

## **Analysis of the leprosy literature indexed in Medline (1950–2007)**

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### *Summary*

Some 19 201 leprosy-related articles were identified in the *Medline* database for the period 1950–2007. These were analysed for distribution and evolution of a number of variables: publication years, languages, document types, journals, authors, major aspects and countries involved, and author addresses. Next to a number of tables presenting the actual results, some noteworthy trends and possible pitfalls in the interpretation of these results are discussed. The analysis shows that the number of leprosy-related articles peaked in the 1980s and has been in decline ever since, as well in absolute as in relative numbers. Coverage of non-English language literature has decreased far more strongly than that of English language articles. The scholarly input of a number of countries where the leprosy burden is the highest, such as India and Brazil, is clearly visible in the distribution of journals, authors, and for some, language, but this is certainly not the case for all countries afflicted.

### **Introduction**

No extensive analysis of the scientific literature on leprosy is available. One may ask what are the major journals, authors, languages, document types, subjects and countries involved in the published leprosy research and how have these evolved over the years? We studied these factors using *Medline*, the major bibliographical database produced by the US National Library of Medicine and the National Institutes of Health. *Medline* now has almost 18 million records from the international biomedical research literature published since 1950. The *PubMed* (<http://pubmed.gov/>) version is freely available to anyone with an internet connection, and includes millions of links to full-text articles, many of which are freely available from open access journals or archives like *PubMed Central* (<http://www.pubmedcentral.nih.gov/>). *Medline* is a useful resource for the analysis of the scholarly literature on specific topics. *Medline* has some limitations: for example only journal articles from a selection of some 4500 biomedical journals are covered, but this body of data encompasses the majority of published scientific findings in medicine and allied sciences.

## Methodology

We first searched *Medline* in December 2006. Search terms were limited to the Medical Subject Headings (MeSH terms) 'Leprosy' and '*Mycobacterium leprae*'. Almost 19 000 leprosy-related journal articles were retrieved in this first selection round.

*Mycobacterium lepraemurium*, the causative agent of murine leprosy, which for several decades was studied intensively as a model useful for the understanding of human leprosy, was also considered as a potential search term. In *Medline* *M. lepraemurium* was initially indexed under the MeSH terms '*M. leprae*' and/or 'Leprosy'. It did not receive its own specific MeSH term '*M. lepraemurium*' until 1972. We have not included those records (about 400) dealing with murine leprosy only, but retained those (about 100) studying both *M. leprae* and *M. lepraemurium*. We added 59 records with the MeSH term 'Leper colonies' and, after careful handpicking, 197 records that had the words 'leprosy' or 'leprae' in their title but had not come up with our MESH terms 'leprosy' or '*M. leprae*' – most of them from the pre-1965 period, when keyword indexing was rather rudimentary.

We covered the publication years 1950, the starting point of the (*Old*)*Medline* database to 2007 papers which were already fully indexed in *Medline*. Preliminary records appearing in *PubMed* and 'e-publications before print' were not included.

The 19 201 *Medline* records thus identified were converted to *BiB/Search*, a lesser known and now obsolete bibliographic database management system that is very well suited for the kind of analyses presented here.

## Results

### PUBLICATION YEARS

Table 1 shows the distribution per decade of leprosy-related articles included in *Medline*.

The numbers continually increase with a peak during the 1980s and then decrease. This evolution is much more conspicuous if the increasing volume of biomedical journals and their coverage by *Medline* is taken into account (see the lower rows of the table). Even during the first decades the increase in leprosy articles does not hold the same pace as the overall increase in the number of *Medline* articles (the column 2000–2007 represents only 8 years, not 10). The relative number of leprosy papers in the first decade (11.7%) is almost double that of the full *Medline* set (6.0%). By the end of the 1980s two thirds (66.4%) of all registered leprosy papers had been listed in *Medline*, while for the total of current *Medline* articles this is less than half (47.6%). As far as *Medline* coverage is concerned the relative interest in leprosy papers (on average a little over 0.1% of all *Medline* records) can clearly be said to have decreased since the 1980s.

### LANGUAGES

Table 1 also shows the evolution in the language distribution of the leprosy literature over almost six decades; 76.4% of leprosy publications in *Medline* were published in English. This is not at all surprising for a database with an obvious strong English language bias. The decline in numbers of leprosy articles is also far steeper for non-English than for English language articles. In the first decade English represents 40% of the total number of leprosy papers, and French and Portuguese combined (882) almost equal the English language contributions (901). In the last period almost

**Table 1.** Evolution of productivity and language distribution

Language	1950–59	1960–69	1970–79	1980–89	1990–99	2000–07	Total	Distribution	Medline total	Distribution
English	901	1526	2575	3864	3651	2153	14 670	76.40%	13578,296	77.39%
French	497	365	214	365	156	69	1666	8.68%	624,137	3.56%
Japanese	0	62	126	128	113	101	530	2.76%	366,265	2.09%
Portuguese	385	133	50	100	31	27	726	3.78%	63 921	0.36%
Spanish	254	170	67	84	43	35	653	3.40%	249,338	1.42%
German	63	121	105	56	19	13	377	1.96%	759,929	4.33%
Russian	21	55	55	42	17	10	200	1.04%	628,181	3.58%
Italian	93	56	14	9	3	3	178	0.93%	283,951	1.62%
Other	55	36	60	78	45	17	278	1.45%	?	?
Multiple	8	1	1	1	20	15	46	0.24%	1443	0.01%
Total	2248	2523	3261	4707	4051	2411	19 201	100.00%	17544,339	100.00%
Distribution	11.71%	13.14%	16.98%	24.51%	21.10%	12.56%	100.00%			
Medline total	1043,604	1617,765	2425,560	3262,934	4329,968	4864,530	17544,339			
Distribution	5.95%	9.22%	13.83%	18.60%	24.68%	27.73%	100.00%			

Because of multiple languages, some totals slightly exceed 100%.

Because of the 'Undetermined' label, *Medline* language counts may be slightly underrated.

90% of all leprosy papers were published in English. When compared with the overall *Medline* language distribution it appears that in the leprosy literature French, Spanish and especially Portuguese are relatively well represented. Conversely, German, Russian and Italian appear to be considerably less popular in the leprosy literature than their overall distribution in *Medline* might suggest. Some 655 articles from the 1950s had 'undetermined' as a language code. These were manually corrected for this analysis. 'Multiple languages' is also a category that was not well indicated in *Medline* and needed some correction.

#### DOCUMENT TYPES

Table 2 shows the distribution of the major publication types (uncorrected, i.e. as listed in *Medline*).

In the first decade all records were labeled 'journal article' and 41 of these received the additional qualification 'case reports'. In later decades, a richer diversity of document types emerged (e.g. 'letters', 'editorials', 'reviews'), but this is probably due to an evolution in the classification habits of *Medline* indexers. Also, many articles have more than one label: a 'review article' or a 'clinical trial' is always labeled as a 'journal article' too. Historical articles, including most of the biographies and papers about leper colonies, seem to be popular (4.2% of all leprosy literature).

#### JOURNALS

Table 3 presents the distribution of this literature over the many journals indexed by *Medline*.

Title changes and mergers have been combined as one journal. The top three comprises *The International Journal of Leprosy and Other Mycobacterial Diseases*, *Leprosy Review* and *Leprosy in India/Indian Journal of Leprosy*. There is a high degree of concentration: these top three journals account for 37.6% of all leprosy literature. For the numbers four (*Acta Leprologica*) and five (the Japanese *Nihon Hansenbyo Gakkai Zasshi* and its successor) this is far less with 2.8% and 2.5% respectively – and from number six onwards no journal can claim more than a 1.6% share. Below this top concentration there is a very wide dispersion, as the selection includes no less than 2068 different journals. Almost half of these journals

**Table 2.** Evolution of publication types

Document type	1950–59	1960–69	1970–79	1980–89	1990–99	2000–07	Total	Distribution
Journal Article	2248	2520	3127	4303	3190	1947	17 335	90.28%
Case Reports*	41	94	184	442	460	374	1595	8.31%
Letter	0	1	75	333	601	294	1304	6.79%
Review*	0	54	105	238	424	298	1119	5.83%
Historical Article*	0	79	238	185	148	136	786	4.09%
Clinical Trial*	0	39	97	101	166	67	470	2.45%
Comment*	0	0	0	7	205	100	312	1.62%
Editorial	0	0	32	51	135	87	305	1.59%
Biography*	7	35	80	47	50	36	255	1.33%
Congresses	0	1	19	1	73	44	138	0.72%
Total	2248	2523	3261	4707	4051	2411	19 201	100.00%

\* These publication types are generally combined with others, mostly 'Journal Article'; totals always exceed 100%. The list of publication types is not exhaustive.

**Table 3.** Journals

Journal	1950–59	1960–69	1970–79	1980–89	1990–99	2000–07	Total	Distribution	
International Journal of Leprosy [and Other Mycobacterial Diseases]	1934–2005	325	409	556	702	729	233	2954	15.38%
Leprosy Review	1930-	123	295	348	558	557	458	2339	12.18%
Indian Journal of Leprosy + Leprosy in India	1929-	0	0	249	825	570	276	1920	10.00%
Acta Leprologica	1960–2001	0	0	60	325	131	15	531	2.77%
Nihon Hansenbyo Gakkai Zasshi + Nippon Rai Gakkai Zasshi + Repura	1930-	0	0	83	158	133	104	478	2.49%
Hansenologia Internationalis + Revista Brasileira de Leprologia	1936-	134	58	11	95	0	0	298	1.55%
International Journal of Dermatology + Dermatologia Internationalis	1962-	0	38	47	57	69	31	242	1.26%
Bulletin de la Société de Pathologie Exotique [et de ses Filiales]	1908-	117	65	21	15	6	2	226	1.18%
Lancet	1823-	15	33	76	23	52	24	223	1.16%
Arquivos Mineiros de Leprologia	1941–1963	181	27	0	0	0	0	208	1.08%
Infection and Immunity	1970-	0	0	42	60	68	21	191	0.99%
Clinical and Experimental Immunology	1966-	0	1	36	82	41	10	170	0.89%
Bulletin de la Société Française de Dermatologie et de Syphiligraphie*	1890-	48	65	7	8	13	13	154	0.80%
Médecine Tropicale (Marseille)	1941-	30	33	15	13	8	10	109	0.57%
BMJ + British Medical Journal	1955-	10	21	39	10	19	7	106	0.55%
[A.M.A.] Archives of Dermatology [and Syphilology]	1955-	20	28	24	12	13	5	102	0.53%
Indian Journal of Medical Research	1913-	5	14	39	27	9	1	95	0.49%
Vestnik Dermatologii i Venerologii + Vestnik Venerologii i Dermatologii	1937-?	12	26	32	24	0	0	94	0.49%
Actas Dermo-Sifiliográficas	1909-	64	14	7	3	0	2	90	0.47%
Annales de la Société Belge de Médecine Tropicale	1920–1995	29	28	18	10	5	0	90	0.47%
Transactions of the Royal Society of Tropical Medicine and Hygiene	1907-	20	13	14	20	15	6	88	0.46%
Bulletin of the World Health Organization	1947-	6	14	40	9	8	7	84	0.44%
American Journal of Tropical Medicine and Hygiene	1921-	4	6	34	10	13	16	83	0.44%
Journal of Immunology	1916-	1	2	3	31	32	13	82	0.43%
Indian journal of Dermatology	1955–1990	0	31	19	27	1	0	78	0.41%
Total		2248	2523	3261	4707	4051	2411	19 201	100.00%

\* + Annales de Dermatologie et de Syphiligraphie/Vénérologie.

(1012) published only one leprosy paper. Over 76% of them had less than five leprosy items. Such concentration and dispersion phenomena are well known in the study of the scientific journal literature, but this appears to be an extreme example. However, this may not be surprising for articles on a specific disease when there are only a very small number of journals dedicated solely to this disease.

Some journals did publish a substantial number of leprosy papers before the *Medline* records began. The top three journals respectively have 16, 20 and 21 pre-1950 years which, had these been included in the database, would have boosted their positions even further. The *Annales de la Société Belge de Médecine Tropicale*, for instance, featured 29 pre-1950 volumes with 82 articles on leprosy. Others were included in *Medline* only after many years of continued publishing, and some, like *Hansenologia Internationalis*, were dropped from the *Medline* selection after many years of inclusion. Still others, like *The International Journal of Leprosy and Other Mycobacterial Diseases* stopped publishing. Earlier or prolonged inclusion of additional years might also have given a boost to the positions of a number of non-USA/UK-based journals and journals in non-English languages in the post-1950 leprosy literature.

#### AUTHORS

Table 4 lists the most prolific authors in this *Medline* subset.

Some authors may be disadvantaged by the initial cut-off date of 1950. For several the evolution over the decades suggests their full career is listed here in articles indexed by

**Table 4.** Authors

Author	1950–59	1960–69	1970–79	1980–89	1990–99	2000–07	Total
Anonymous	65	48	145	105	149	68	580
Job CK	0	24	31	53	55	25	188
Ramu G	1	1	28	92	28	8	158
Rees RJ	3	40	64	37	5	0	149
Kumar B	0	0	16	78	23	26	143
Browne SG	4	65	57	13	0	0	139
Kaur S	0	0	20	80	36	0	136
Antia NH	0	3	20	65	35	9	132
Floch H	115	6	1	2	0	0	124
Desikan KV	0	3	30	59	15	16	123
Ganapati R	0	4	19	39	45	14	121
Languillon J	7	58	25	24	1	0	115
Pattyn SR	0	7	29	51	25	2	114
Ghosh S	3	65	30	11	4	0	113
Sehgal VN	0	11	13	47	32	9	112
Girdhar BK	0	0	9	46	36	20	111
Brennan PJ	0	0	0	39	33	37	109
Rea TH	0	0	18	43	25	22	108
Sengupta U	0	0	6	46	39	16	107
Convit J	12	16	36	20	15	6	105
Levy L	0	13	55	23	6	4	101
Sarno EN	0	0	0	17	31	53	101
Total number of top 21 mentions*	145	316	507	885	489	267	2609
Total Nr of publications	2248	2523	3261	4707	4051	2411	19 201

\* Excluding 'Anonymous'

*Medline*. Some of these authors are dead, others are active today and will undoubtedly enhance their positions in later analyses: nine authors out of the 21 listed had published 14 or more *Medline* papers in the last 8 years (one had 53 papers, another had 37). The bottom of the table is cut off at 100 *Medline* publications, so several well-known leprosy experts that might be expected here are just below this threshold with close to 100 papers. In a few cases we cannot be certain that a name does not cover two or more homonymous authors. When different second initials appeared only the most probable combination was selected. So it is possible that here and there an item too many or too few has been listed – it was not feasible to verify this for the full 100%. This leprosy database subset contains over 21 000 different author names – a substantial part being two or more versions of the same name, e.g. with or without periods after initials, names in upper case (pre-1965) vs. mixed lower and upper case (1965–2007). As for the intrinsic value of this total output, *Medline* records can represent different types of publications from short editorials or letters to major research articles and reviews. Table 4 does not differentiate in this respect. Neither does it measure ‘impact’ (e.g. based on citation analysis). But this non-exclusive list highlights some highly visible authors from the last six decades.

The author distribution pattern is much more even than that of the journals, with numbers three up to 21 having a listed publication output between 100 and 150 papers. Numbers one and two do not exceed this range by more than 26%. It is remarkable, however, that in the most productive period the top 20 authors feature in almost 20% of the total number of publications (unchecked for possible co-authorship) while in the last period this is down to 10%. But this may be partly due to this group’s position at the edge of the time line studied, or to increasing multi-authorship. This dataset actually offers a good opportunity to check on this long-term trend towards an increasing number of authors per article generally perceived in the scientific literature.<sup>1</sup> Counting the average number of authors in a sample of the first 50 records for a middle year of each decade gave the following results: 1955: 1.52; 1965: 1.80; 1975: 2.16; 1985: 3.06; 1995: 3.64 and 2005: 3.36. These figures illustrate the increasing number of authors trend (with a peak of five authors in the 1955 sample and nine authors in 2005). Yet the number of single author papers in this sample seems remarkably high: 68% in 1955, and 60%, 44%, 22%, 26% and 26% for each later decade. In the whole of the database 580 papers (3%) were labeled ‘Anonymous’. These include congress reports, news, biographies and historical articles, yet 72% is labeled ‘Journal article’ – somewhat inadequately upon closer inspection, as they often contain epidemiological updates or editorial material. It would be interesting to investigate closer the possible relationships between the number of authors and specific publication types, but this option was kept outside the scope of this review.

## SUBJECTS

Due to the high level of sophistication of the MeSH thesaurus, such a large range of keyword-subheading combinations is possible that the exact prevalence of individual combinations cannot be evaluated (over 17 000 different ones were found). These have also evolved over the 58 years analysed. Also, certain keywords may be used to describe different concepts, e.g. ‘(dosage and) administration’ vs. ‘administration (of public health services)’, or ‘isolation (and purification)’ vs. ‘isolation (of patients)’. We looked at the most popular single keywords and subheadings, applying obvious truncations (marked with an asterisk). Of the keywords used as a selection criterion, ‘leprosy’ appeared in over 90% of the articles, and

'*Mycobacterium leprae*' in 23%. For a long time leprosy was used as a generic MeSH term. Only in the 1980s did the differentiation lepromatous, tuberculoid and borderline appear. In this table, thematically related keywords have been grouped, ranged in order of frequency. Therapeutics and immunology related keywords were the most prevalent ones, but they appear to follow the overall downwards trend in the last decades. Public health aspects and genetics received their highest scores after the 1980s, while historical studies reached their peak in the 1970s. However firm conclusions on the comparative popularity of various leprosy aspects would necessitate a more detailed study of the full MeSH term combinations (Table 5).

The average number of MeSH terms per article read as follows: 1955: 1.68; 1965: 4.60; 1975: 10.56; 1985: 8.44; 1995: 10.64 and 2005: 11.32. The maximum number of keywords counted for 1955 records was five, in 2005 it was 20. In this test the number of keyword combinations (MeSH terms + subheadings) was counted, not the individual keywords (as in Table 5). The number of different MeSH terms used reflects a characteristic of the *Medline* indexers, not author behaviour or preference, as in the previous section. Tables 6 and 7 show some results relating to geographical keywords and countries in author addresses.

Geographical keywords were introduced during the 1960s and have consistently been added to the database in a standardised MeSH format by professional indexers. Author addresses, on the other hand, have been listed in *Medline* only since 1987 (with a small number of early exceptions), and clearly not in a rigorous way, so they should be dealt with much more cautiously (see below).

## Discussion

The present results indicate that the *Medline* literature reflects some historical and geographical realities known about leprosy research:

1. The volume of leprosy research is clearly in decline: That the number of leprosy papers peaked in the 1980s and decreased significantly after seems to corroborate what has been reported previously about leprosy research.<sup>2</sup> Indeed, so much progress had been made in the understanding and control of leprosy (e.g. reduction of 90% of registered cases) in the 1960s, 1970s and 1980s that in 1991 it was targeted for elimination by the year 2000<sup>3</sup> – even if this elimination has not happened and not all questions have been answered yet.<sup>2</sup>
2. The scientific input of a number of countries with a long lasting high leprosy burden is clearly visible in several of the parameters analysed: The journal names in this table give a clear indication of the abundance of Indian contributions. This seems logical since India has the largest burden of leprosy patients, with Brazil in second place. Only the literature represented in *Medline* was counted, not the complete published output. Table 4 also clearly illustrates the visibility of Indian authors, who take up about half of the top 20 positions. The relatively high score for Portuguese in the language distribution reflects the gravity of the problem in Brazil. As for the geographical keywords, India is by far the most represented, with Brazil again in second place, followed by developing countries like Ethiopia, Nigeria, China and Nepal. Yet developed countries like Japan, USA and UK also feature high on this list of geographical keywords. Obviously this cannot be due to heavy disease burdens during the last 58 years. Historical reviews (e.g. Norway, in relation to G.A. Hansen) and imported cases accounted for a large part of these records. Hawaii has

**Table 5.** Keywords

Subjectgroups	MeSH	1950–59	1960–69	1970–79	1980–89	1990–99	2000–07	Total	Distribution
General	Leprosy	2093	2369	3029	4230	3622	2195	17 538	91.34%
	Mycobacterium leprae	57	256	773	1421	1216	686	4409	22.96%
	Skin or cutaneous or dermatol*	23	264	506	602	470	302	2167	11.29%
	Lepromatous	0	0	5	188	710	321	1224	6.37%
	Tuberculoid	0	0	4	110	370	149	633	3.30%
	Borderline	0	0	0	76	283	104	463	2.41%
Therapeutics	Therap*	516	534	851	1249	1264	854	5268	27.44%
	Drug*	7	377	727	1140	1157	770	4178	21.76%
	Agents	17	74	140	318	627	588	1764	9.19%
	Leprostatic	0	0	64	269	538	523	1394	7.26%
	Dapsone	0	122	358	535	242	118	1375	7.16%
	Pharma*	1	70	226	366	254	147	1064	5.54%
	Dosage and administration	5	42	191	298	281	217	1034	5.39%
Immunology	Immunolog*	212	201	719	1410	1087	408	4037	21.02%
	Antigen*	15	91	301	668	607	191	1873	9.75%
	Lymphocyt*	1	16	191	443	339	108	1098	5.72%
Pathology	Pathology	76	275	521	824	717	543	2956	15.40%
	Complications	131	297	523	608	688	430	2677	13.94%
	Etiology	7	184	438	513	463	310	1915	9.97%
Diagnosis/laboratory procedures	Diagnos*	140	304	389	621	675	614	2743	14.29%
	Microbiolog*	8	88	451	598	564	449	2158	11.24%
	Antigen*	15	91	301	668	607	191	1873	9.75%
	Analysis	4	50	305	603	444	190	1596	8.31%
	Mice	0	123	291	452	336	142	1344	7.00%
	Blood	79	127	275	277	334	160	1252	6.52%
	Isolation and purification	0	73	289	316	311	211	1200	6.25%
	Metabolism	12	45	191	300	303	218	1069	5.57%
Public health aspects	Epidemiolog*	141	254	360	504	651	623	2533	13.19%
	Prevention (and) control	194	160	296	426	549	422	2047	10.66%

**Table 5.** *continued*

Subjectgroups	MeSH	1950–59	1960–69	1970–79	1980–89	1990–99	2000–07	Total	Distribution
Genetics	Genetic*	2	44	109	236	383	331	1105	5.75%
History	History or biography	40	101	242	188	148	137	856	4.46%
	Leper colonies	1	43	62	53	35	31	225	1.17%
	Total Nr of publications	2248	2523	3261	4707	4051	2411	19201	100.00%

\* truncation, any word starting with this stem.

**Table 6.** Countries in MeSH

Country	Prevalence*	New cases**	1950–59	1960–69	1970–79	1980–89	1990–99	2000–07	Total
India	82 801	139,252		84	172	309	254	322	1141
Brazil	60 567	44 436		23	38	49	55	106	271
Japan	10	7		21	66	42	46	49	224
USA (excl. Hawaii)				24	45	46	36	20	171
Ethiopia				8	31	35	34	28	136
Nigeria	4830	3544		24	18	18	34	29	123
China	3294	1512		8	14	30	31	32	115
UK				17	38	20	15	15	105
Nepal	3951	4253		3	5	23	28	41	100
Norway				5	34	19	17	11	86
Thailand	1157	665		8	20	16	24	18	86
France				19	20	15	11	8	73
Philippines				12	16	16	15	11	70
Malawi				3	5	18	27	8	61
Germany				10	25	10	5	10	60
Mexico	702	243		12	23	9	8	8	60
Hawaii				7	23	17	7	5	59
Senegal	481	353		6	6	20	16	6	54
Myanmar		3721		2	16	7	13	13	51
Bangladesh	4969	6280		0	1	4	26	18	49
Indonesia	22 175	17 682		5	4	6	17	15	47
Uganda	505	423		12	14	9	7	5	47
Total Nr of publications			2248	2523	3261	4707	4051	2411	19 201

\*Registered prevalence 2007 according to Ref. 4.

\*\*Newly detected cases 2007 according to Ref. 4.

**Table 7.** Countries in author addresses (limited data)

Countries	< 1990	1990–99	2000–07	Total
India	122	468	352	942
UK + England + Scotland + . . .	73	205	126	404
Japan	7	139	225	371
USA	2	134	210	346
Brazil	25	139	170	334
Netherlands	20	104	74	198
France	28	69	50	147
Nepal	1	55	34	90
China	5	28	32	65
Ethiopia	10	42	11	63
Australia	10	37	14	61
Germany	3	39	19	61
Canada	8	33	19	60
Thailand	7	32	14	53
Mexico	8	26	16	50
Senegal	6	40	3	49
Nigeria	2	27	16	45
Argentina	7	21	16	44
Belgium	6	32	4	42
Total Nr of publications	12 739	4051	2411	19 201

been listed separately from the USA – about half of the 59 articles clearly had an historical interest. Other countries with a heavy leprosy burden,<sup>4</sup> like The Philippines, Malawi, Myanmar, Bangladesh and Indonesia, tended to rank highly on the geographical keywords list and, to a lesser degree, in the author addresses, but they were barely visible in the journals list. This is partly because most local medical journals are not indexed by *Medline*. However the *Ethiopian Medical Journal*, for instance, was represented with 50 leprosy articles. Other non-Indian developing countries based journals include *Maroc Médical* (66), *Bulletin de la Société Médicale d'Afrique Noire de Langue Française + Dakar Médical* (58 articles), *East African Medical Journal* (55), *Southeast Asian Journal of Tropical Medicine and Public Health* (36) and *Revista Cubana de Medicina Tropical* (34).

The fact that a number of high-burden countries are clearly visible in the international research output does not imply that the attention is 'correctly' divided. And geographical keywords do not necessarily imply the active involvement of local researchers and publication sources. The Democratic Republic of Congo (DRC, formerly Zaire) with one of the highest current prevalence rates is represented by only 29 publications and it does not have a single journal indexed by *Medline*. Yet from our own *Medical Literature on Central Africa* bibliographic database we know of 128 journal contributions on leprosy in the DRC published during this period. Mozambique is featured in only 13 articles, Madagascar in nine, and Angola in five. Language, for obvious reasons, was generally not a very useful parameter to study geographical distribution, and author names were not investigated in this respect (except for the omnipresence of Indians in the authors list).

In the author addresses survey India and Brazil are again in the top five, accompanied by USA, UK and Japan. But *Medline* is not well suited for the analysis of this parameter. First of all, maximum one author address per record is listed, so there is at least a nominal under

representation of the author countries. Author addresses clearly do not have a standardised format. Country names may appear in different forms (e.g. Brazil vs. Brasil), so we have combined obvious spelling variants. For the UK, we included terms like United Kingdom, Great Britain, England, Scotland and Wales. If included at all, *Medline* author addresses are often incomplete, frequently ending with a city without listing the country name. For the USA, adding only a few major cities or states (e.g. + California + Louisiana + New York + Washington) immediately increased the country total by 60%. However such complex constructions for all the countries listed cannot be used. So the *Medline* author addresses pose severe problems which make analyses and distributions based on this criterion rather incomplete. Hence Table 7 is far less comprehensive than the others. Yet we present it here as a tentative snapshot of the author distribution during the last two decades.

#### ALTERNATIVE BIBLIOGRAPHIC SOURCES

This analysis deals exclusively with articles published in journals covered by *Medline*. Yet several high quality alternatives exist. The *Embase* database, incorporating a.o. the former *Excerpta Medica Leprosy and Related Subjects* section, is a major competitor of comparable size, but with substantial differences in coverage. *Embase* was not consulted by lack of subscription. *Global Health (CABI)* presently includes about 5000 leprosy references published between 1973 and 2007, i.e. on average almost 150 per year. Unlike *Medline* it is not limited to journal literature. Recently an archive section with 800,000 references from 1910 to 1972 has become available, but we had no access to this resource. *Thomson Scientific* (formerly *ISI – Institute of Scientific Information*) *Web of Science (WoS)* citation databases contain some 10 500 leprosy references published since 1972, i.e. on average almost 300 per year. This is quite substantial but less than *Medline*, and the options for retrieval by controlled keywords are far less sophisticated. Yet these citation indexes are superior for the analysis of author affiliations and international scientific collaboration – and, of course, citation analysis. About 10% of these leprosy items were meeting abstracts published in journal issues, a publication type not included in most other bibliographical databases. In *WoS* the language concentration is even stronger than in *Medline*, with over 95% of the leprosy articles in English. No more than 25 items in Portuguese were featured, only seven in Italian and three in Japanese. Notwithstanding the obvious differences in selection criteria and the shorter period covered, the most prolific authors are roughly the same, but some of the Indian authors have fewer of their publications selected for *WoS*. The absence of e.g. *The Indian Journal of Leprosy* obviously has a visible impact on *WoS* derived distributions. While the international English language top journals are roughly the same, *Medline* obviously has a much wider variety of non-English and national or regional journals.

As far as leprosy-specific bibliographies are concerned, two examples deserve special mention. The first is a monumental Brazilian endeavour<sup>5</sup> that contains tens of thousands of references to the immense pre-1945 literature. The second is a CD-ROM database on leprosy literature 1913–1991 published by the *Leprosy Research Foundation*,<sup>6</sup> featuring over 40 000 records.

#### SUGGESTIONS FOR FURTHER STUDY

Although a fair number of parameters have been analysed for these 19 201 articles, some additional issues have not been investigated, either because the necessary data were not

available in the Medline database, or because this would have involved an enormous amount of manual record per record analysis. Such options include: relationships between certain publication types and numbers of authors, e.g. single author contributions; a larger list of authors, with disambiguation of possible homonyms, identification of deceased authors (need for additional information on biographies and institutional affiliations); more in-depth analysis of MeSH combinations used in the leprosy literature; the relatively high positions of specific developed countries in the geographical keywords list; correct and complete addresses + availability of addresses for all authors involved: distribution and evolution of national and international cooperation (making use of other databases, e.g. *ISI Web of Science*, as in Falagas *et al.*<sup>7</sup>); and the analysis of impact based on citations: highly cited journals, authors, publication types, age, aspects, etc.; comparison of leprosy literature published in high impact journals vs. specialist journals (*idem*, but citation databases may be too selective for this purpose – currently only one leprosy journal is indexed by *ISI Web of Science*).

## Conclusions

This analysis shows that the number of leprosy-related articles have peaked in the 1980s and have been in decline ever since, especially as the overall *Medline* trend of adding more records each year than the year before has continued. Coverage of non-English language literature has decreased far more strongly than that of English language articles. The scholarly input of a number of countries where the leprosy burden is the highest, such as India and Brazil, is clearly visible in the distribution of journals, authors, and for some, language, but this is certainly not the case for all countries afflicted.

## Contributors

Dirk Schoonbaert (guarantor) devised the concept of this paper, made the record selection and performed the initial analysis.

Veerle Demedts (contributor) improved the methodology and conducted the final analysis. We dedicate this review to the memory of the late Prof. em. S.R. Pattyn (ITM) who advised us on the first draft and sadly passed away in March 2008. As librarians we are not aware of any competing interests.

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