM Collection	Type	Indexed
1	Proceedings IVth V.L.D.B.	N		M	N
1	Proceedings of 4th Annual WAMI Meetings	C		M	N
1	Psychopathology in Aged	C	Yes	M	N
1	Reservierte Diagnositche Aussage: Ihre Klinische Bedeutungihre Opt	C		M	N
1	Scanning Electron Microscopy	B	Yes	S	S
1	Symposia on Open and Closed Angle Glaucoma	C	Yes	M	N
1	Trends in Computer-Processed Electrocardiograms	C	Yes	M	N
1	Wenner-Gren Center International Symposium Series	C	Yes	S	N
1	Psychopathology in the Aged	C	Yes	M	N
1	Scanning Electron Microscopy	B	Yes	S	S
1	Symposia on Open and Closed Angle Glaucoma	C	Yes	M	N
1	The Analysis of Diagnostic Data with Application to the Diagnosis of Ce	C		M	N
1	The Computer in the Doctor's Office	C	Yes	M	N
1	The Impact of Computer Technology on Drug Information	C	Yes	M	N
1	Trends in Computer-Processed Electrocardiograms.	C	Yes	M	N
1	Wenner-Gren Center International Symposium Series	C	Yes	S	N
1	World Congress of Nuclear Medicine	C	Yes	M	N
1	World Congress of Nuclear Medicine and Biology IV	C	Yes	M	N

DISTRIBUTION OF CITATIONS BY PUBLICATION YEAR
JOURNALS

Year	Total
?	3
In Press	1
19??	1
1952	2
1953	2
1957	2
1958	1
1959	1
1961	1
1962	4
1963	2
1964	3
1965	1
1966	2
1967	3
1968	3
1969	2
1970	5
1971	7
1972	13
1973	7
1974	13
1975	13
1976	10
1977	17
1978	15
1979	16
1980	18
1981	39
1982	34
1983	56
1984	33

Total Citations   330

DISTRIBUTION OF CITATIONS BY PUBLICATION YEAR
MONOGRAPHS

Year	Total
?	4
In Press	1
1959	1
1961	1
1962	1
1963	1
1964	1
1965	1
1966	1
1967	4
1968	3
1969	2
1971	3
1972	6
1973	3
1974	4
1975	7
1976	8
1977	6
1978	9
1979	7
1980	19
1981	12
1982	13
1983	16
1983? In Press	1
1984	5

Total Citations   140

DISTRIBUTION OF CITATIONS BY PUBLICATION YEAR
PROCEEDINGS

Year	Total
?	2
1968	1
1969	1
1970	2
1974	1
1975	2
1976	2
1977	8
1978	4
1979	9
1980	2
1980	10
1981	15
1982	21
1982?	1
1983	27
1984	6
1984? (In Press)	1

Total Citations   115

DISTRIBUTION OF CITATIONS BY PLACE OF PUBLICATION

Country of Publications	Total
?	7
Australia	1
Austria	2
Belgium	2
Canada	1
Canada?	2
Cuba	3
Czechoslovakia	1
Denmark	3
England	57
France	2
France?	1
Germany, East	1
Germany, West	35
Germany?	3
Ireland	4
Japan	2
Netherlands	50
Norway	1
Poland	1
Romania	1
Scotland	1
Switzerland	5
U.S.	2
U.S.?	1
United States	391
United States?	1
USSR	2
Varies	2

Total Citations   585

INDEXING OVERLAP
Journals (Excluding Office Copies)

	Titles	Total # Citations			Selected Indexing Sources			
1	AAMSI News	1						
2	Accident Facts	1						
3	ACR Bulletin	1						
4	ACTA Cytologica	1	IM	SCI	BA	EM		
5	Advances in Neurology	1	IM	SCI	BA		CA	
6	AI Magazine	1						PA
7	AJR. American Journal of Roentgenology	4	IM		BA		CA	
8	American Heart Journal	1	IM	SCI	BA	EM	CA	
9	American Journal of Cardiology	1	IM	SCI	BA	EM	CA	
10	American Journal of Clinical Pathology	2	IM	SCI	BA	EM	CA	
11	American Journal of Epidemiology	1	IM	SCI	BA	EM		
12	American Journal of Hospital Pharmacy	4	IM	SCI	BA	EM	CA	
13	American Journal of Medicine	3	IM	SCI	BA	EM	CA	
14	American Journal of Mental Deficiency	1	IM	SCI	BA	EM		PA
15	American Journal of Optometry and Archives of American Academy of Optometry	1	IM		BA			
16	American Journal of Physiology	2	IM	SCI	BA	EM	CA	
17	American Journal of Psychiatry	2	IM	SCI	BA	EM	CA	PA
18	Anesthesiology	1	IM	SCI	BA	EM	CA	
19	Annales de Physique Biologique et Medicale	1		SCI	BA			
20	Annals of Clinical and Laboratory Science	1	IM	SCI	BA	EM	CA	
21	Annals of Internal Medicine	7	IM	SCI	BA	EM	CA	
22	Annals of the Medical Section of the Polish Academy of Sciences	1	IM		BA	EM		
23	Annals of the New York Academy of Sciences	1	IM	SCI	BA	EM	CA	PA
24	Annual Report - SRI International	1						
25	Annual Report 1981; Biosciences Information Service	1						
26	Annual Review of Medicine	1	IM	SCI	BA		CA	PA
27	Application of Optical Instrumentation in Medicine	1						
28	Applied Optics	1		SCI		EM	CA	
29	Archives Internationales de Pharmacodynamie et de Therapie	1	IM		BA	EM	CA	
30	Archives of Internal Medicine	1	IM	SCI	BA	EM	CA	
31	Archives of Ophthalmology	3	IM	SCI	BA	EM	CA	
32	Archives of Otolaryngology	1	IM	SCI	BA	EM	CA	
33	Archives of Physical Medicine and Rehabilitation	1	IM	SCI	BA	EM		
34	Arthritis and Rheumatism	1	IM	SCI	BA	EM	CA	
35	Artificial Intelligence	4						
36	Avtomatika I Telemeekhanika	1					CA	
37	Behavior Research Methods and Instrumentation	5			BA			PA

38	Biochemical Journal	1	IM	SCI	BA	EM		
39	Biochimica et Biophysica ACTA	1	IM	SCI	BA	EM	CA	
40	Biomedizinische Technik	1	IM	SCI	BA	EM	CA	
41	Biometrics	4	IM	SCI	BA			
42	Biometrika	9		SCI	BA			
43	Biophysical Journal	2	IM	SCI	BA	EM	CA	
44	Biopolymers	1	IM	SCI	BA	EM	CA	
45	Birth Defects Original Article Series	1	IM	SCI		EM	CA	
46	British Journal of Preventive and Social Medicine	1	IM	SCI	BA			
47	British Medical Journal	2	IM	SCI	BA	EM	CA	
48	Bulletin of the New York Academy of Medicine	1	IM	SCI	BA	EM		
49	Canadian Medical Association Journal	1	IM	SCI	BA	EM	CA	
50	Cancer	2	IM	SCI	BA	EM	CA	
51	CID Electr. y. Proc. Datos en Cuba	1						
52	Circulation	5	IM	SCI	BA	EM	CA	
53	Circulation Research	1	IM	SCI	BA	EM	CA	
54	Clinical and Laboratory Haematology	1	IM			EM	CA	
55	Clinical Cardiology	1	IM	SCI	BA	EM	CA	
56	Clinical Genetics	1	IM	SCI	BA	EM	CA	
57	Clinical Immunology and Immunopathology	1	IM	SCI	BA	EM	CA	
58	Clinics in Laboratory Medicine	1	IM			EM		
59	Communications of the ACM	4						
60	Comprehensive Psychiatry	2	IM	SCI	BA	EM		PA
61	Computer Journal	1					CA	
62	Computer Programs in Biomedicine	3	IM	SCI	BA	EM		
63	Computers and Biomedical Research	9	IM	SCI	BA	EM	CA	
64	Computers in Biology and Medicine	1	IM	SCI	BA	EM	CA	
65	Computers in Nursing	2						
66	Continuing Medical Education Newsletter	1						
67	Controlled Clinical Trials	1	IM		BA	EM		
68	Critical Care Medicine	1	IM	SCI		EM		
69	Cytometry	1	IM		BA	EM	CA	
70	Diabetes	1	IM	SCI	BA	EM	CA	
71	Electroencephalography and Clinical Neurophysiology	4	IM		BA	EM	CA	PA
72	Ergonomics	1	IM	SCI	BA	EM		PA
73	Experimental Neurology	1	IM	SCI	BA	EM	CA	
74	Fertility and Sterility	1	IM	SCI	BA	EM	CA	
75	Health Education	2						
76	Hepatology	2	IM			EM	CA	
77	Hospital and Community Psychiatry	2	IM			EM		PA
78	Hospital Progress	1				EM		
79	Hospitals	1	IM			EM		
80	IEEE Engineering in Medicine and Biology Magazine	1						
81	IEEE Trans. Automatic Control	2					CA	
82	IEEE Transactions on Biomedical Engineering	1	IM	SCI	BA	EM	CA	PA
83	IEEE Transactions Pattern Analysis Machine Intelligence	2				EM		

84	Infoletter, Newsletter of GTE Telenet Medical Information Network	1						
85	Informatie	1				EM		
86	Informatik-Spektrum	1						
87	Information and Records Management	1						
88	Inquiry	1	IM			EM		
89	Instructional Science	1						PA
90	International Journal of Computer and Information Sciences	1						
91	International Journal of Man-Machine Studies	3			BA	EM		PA
92	International Journal of Rehabilitation Research.	1	IM			EM		PA
93	International Journal of Systems Science	1		SCI	BA	EM		
94	JAMA	2	IM	SCI	BA		CA	
95	Journal of Applied Physiology	2	IM		BA	EM		
96	Journal of Applied Physiology: Respiratory, Environmental and Exercise Physiology	1	IM		BA	EM	CA	
97	Journal of Biomechanical Engineering	1	IM			EM	CA	
98	Journal of Biomechanics	1	IM	SCI	BA	EM		
99	Journal of Chronic Diseases	3	IM	SCI	BA	EM	CA	
100	Journal of Clinical Computing	2				EM		
101	Journal of Documentation	1		SCI				
102	Journal of Family Practice	2	IM	SCI	BA	EM		PA
103	Journal of Laboratory and Clinical Medicine	1	IM	SCI	BA	EM	CA	
104	Journal of Medical Education	2	IM	SCI	BA	EM		PA
105	Journal of Medical Systems	3	IM			EM		
106	Journal of Molecular Biology	1	IM	SCI	BA	EM		
107	Journal of Nuclear Medicine	1	IM			EM		
108	Journal of Nursing Administration	1	IM			EM		
109	Journal of Nursing Education	1	IM	SCI				
110	Journal of Pediatrics	1	IM	SCI	BA	EM		
111	Journal of Pharmacokinetics and Biopharmaceutics	1	IM	SCI	BA	EM	CA	
112	Journal of Physiology	3	IM	SCI	BA	EM	CA	
113	Journal of the American Statistical Association	1		SCI		EM		
114	Journal of the National Cancer Institute	1	IM	SCI	BA	EM		
115	Journal of the Royal Statistical Society. Series B. (Methodological)	2		SCI				
116	Kybernetik	2	IM	SCI	BA			
117	Lancet	8	IM	SCI	BA	EM		
118	Lecture Notes in Medical Informatics	9						
119	Mathematical Biosciences	1		SCI	BA	EM	CA	
120	MD Computing	2						
121	Medical and Biological Engineering	1	IM	SCI	BA	EM		
122	Medical and Biological Engineering and Computing	6	IM	SCI		EM	CA	
123	Medical Care	1	IM	SCI		EM		
124	Medical Informatics	1	IM		BA	EM		
125	Medical Journal of Australia	1	IM	SCI	BA	EM	CA	
126	Medical Radiography and Photography	1	IM		BA			

127	Medical Record and Health Care Information Journal	1						
128	Medicine and Computer	1						
129	Medizinische Informatik und Statistik	1						
130	Mental Health Service System Reports. Series FN: Information Systems	1						
131	Methods of Information in Medicine	9	IM	SCI	BA	EM		
132	Methods of Information in Medicine. Supplement	2	IM					
133	Mikroskopie	1	IM	SCI	BA	EM	CA	
134	MLO: Medical Laboratory Observer	1						
135	Modern Healthcare (Long Term Care)	1						
136	Nachrichten fur Dokumentation	2					CA	
137	Nature	2	IM	SCI	BA	EM	CA	PA
138	Neurology	2	IM	SCI	BA	EM	CA	PA
139	New England Journal of Medicine	9	IM		BA	EM	CA	PA
140	NHRC Report	1						
141	Nurse Educator	1						
142	Nursing Outlook	3	IM			EM		PA
143	Nutrition Reviews	1	IM	SCI	BA		CA	
144	PC Week	1						
145	Pediatrics	1	IM	SCI	BA	EM	CA	
146	Physics in Medicine and Biology	1	IM	SCI	BA	EM	CA	
147	Physiologist	1	IM		BA	EM		
148	Progress in Biophysics and Molecular Biology	1	IM	SCI	BA		CA	
149	Progress in Cardiovascular Diseases	2	IM	SCI	BA	EM	CA	
150	Progress in Clinical and Biological Research	1	IM		BA		CA	
151	Progress in Neurological Surgery	1			BA			
152	Psychiatric Annals	1						PA
153	Psychiatry in Medicine	1	IM		BA			
154	Radiology	5	IM	SCI	BA	EM	CA	
155	Respiratory Care	1				EM		
156	Revista Cubana de Administracion de Salud	2						
157	Scandinavian Journal of Gastroenterology	1	IM	SCI	BA	EM	CA	
158	Science	2	IM	SCI	BA	EM	CA	PA
159	Side Effects of Drugs	1			BA			
160	Sloan Management Review	1						
161	Social Science Research	1						PA
162	Softalk	2						
163	Surgery	2	IM	SCI	BA	EM	CA	
164	Technometrics	2		SCI				
165	Topics in Health Care Financing	1	IM					
166	Update, Computers in Medicine	1						
167	Vital and Health Statistics. Series 10: Data from the National Health Survey	2	IM					
168	Vital and Health Statistics. Series 13: Data from the National Health Survey	1	IM					
169	Western Journal of Medicine	1	IM	SCI	BA	EM	CA	
170	WHO Chronicle	1	IM	SCI	BA	EM		
171	WHO Regional Publications European Series	1						

172	World Health Organization Technical Report Series	1	IM		BA	EM		
173	World Hospitals	1				EM		
174	Zeitschrift fur Arztliche Fortbildung	1	IM			EM		

Total Citations   310

INDEXING OVERLAP
Proceedings

	Titles	Total # Citations	Selected Indexing Sources				
1	AAAS Selected Symposium	1			BA		CA
2	Application of Optical Instrumentation in Medicine	1					
3	Federation Proceedings	1	IM	SCI	BA	EM	CA
4	International Conference on the Adjuvant Therapy of Cancer	1					
5	International Congress Series	2				EM	CA
6	International IFIP/IFAC Prolamat Conference	1					
7	Machine Intelligence	1					
8	MEDINFO	17					
9	Online	1					CA
10	Proceedings of the Western Pharmacology Society	1	IM	SCI	BA	EM	CA
11	Proceedings of the . . . Annual Conference on Rehabilitation Engineering	2					
12	Proceedings, Annual Meeting of the American Society of Clinical Oncology	1				EM	
13	SCAMC - Symposium on Computer Applications in Medical Care	26					
14	Scanning Electron Moscopy	1	IM	SCI	BA	EM	CA
15	Wenner-Gren Center International Symposium Series	1					CA

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