Retrieval Efficiency of Search Engines on Medical Tourism in Kerala: A Webometric Analysis

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ABSTRACT: *World Wide Web is like an ocean of information; it is not easy to find specific information from it because the web is very huge and growing all the time. So there are certain tools used to search information from the web. They are called search engines. They search through all the web sites and create an index of the information of the web sites and act as a single point to find relevant information. E.g. Google, Yahoo, Bing, Lycos, Info seek etc. Analysis on 8 representative variables form all the subsectors of on Medical Tourism in Kerala, the search engine Lycos retrieves 59% of the total results and stands first followed by Bing in the second position with 37% and Google in third position with only 2% of results . The remaining less than 1% is shared by all Metasearch engines, of these Ixquick stands first with a slight difference from others followed by Dogpile and WebCrawler Analysis of 10 variables on Ayurveda tourism Lycos occupies first place with a high result of 85% and Google in the second position followed by Bing in the third position with a less Percentage of 7 and 6 respectively. Among Metasearch engines Ixquick stands first, followed by WebCrawler and Dogpile.*

1. Introduction

Webometric covers research of all network based on communications using informetric or other qualitative measures. Its methodology draws especially from bibliometrics. It is clear that informetric methods using word counts and similar techniques can be regarded as a citation network, where the traditional information entities and citations from them are replaced by web pages. These pages are the entities of information on the web with hyperlinks from them acting as citations. The use of info metric methods on www allows the analysis to be similar way as in the traditional citation database. Studies in webometrics focus on hyperlinks as a potential source of new information. The retrieval efficiency of a search engine means the efficiency to retrieve more documents on a particular query. The variables selected for the key word searching are grouped into ten categories of sub headings in the topic Medical Tourism in Kerala for the analysis of retrieval efficiency of search engines as follows.

1) Medical Tourism in Kerala

2) Ayurveda Tourism in Kerala

3) Dental Tourism in Kerala

4) Fertility Tourism in Kerala

5) AYUSH in Kerala

6) Medical Tourism Hospitals in Kerala

7) IVF Hospitals in Kerala

8) Ayurveda Centers in Kerala

2. Review of Literature

Bharat and Border (1998) measured overlap among websites indexed by Hotbot, Altavista, Excite, and Infoseek using 10,000 queries carried out at two different intervals of time in June 1999 and November 1999, and found that the overlap was very small, less than 1.4 percent of the total coverage. Chowdhury(2002) introduced search engines and explains at some length how they operate, highlighting their strength and weakness. It gave a useful overview of the range of resource available, and provided a good grounding on the technique and principles involved in information retrieval on the web. Ding and Marchionini (1996) studied Infoseek, Lycos and Open Text for precision, duplication and degree of overlap using five complex queries. The first twenty hits assessed for precision show that the best results were obtained from Lycos and Open Text. Leighton and Srivastava (1997) conducted a study to compare five search engines for precision on the first 20 results returned for 15 queries. Analysis shows that AltaVista, Excite and Infoseek are top three services. Clarke and Willett (1997) searched thirty queries of varying nature on AltaVista, Excite and Lycos and obtained best results in terms of precision, recall and coverage from AltaVista. Bar-Ilan (1998) investigated six search engines using a single query "Erdos". All 6,681 retrieved hits examined for precision, overlap and an estimated recall reported that no search engine had high recall. Chignell, Gwizdka, and Bonder (1999) found little overlap in the results returned by various search engines and describe meta?search engines as useful.

3. Objectives of the Study

To ascertain the various types and quantities of information resources accessible through World Wide Web in the field of Medical Tourism in Kerala.

To compare and evaluate the relative efficiency of six search engines that is three general search engines with three Metasearch engines. Bing, Google, Lycos with Dogpile, Ixquick and WebCrawler in locating the web resources on Medical Tourism in Kerala and thereby identify and select relevant search engine in this field.

To compare and evaluate the above search engines on the basis of their precision and recall.

To find out the rate of stability of search results of these search engines.

4. Methodology

Methodology used for the study is the webometric study. Six search engines namely Bing, Google, Lycos, and Dogpile, Ixquick and WebCrawler are used to collect relevant information from the web. For it different variables on the topic Medical Tourism in Kerala are selected for key word searching. Quantitative analysis is done on these results for each search engine. Search on each category is done simultaneously due to the dynamic nature of the web.

5. Data Analysis

For analysis of Retrieval efficiency of search engines on Medical Tourism in Kerala 10 representative variable from different sub sectors of Medical Tourism are selected as key words. Search was conducted on 26 th September 2014 and number of hits retrieved for each query by all the six search engines were noted. The key words used and number of hits retrieved by each search engines are as shown in table 1.

No.	Keywords	Search Engines			Metasearch Engines			Total
		Bing	Google	Lycos	Dogpile	Ixquick	Web Crawler	
1	Medical Tourism	8980000	1240000	4330000	630	853580	270	15404480
2	Health Tourism	5080000	2950000	3260000	570	539420	490	11830480
3	Ayur-veda Tourism	1920000	2360000	140000	640	687789	530	6108959
4	Dental Tourism	320000	443000	281000	230	238659	210	1283099
5	Med.Tour.Hospita-ls	62500000	1720000	67300000	530	303893	450	131824873
6	Med. Trav.Agen.	44500000	403000	65100000	650	295999	490	110300139
7	Med. Travel Comp.	46700000	222000	88400000	710	203057	530	135526297
8	Med.Tour. Packages	48700000	719000	58400000	670	308852	530	108129052
9	Cost of Treat.	1860000	308000	60100000	250	230813	210	62499273
10	Jobs and Carriers	2500000	421000	3630000	280	414461	210	6965951
Total		223060000	10786000	351941000	5160	4076523	3920	589872603
Percentage		37.814	1.828	59.663	0.0008	0.691	0.0006	

Table 1. Retrieval efficiency of search engines on Medical Tourism in Kerala

On analysis it is found that number of hits retrieved for a particular key word varies with search engines. Further number of hits retrieved by Metasearch engines is very less, even negligible, when compared to that of general search engines. The table 1 shows that a total of 589872603 hits were retrieved by all the six search engines, of these Lycos shows high retrieval efficiency with 351941000 (59.66%) sites followed by Bing in the second position with 223060000 (37.81%) sites and Google with 10786000 (1.82%) sites and stands at the third position and the remaining less than 1% is shared by all the three Metasearch engines. Of these Ixquick stands first with a slight difference from others followed by Dogpile and WebCrawler.

Ten variables under the sub sector Ayurveda tourism is used to collect the results from six search engines. The variables used as key words are as shown in Table 2. On analysis it is found that a total of 44473380 sites were retrieved by all six search engines. Here also Lycos shows very high retrieval efficiency with 38023900 (85.49%) sites followed by Google and Bing with 7.87% and 6.59% of results respectively. Among Metasearch engines Ixquick stands first with 0.012% of total sites followed by WebCrawler and Dogpile.

Ten variables under the sub division Dental tourism in Kerala are used as key words and results are noted as given in Table 3. On analysis it is found that Search engine Google retrieved 5269200 sites out of a total of 11403330 sites and attains first with 46.20 % of results. Here Lycos comes second with 34.89% followed by Bing with 18.80%. Among Metasearch engines Ixquick stands first 0.042% followed by Dogpile and WebCrawler.

No.	Keywords	Search engines				Metasearch Engines		Total
		Bing	Google	Lycos	Dog-pile	Ixquick	WebCra-wler	
1	Ayurveda Tourism	767000	704000	2100000	310	640	410	3572360
2	Ayurveda Centres	375000	454000	446000	590	500	480	1276570
3	Ayurveda Packages	278000	371000	447000	350	850	600	1097800
4	Ayurveda Treatments	333000	433000	194000	330	740	270	961340
5	Pizhichil,Njavara., Dhaara,Mass.	6930	84300	64900	290	710	470	157600
6	Rasayana Chikitsa	46300	9400	125000	410	570	380	182060
7	Sweda Karma	1940	48000	1270900 280	140	210	0	1271637
8	Pancha karma	118000	3380000	1100000	280	570	4400	1145729
9	Yoga& Meditation	283000	2390000	1010000	310	350	2500	1062311
10	SPA Resorts	725000	865000	838000	230	460	390	2429080
	Total	2934170	35025000	38023900	3380	5530	3900	**44473380**
	Percentage	6.598	7.875	85.498	.008	.012	.009	

Table 2. Retrieval efficiency of search engines on Ayurveda tourism in Kerala

Five variables in the topic Fertility tourism are selected as key words and number of hits by all six search engines was noted as in Table 4. On analysis it is found that from a total of 25727150 sites Bing retrieved 15485400 sites with 60.19 % followed by Lycos with34.50 % and Google with 5.27% of results. Here also Metasearch engine Ixquick stands first among them followed by WebCrawler and Dogpile.

AYUSH is an acronym of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. Government of Kerala, with an aim to give a boost to traditional systems of medicines and incorporate them in the prevention and treatment of diseases, launched its AYUSH department on 5th August, 2015. The proposed department, designed on the model of the Centre's AYUSH department, is envisaged to focus on treatment, research and education in Ayurveda, Yoga, Unani, Siddha and Homoeopathy. Five components of AYUSH are selected for the key word searching and number of hits retrieved by six search engines was tabulated as in Table 5. On analysis it is found that search engine Lycos retrieved 33285000 sites with 50.47% from a total of 65941370 sites followed by Bing with 46.23% and Google with 3.28%. Among the Metasearch engines Dogpile stands first with 0.004% of total results followed by Ixquick and WebCrawler.

A number of Medical Tourism hospitals are there in Kerala. Ten hospitals selected from the top pages of all the six search engines were used to evaluate the retrieval efficiency of search engines on Medical Tourism hospitals. AIMS- Kochi, Ananthapuri-Trivandrum, Aster Medcity- Kochi, Indo American Hospital- Vaikom, KIMS- Trivandrum, Lakeshore- Kochi, Medical Trust-Kochi and Trichur Heart Hospital- Thissure are the selected hospitals and used as key words. Numbers of hits retrieved for each

No.	Keywords	Search engines			Metasearch engines			Total
		Bing	Google	Lycos	Dogpile	Ixquick	Webcra	
1	Dental Tourism	194000	455000	195000	270	430	330	845030
2	Dental Clinics	191000	1040000	186000	270	420	360	1418050
3	Dental tourism Packages	143000	870000	114000	290	590	240	1128120
4	Dental Treatments	201000	392000	191000	300	540	450	785290
5	Cosmetic Dentistry	34300	87200	50500	270	520	250	172840
6	Dental Studios	122000	650000	294000	300	400	290	1066990
7	Smile Designers	321000	825000	320000	310	520	400	1467230
8	Dental Implants	24400	109000	20200	250	300	350	154500
9	Orthodontics	32100	619000	38100	300	560	410	690470
10	Root canal Treatments	881000	222000	2570000	820	550	240	3674610
	Total	2143800	5269200	3978800	3380	4830	3320	**11403330**
	Percentage	18.800	46.208	34.891	.030	.042	.029	

Table 3. Retrieval efficiency of search engines on Dental tourism in Kerala

hospital by all six search engines were noted. Analysis shows that search engines Lycos and Bing retrieved almost same amount of hits with 46.90% and 46.26% respectively. As usual Google shows only a less amount of hits with 6.78% of results. Among Metasearch engines Ixquick comes first with 0.016% followed by WebCrawler and Dogpile as shown in Table 6.

Kerala is becoming one of the fertility tourism hubs of South India having a number of infertility clinics with world class facilities at affordable expense. IVF means In Vitro Fertilization which is an advanced reproductive technique. Hospital having infertility treatments are commonly called IVF hospitals. Five popular IVF hospitals selected from the top pages of six search engines were used as key words for finding retrieval efficiency of search engines on them. ARMC-Kozhikode, CRAFT Hospital- Thrissur, GIFT- Gyno IVF- Kochi, Lifeline Hospital-Adoor and Samad IVF- Trivandrum were the selected hospitals for the study. A total of 2764280 hits were retrieved by all the six search engines, of these Lycos stands first with 1408500 hits with 50.95% followed by Bing with 46.17% and Google at far behind with only 2.69%of hits. Here also Metasearch engine Ixquick comes first among them followed by Dogpile and WebCrawler as shown in Table 7.

Kerala is known as the land or home of Ayurveda and treatment centers are known by name resorts, hospitals, vydyasalas, clinics, spas, massage centers, ayurveda parlors etc; .Ayurveda tourism centers are there in all the 14 districts of Kerala. Here only five

No.	Keywords	Search Engines			Metasearch Engines			
		Bing	Google	Lycos	Dogpile	Ixqui-ck	Web Crawler	Total
1	Fertility Tourism	3070000	601000	3330000	230	550	450	7002230
2	Reproductive Tourism	2180000	469000	2150000	210	560	440	4800210
3	Surrogacy Tourism	9880000	143000	2950000	430	510	460	12974400
4	IVF	310000	81600	261000	580	480	530	654190
5	Neonatology	45400	62400	187000	510	420	390	296120
	Total	15485400	1357000	8878000	1910	2520	2270	25727150
	Percentage	60.190	5.274	34.508	.007	.009	.008	

Table 4. Retrieval efficiency of search engines on Fertility tourism in Kerala

No.	Keywords	Search Engines			Metasearch Engines			
		Bing	Google	Lycos	Dogpile	Ixqui-ck	Web Crawler	Total
1	AYUSH	9630000	425000	10500000	570	350	330	20556250
2	Yoga & Naturopathy	1090000	219000	1350000	690	580	510	2660780
3	Unani	9800000	433000	10800000	590	550	390	21034530
4	Siddha	9790000	536000	10500000	570	520	370	20827460
5	Homeopathy	176000	550000	135000	450	500	400	862350
	Total	30486000	2163000	33285000	2870	2500	2000	**65941370**
	Percentage	46.231	3.280	50.476	.004	.003	.003	

Table 5. Retrieval efficiency of search engines on AYUSH in Kerala

famous and well established Ayurveda centers in Kerala namely Dhanvanthari, Dhathri, Kottakkal, Nagarjuna and Somatheeram Ayurveda centers are taken as the key words for collecting web resources by six search engines. On analysis it is found that a total of 1591900 sites were retrieved by all the six search engines and Google stands first with 963000 sites with 60.49% followed by Lycos with 22.90% of results and Bing with 16.27%. Among the Metasearch engines Ixquick stands first as usual followed by WebCrawler and Dogpile as shown in Table 8.

No.	Keywords	Search Engines			Metasearch Engines			
		Bing	Google	Lycos	Dog-pile	Ixqui-ck	Web Crawler	Total
1	AIMS, Kochi	955000	664000	958000	530	510	390	2578430
2	Ananthapuri Trivandrum	8640	21100	13600	250	340	280	44210
3	Aster Medcity, Kochi	11700	30300	11600	300	330	370	54600
4	Indo-Amer. Hospital, Vaikom	2130	7130	2140	320	420	290	124300
5	KIMS, Trivandrum	27800	97000	27800	290	310	300	153500
6	Lakeshore, Kochi	40700	53300	40700	530	540	480	136250
7	Medi.Trust, Kochi	111000	157000	111000	310	330	360	380000
8	MIMS, Kottakkal	4350	15500	4220	290	310	300	24970
9	Specialists Hospital, Kochi	9500000	488000	9690000	410	500	430	19679340
10	Trichur Heart Hospital	89300	43100	40300	310	320	360	173690
	Total	10750620	1576430	10899360	3540	3910	3560	**23237420**
	Percentage	46.264	6.784	46.904	.015	.016	.015	

Table 6. Retrieval efficiency of search engines on Medical Tourism hospitals in Kerala

5. Conclusion

Medical Tourism in Kerala is an emerging field with a number of best hospitals, their infrastructure facilities, cost effective medical treatments and well trained human resources. But printed documents and reference sources are very less in this topic. Nascent information in primary sources are scattered in the journals of various disciplines like tourism, medicine business, economics, management etc. due to its multidisciplinary nature. But there are a number of web sources in the World Wide Web on Medical Tourism in Kerala. The exponential growth of the web resources propelled the rapid development of the web search engines which

No.	Keywords	Search Engines			Metasearch Engines			
		Bing	Google	Lycos	Dog-pile	Ixqui-ck	Web Crawler	Total
1	ARMC, Kozhikode	19900	5450	64200	340	310	330	90530
2	CRAFT Hosp.Tsr.	1060000	44400	1070000	470	500	410	2175780
3	GIFT?Gyno IVF, Kochi	132000	8830	132000	310	330	300	273770
4	Lifeline Hosp.Adr.	32200	9850	32300	270	340	280	75240
5	Samad IVF, Trivandrum	32200	5960	110000	220	330	250	148960
	Total	1276300	74490	1408500	1610	1810	1570	**2764280**
	Percentage	46.171	2.694	50.953	.058	.065	.056	

Table 7. Retrieval efficiency of search engines on IVF hospitals in Kerala

No.	Keywords	Search Engines			Metasearch Engines			
		Bing	Google	Lycos	Dog-pile	Ixqui-ck	Web Crawler	Total
1	Dhanvanthari Ayurveda	106000	123000	114000	370	720	570	344660
2	Dhathri Ayurveda	17500	113000	30500	190	290	250	161730
3	Kottakkal Ayurveda	51300	257000	64100	340	350	330	373420
4	Nagarg. Ayurveda	40600	361000	61600	260	450	410	464320
5	Somath. Ayurveda	43700	109000	94400	230	270	170	247770
	Total	259100	963000	364600	1390	2080	1730	1591900
	Percentage	16.276	60.493	22.903	0.087	0.130	0.108	

Table 8. Retrieval efficiency of search engines on Ayurveda Centers in Kerala

are the most effective tools to access information on various topics. They retrieve a huge amount of information with a number of irrelevant sites. In this study search engines and Metasearch engines are at two extremes in their retrieval efficiency, but their precisions are at the same range. Even though Metasearch engines show very low relative recall, their precision is same as that of search engines with high relative recall. Webometric studies on search engines are manifold, which provide some inputs to web site developers as well as search engine designers to make the search engines more capable.

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