The Information Content of Titles in Contraception Literature

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This paper attempts to evaluate the effectiveness of a keyword or descriptor in the title, from the viewpoint of document selection and information retrieval for scientists engaged in contraception research. A total of 2152 document titles recorded in the *Index Medicus* during 1973–75 was examined. Another set of 567 contraception titles published in the *Index Medicus* during 1963–65 was also studied to determine if there were any changes in the information content of the titles over a 10-year period. Employing the Montgomery–Swanson method, it was found that 92.2% of the documents from the later period and 88.0% of those from the earlier period had at least one "contraception term" in their titles. The data obtained in this study exceed those of published reports. A brief review of some of the previous studies dealing with the retrieval capabilities of titles in various branches of medical and life sciences is presented. It is concluded that the title search method is a very effective means of retrieving pertinent documents in the field of contraceptive technology. A trend of improvement in the information content of the scientific titles is also noted.

INTRODUCTION

For centuries mankind has attempted to prevent pregnancy by a variety of agents and methods. Most of the ancient contraceptive efforts were usually unscientific and enshrouded in superstition.[1] The history of organized, planned efforts toward helping the masses acquire a knowledge of contraception is, at the most, approximately a century old, and the achievement of some reliable contraceptive methods is quite recent.[2] In the past decades considerable advances have been made in contraceptive technology. During this period, the development and subsequent modification of oral steroid contraceptives, together with the designing of improved types of intrauterine devices, have greatly influenced the attitude and application of birth control measures followed by couples practicing contraception on a global basis.[3] Some of us[4] have even hailed the development of oral contraceptives as being one of the epochal events of the 20th century. One source estimates that there are over 400 commercial oral contraceptive products in present use or which have been used in the recent past.[5] Another source indicates that following introduction in the late 50's, oral contraceptives have been the object of more direct research, scientific evaluation, and newsprint than any other medical substance ever introduced.[6] The truth behind such a statement may not be difficult to substantiate, especially when we appreciate the magnitude of the problems of population control and the involvement of people from almost all national, ethnical, and racial origins. As is well known, biological, medical, technological, social, cultural, economic, and political considerations are all involved in such a crusade for the survival of man's existence on earth. Collectively, all these factors simply highlight the fact that contraceptive technology is indeed a very active field of present-day endeavor and concern.

To this author's knowledge, there do not exist definite data on the total literary output documenting the research efforts in the field of contraception. However, the near-quadrupling of the number of papers on this subject in 1973–75 as compared with 1963–65 (as will be seen in the latter part of this paper) gives some indication of the tremendous growth of the literature on contraception. In the present context of "literature explosion", scientists are hard pressed to remain constantly informed of the results of the latest research and development. Numerous information processing and disseminating devices (manual as well as computerized) are being designed, modified, and employed to assist scientists to filter through, choose, and retain the myriad bits of information available.

One of the keys that is used traditionally to unlock the informational content of a scientific paper is its title. The title of a research document should relate the content or focal point of the document. However, from our experience we know that document titles may vary enormously in depth and quality of meaningfulness. A title may be very specific and meaningful, "The Effect of a Copper IUD and 'Inert' IUDs on the Incorporation of 3-*H*-Thymidine and 5-3-*H*-Uridine into the Endometrium of the Rabbit after Stimulation with Human Chorionic Gonadotropin"; or may be information-poor, "Love without Scandal and Pleasure without Fear", for a document advocating the use of a contraceptive; or may be absolutely nonsensical, "And So On". The adequacy and appropriateness of titles alone as a means of accessing the subject content of scientific and technical documents have been questioned, tested, discussed, and reported to a considerable degree. An overview of the earlier studies, dealing with the manipulation of titles for information storage, retrieval, and dissemination purposes, has been presented in some detail by Stevens,[7] Sparck Jones,[8] and Feinberg.[9] A brief review of some of the recent reports[10–18] leaves very little doubt that additional studies are required to be carried out before we can arrive at generalizations on the extent of subject representation in document titles. Thus, in an effort to evaluate the effectiveness of a keyword or descriptor in the title, from the viewpoint of document selection and information retrieval for the scientists engaged in contraception research, it was decided to examine the titles of a collection of previously analyzed documents dealing with contraceptive agents, contraceptive devices, and nonsurgical methods of contraception. In a subsequent communication, attempts will be made to identify and draw up a list of "core" periodicals in the field of contraceptive technology. It must be stressed at this point that social, cultural, political, and economic aspects of family planning and population control, in general, as well as the specific chemicals which may have both contraceptive and noncontraceptive uses, are beyond the scope of the present paper.

MATERIAL

Medical Subject Headings (MeSH) is an authority list for the subject analysis of the biomedical documents at the National Library of Medicine, Bethesda, Md. It contains the subject headings or descriptors under which references to all

Table I. Distribution of Contraception Papers According to IM Years and MeSH Terms (1973–75)

MeSH terms	IM years 1973	1974	1975	Total
Contraception	69	74	107	250
Contraception behavior			6	6
Contraceptive agents	62	42	6	110
Contraceptive agents, female			7	7
Contraceptive agents, male			5	5
Contraceptive devices	12	15	9	36
Contraceptives, oral	394	429	327	1150
Contraceptives, oral, hormonal			10	10
Contraceptives, oral, synthetic			20	20
Contraceptives, postcoital	14	19	8	41
Contraceptives, postcoital, hormonal			1	1
Intrauterine devices	184	188	144	516
Total	735	767	650	2152

Table II. Distribution of Contraception Papers According to IM Years and MeSH Terms (1963–65)

MeSH terms	IM years 1963	1964	1965	Total
Contraception	22	26	35	83
Contraceptives	20	20	71	111
Contraceptives, oral	42	149	182	373
Total	84	195	288	567

papers, after an in-depth analysis of their contents, appear in the *Index Medicus* (IM), a monthly (cumulated annually) record of biomedical literature. The 1973–75 editions of MeSH[19] were consulted to find out which descriptors were used in IM, in those years, to index the contraception literature. The papers listed under the candidate MeSH headings in 1973–75 IM constituted the basic test material of this study. During preliminary examination of MeSH and the indexing policy of IM, it was observed that, in order to cater to the specific needs of the individual users, a multifaceted article such as "Ceylon: Continuing Practice of Contraception by Acceptors of Oral Contraceptives and Intrauterine Devices in a Field Programme" was indexed in IM under more than one MeSH heading namely, under CONTRACEPTION; CONTRACEPTIVES, ORAL; and INTRAUTERINE DEVICES. After discounting all such duplicates, a total of 2152 unique titles, for the years 1973–75, was included in this study. The yearwise distribution of these papers appearing under various MeSH headings is presented in Table I.

Similarly, in order to determine if there were any changes, over the years, in the practice of the authors to provide more informative titles for the readers of contraception literature, another set of 567 papers, indexed in IM during 1963–65 (i.e., during a corresponding 3-year period 10 years ago) was collected, and is given in Table II. For the sake of convenience, the periods 1973–75 and 1963–65 will be referred to in this paper as Period I and Period II, respectively.

METHOD

The matching procedure followed in this study was essentially the subject heading–title word correlation technique developed by Montgomery and Swanson,[10] further clarified by O'Connor[11] as being the synonym inclusion method. For the purposes of matching and analyzing IM titles, a list of significant words and phrases, descriptive of the subject interest of the contraceptive researchers (hereinafter called profile terms), was compiled with the help of medical dictionaries and subject specialists. In constructing these profile terms, singular and plural forms of the individual words and multiword phrases (hyphenated or nonhyphenated), their abbreviations or acronyms, as well as their inflectional and syntactical variants were taken into consideration. Finally, these profile terms (PT's) were categorized into the following types.

Type 1—Substantive MeSH terms (i.e., the basic conceptual root word of a MeSH term) and their inflectional variants (=PT1 terms), e.g.,

contracepting
contraception
contraceptive(s)
intra-uterine device(s)
intrauterine device(s)
IUCD(s)
I.U.C.D.(s)
IUD(s)
I.U.D.(s)

Type 2—Terms (including the generic group names for the contraceptive agents/devices) and their inflectional or syntactical variants synonymous to PT1 terms (=PT2 terms), e.g.,

anovulant(s)
anovulator(s)
anovulatory activity(ies)
anti-conception/anticonception
anti-fertility/antifertility agent(s)/compound(s)
antispermatogenic effect(s)
blocking of ovulation/ovulation-blocking
condom(s)
control of fertility/fertility control
diaphragm(s)
inhibition of ovulation/ovulation inhibition
intrauterine copper/pessary(ies)
mini-pill(s)/minipill(s)/morning-after-pill(s)
ovulation suppression/suppressing ovulation
pessary(ies)
preventing pregnancy/prevention of pregnancy
regulation of/regulating conception
rhythm
spermicide(s)
etc., etc.

Type 3—Specific contraceptive agents/devices, usually identifiable by their individual generic chemical/trade name(s) (=PT3 terms), e.g.,

Copper-T
Dalkon shield
Enovid
Lippe's loop
Majzlin spring
medroxyprogesterone
norgestrel
Ovral
etc., etc.

Type 4—Terms broadly related to PT1 terms (=PT4 terms), e.g.,

estro-progestagen(s)/estroprogestogen(s)
estroprogestational/oestroprogestational agent(s)
estro-progestative(s)/estroprogestative(s)
estroprogestinic drug(s)
estrogen-progestogen agent(s)/combination
estrogen/gestogen combination(s)
postcoital estrogen(s)

Table III. Results of Title Study on the 1973-75 Test Papers

MeSH terms	Year	TYPE OF PROFILE TERMS: PT1 No.	PT1 %	PT2 No.	PT2 %	PT3 No.	PT3 %	PT4 No.	PT4 %	PT5 No.	PT5 %	Total	% of GT
Contraception	1973	45	65.2	13	18.2	-	-	-	-	11	16.0	69	
	1974	60	81.1	9	12.2	-	-	-	-	5	6.7	74	
	1975	63	58.9	23	21.5	-	-	-	-	21	19.6	107	
Total (a) ...		168	67.2	45	18.0	-	-	-	-	37	14.8	250	11.6
Contraception behavior ...	1973	-	-	-	-	-	-	-	-	-	-	-	
	1974	-	-	-	-	-	-	-	-	-	-	-	
	1975	5	83.3	-	-	-	-	-	-	1	16.7	6	
Total (b) ...		5	83.3	-	-	-	-	-	-	1	16.7	6	0.3
Contraceptive agents ...	1973	39	62.9	14	22.6	3	4.8	1	1.6	5	8.1	62	
	1974	27	64.3	5	11.9	-	-	2	4.8	8	19.0	42	
	1975	6	100.0	-	-	-	-	-	-	-	-	6	
Total (c) ...		72	65.5	19	17.3	3	2.7	3	2.7	13	11.8	110	5.1
Contraceptive agents, Female	1973	-	-	-	-	-	-	-	-	-	-	-	
	1974	-	-	-	-	-	-	-	-	-	-	-	
	1975	5	71.4	2	28.6	-	-	-	-	-	-	7	
Total (d) ...		5	71.4	2	28.6	-	-	-	-	-	-	7	0.3
Contraceptive agents, Male	1973	-	-	-	-	-	-	-	-	-	-	-	
	1974	-	-	-	-	-	-	-	-	-	-	-	
	1975	-	-	3	60.0	-	-	-	-	2	40.0	5	
Total (e) ...		-	-	3	60.0	-	-	-	-	2	40.0	5	0.2
Contraceptive devices ...	1973	9	75.0	3	25.0	-	-	-	-	-	-	12	
	1974	9	60.0	2	13.3	1	6.7	-	-	3	20.0	15	
	1975	5	55.6	3	33.3	-	-	-	-	1	11.1	9	
Total (f) ...		23	63.9	8	22.2	1	2.8	-	-	4	11.1	36	1.7
Contraceptives, Oral ...	1973	271	68.8	65	16.5	13	3.3	17	4.3	28	7.1	394	
	1974	330	76.9	48	11.2	20	4.7	7	1.6	24	5.6	429	
	1975	241	73.7	47	14.4	9	2.7	3	1.0	27	8.2	327	
Total (g) ...		842	73.2	160	13.9	42	3.7	27	2.3	79	6.9	1150	53.4
Contraceptives, Oral, Hormonal ...	1973	-	-	-	-	-	-	-	-	-	-	-	
	1974	-	-	-	-	-	-	-	-	-	-	-	
	1975	6	60.0	3	30.0	-	-	-	-	1	10.0	10	
Total (h) ...		6	60.0	3	30.0	-	-	-	-	1	10.0	10	0.5
Contraceptives, Oral, Synthetic ...	1973	-	-	-	-	-	-	-	-	-	-	-	
	1974	-	-	-	-	-	-	-	-	-	-	-	
	1975	11	55.0	6	30.0	-	-	2	10.0	1	5.0	20	
Total (i) ...		11	55.0	6	30.0	-	-	2	10.0	1	5.0	20	0.9
Contraceptives, Postcoital	1973	6	42.9	8	57.1	-	-	-	-	-	-	-	
	1974	6	31.6	8	42.1	2	10.5	-	-	3	15.8	19	
	1975	4	50.0	3	37.5	1	12.5	-	-	-	-	8	
Total (j) ...		16	39.0	19	46.4	3	7.3	-	-	3	7.3	41	1.9
Contraceptives, Postcoital Hormonal ...	1973	-	-	-	-	-	-	-	-	-	-	-	
	1974	-	-	-	-	-	-	-	-	-	-	-	
	1975	-	-	-	-	-	-	-	-	1	100.0	1	
Total (k) ...		-	-	-	-	-	-	-	-	1	100.0	1	-
Intrauterine devices ...	1973	146	79.4	15	8.1	16	8.7	-	-	7	3.8	184	
	1974	150	79.8	8	4.3	20	10.6	-	-	10	5.3	188	
	1975	105	72.9	6	4.2	24	16.7	-	-	9	6.2	144	
Total (l) ...		401	77.7	29	5.6	60	11.6	-	-	26	5.1	516	24.0
Grand Total (GT) (i.e. Total of (a) through (l))		1549	71.9	294	13.7	109	5.1	32	1.5	168	7.8	2152	

synthetic gestagen(s)/gestogen(s)
etc., etc.

Type 5—None of the above (=PT5 terms).

Each IM title was analyzed visually and matched against the profile terms. If any of the profile terms, belonging to types 1–4, existed in the title, the paper was considered a "hit" by the title search method and relevant to the interest of contraception research workers. During matching operations multiple occurrences of any of the above "contraception terms" were counted as one. The logic followed in the matching procedure is outlined in Figure 1.

RESULTS

In both Period I and Period II, the highest number of papers indexed in IM appeared under the heading CONTRACEPTIVES, ORAL (1150 or 53.5% in Period I and 373 or 65.8% in Period II; see Tables I and II); the second highest number of 516 (or 24.0%) papers appeared under the heading INTRAUTERINE DEVICES during Period I, while in Period II the second highest number of papers (111 or 19.6%) was indexed under the heading CONTRACEPTIVES. As

Table IV. Results of Title Study on the 1963–65 Test Papers

MeSH terms	Year	TYPE OF PROFILE TERMS PT1 No.	PT1 %	PT2 No.	PT2 %	PT3 No.	PT3 %	PT4 No.	PT4 %	PT5 No.	PT5 %	Total	% of GT
Contraception	1963	8	36.4	4	18.2	-	-	-	-	10	45.4	22	
	1964	12	46.1	3	11.6	1	3.9	1	3.9	9	34.5	26	
	1965	21	60.0	6	17.1	-	-	-	-	8	22.9	35	
Total (A)	...	41	49.4	13	15.7	1	1.2	1	1.2	27	32.5	83	14.6
Contraceptives	1963	15	75.0	2	10.0	1	5.0	-	-	2	10.0	20	
	1964	15	75.0	2	10.0	1	5.0	-	-	2	10.0	20	
	1965	47	66.2	19	26.8	2	2.8	-	-	3	4.2	71	
Total (B)	...	77	69.4	23	20.7	4	3.6	-	-	7	6.3	111	19.6
Contraceptives, Oral	1963	27	64.3	11	26.2	3	7.1	-	-	1	2.4	42	
	1964	46	30.9	48	32.2	21	14.1	14	9.4	20	13.4	149	
	1965	97	53.3	55	30.2	11	6.0	6	3.3	13	7.2	182	
Total (C)	...	170	45.6	114	30.6	35	9.4	20	5.3	34	9.1	373	65.8
Grand Total (GT) (i.e. Total of (A) through (C))	...	288	50.8	150	26.4	40	7.1	21	3.7	68	12.0	567	

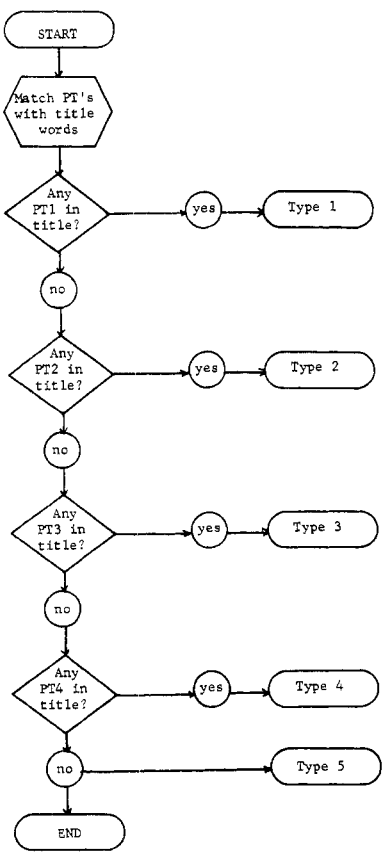

Figure 1. Matching procedure.

can be seen from Tables I and II, the MeSH terms used to document contraception literature were much more elaborated (6 to 12 headings) during Period I than in Period II (3 headings). Results of matches between the various types of profile terms and the words in the titles of the test papers are summarized in Tables III and IV.

As can be seen from Tables III and IV, when one considers all the MeSH headings under which the test papers were indexed in IM, the highest number of matches (in a positive sense of document identification), respectively, for Period I and Period II, occurred with PT1 terms (71.9 and 50.8%), followed by PT2 terms (13.7 and 26.4%), PT3 terms (5.1 and 7.1%), and PT4 terms (1.5 and 3.7%). Thus, cumulatively, 1984 (or 92.2%) of the 2152 papers from Period I of IM had at least one "contraception term" in their titles. Similarly, at least one "contraception term" existed in 499 (or 88.0%) of the 567 titles of papers appearing in IM during Period II. A comparison of the figures for Period I and Period II demonstrates that the overall frequency of occurrence of PT1 terms (71.9%) was significantly higher ($P = 0.0005$) with the 1973–75 papers than that with the 1963–65 papers (50.8%). However, the occurrence of the remaining types of profile terms (i.e., PT2, PT3, and PT4) was significantly lower in 1973–75 sample test papers, namely, 13.7, 5.1, and 1.5%, respectively, as compared with 26.4, 7.1, and 3.7% in 1963–65 papers. The percentage of papers that did not have any "contraception term" (i.e., PT5) was significantly higher with the 1963–65 papers (12.0%) compared with 7.8% of the 1973–75 papers ($P = 0.0005$).

DISCUSSION

The results of the present study reveal that exclusively on the basis of a title search with PT1 terms (i.e., substantive MeSH terms and their inflectional variants) one could identify and retrieve about 72% of the contraceptive documents in general. By adding PT2, PT3, and PT4 terms (i.e., synonyms as well as the related terms together with their inflectional and syntactical variants) to the search strategy, the percentage of retrieval efficiency of the titles is gradually increased to 85.6, 90.7, and 92.2, respectively. In other words, solely on the basis of a title search (manual or computerized) with the "contraception terms" it is possible to retrieve about 92% of documents pertinent to the areas of interest to contraception research workers. The high percentage of retrieval (as well as relevance) efficiency through the title search method employed here exceeds the data obtained by others in different areas of biomedical research. In order to provide a comparative insight, a brief review of some of the previous studies dealing with the retrieval capabilities of titles in various branches of medical and life sciences is in order.

O'Connor,[11] in his study on the correlation of index headings and title words in three medical indexing systems, observed that the occurrence of index terms in titles of the sample papers from the "Index-Handbook of Cardiovascular Agents", "Merck, Sharp and Dohme Retrieval System", and "NIH (National Institutes of Health) Research Grants Index" was 19–45, 40–68, and 13–39%, respectively. He, however, mentioned that about 10 years ago, i.e., in the early 50's, Garfield found a high percentage of title word–index term correspondence in the papers from "Current List of Medical Literature". Garfield's observation was similar to that of Montgomery and Swanson[10] who obtained a match of 86% when they compared about 5000 document titles with the subject headings in IM. Shultz et al.,[12] from their experiment

on comparative indexing of biomedical documents by title words and by authors, concluded that an average of 44% of title words were found to be common to those supplied by the authors.

Abbott et al.,[20] from their study on the current awareness search with *Chemical-Biological Activities*, observed that 50% of materials in response to biologically oriented profiles could be retrieved by title alone. Saracevic's conclusions based on a study of the tropical disease documents[13] implied that with the help of titles alone users would be able to recognize about 66 to 75% of the relevant items. The findings reported by Windsor[16] reveal that about 71% of the 1310 documents on DOPA had at least one "DOPA word" in their titles. Bottle et al.,[14] in one of their earlier studies, observed that 74% of the title samples from the 1967 IM contained references to the search topic, in the titles. Ghosh, in examining the occurrence of disease and syndrome eponyms in the titles of medical literature,[18] found a correlation of 82.2% between the IM subject headings and the 2435 documents, by the synonym inclusion method. Miller[15] concluded that title searching could retrieve four relevant MEDLARS (Medical Literature Analysis and Retrieval System) references (i.e., 80%) for every five (i.e., 100%) retrieved by MEDLARS index term searching. Another study by Ghosh[17] on the content representation in prostaglandin titles reveals that, solely on the basis of title search with the "prostaglandin terms", one could identify about 80% of the pertinent literature.

As it is clear from the above, none of the previous studies came up with a figure that could surpass the surprisingly high "hit" rate of 92.2%, obtained in the present study. However, if one is willing to consider the retrieval of 70% or more relevant documents, as reported by the earlier authors[10,13-18] and found in this study, is within the acceptable range of performance, then the employment of title search technique in any manual or computerized information handling system should be viewed as being reliable and satisfactory.

Another observation of the present study is that the total number of contraception documents, indexed in IM, during Period I (2152 papers) represents almost a 400-fold increase over that indexed in Period II (567 papers). Even when one considers the fact that IM has made genuine efforts in increasing its coverage of additional source journals over the years, the accelerated growth of contraception literature per se during this time is almost impossible to ignore. However, without doing any further studies, it is difficult to quantify the rate of such growth.

The statistically significant differences noted when comparing the overall retrievability of contraception literature of the two periods, 10 years apart (Period I, 92.2%, vs. Period II, 88.0%), by the title search method, suggest that the titles of scientific documents are becoming more informative, a trend observed earlier by Tocatlian[21] and Bird et al.[22]

CONCLUSION

Within the framework of the present investigation, it is observed that the title search method is a very effective way of retrieving pertinent documents in the field of contraceptive technology. Scientists wishing to keep themselves abreast of the latest developments in this area of research as well as in other fields can heavily depend upon the titles of the documents. The fact of relying upon the titles for the information content of a scientific and technical document is attested by the increasing popularity of title-based indexes (e.g., KWIC indexes) to the literature, and of lists of current titles or contents pages as aids to keeping up with the literature.[22] However, in-depth indexing of specific documents or other means of obtaining additional information on any subject cannot and should not be overlooked.

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