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Webometric analysis of Open Access Repositories of Health and Medical Sciences in the Continent of North America

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Evaluating the quantity and quality of information available on the digital repository websites of Health and Medical Sciences in North American continent is a key strategy to ensure the web-based activities of these repositories. A total of 72 open-access digital repositories were identified from Open ROAR and DOAR. Data was collected using the Google search engine. Results indicate that the College of Physicians of Philadelphia Digital Library occupies first place with 10.40% SWIF. The repository of the Rockefeller University i.e. digital commons @ RU ranks first position with 16800 web pages and 30800 in-link web pages and 1.83 in-links WIF. Mouseion at the JAX Library occupies the first rank with a 19.88371 wiser index value followed by the bioRxiv. This analysis will help the information professionals, researchers to get a clear idea about the qualitative and informative repositories' websites of this discipline in the continent of North America. Suggests the need to incorporate certain practices to increase their global visibility and web presence.

Keywords: *Digital Repository, Open Access, Open DOAR, Open ROAR, Health & Medical Science, WISER Index, Web Impact Factor*

1 INTRODUCTION

The initiative of the open access movement has brought major changes in the communication process of the scholarly community. It has played a major role in building institutional digital repositories (IDR) in various educational institutions, and research institutes in different countries.

Academic and research institutes worldwide are acquiring and preserving scholarly literature published by scholars of these institutes in order to provide global access to such knowledge objects outside the institute through their websites.

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An IDR of health and medical Sciences is no exception. In this digital age, various research institutes in health and medical Sciences promote their scholarly research through institutional digital repositories and spread it to different parts of the world through websites. Health and medical science is an important field of research to the academic community as it helps to prolong the lives of patients suffering from various diseases through the application of modern medical treatment. A total of 72 unique repositories have been selected from ROAR and Open DOAR databases after eliminating all common repositories for this study. The objective of the study is to analyse the websites of select open-access digital repositories in the continent of North America to find out their various types of links in exploring the web presence of such repositories and to calculate web impact factors of selected open-access digital repository websites of such domain. Another objective is to know the visibility and connectivity of open-access digital repositories of health and medical sciences on the web based on WISER ranking method.

2 LITERATURE REVIEW

Webometrics is an important field that helps information professionals to analyse websites and to rank them based on webometric methods. Webometrics is a quantitative study that includes the different areas of webometric research i.e. webometrics development, web content analysis, web link analysis, web technology analysis, and web impact factor. Björneborn & Ingwersen[1,2] developed the concept of webometric studies through their research. Jalal, Biswas, and Mukhopadhyay[3] observed the trend of webometrics from bibliometric. They also described the important application areas of webometrics research, data collection tools, and techniques to encounter the problems in webometric research. They reviewed the different areas of webometrics research, methodology adopted for data collection, techniques and tools of web analysis, and the problems encountered in web research. Web content analysis is one of the parameters of webometric analysis. Thelwall[4] identified the reasons for the creation of hyperlinks in the academic field and in another study Thelwall[5] reported the methods of targeted links from national systems of university Web sites. Thanuskodi[6] analysed the content of web pages of libraries of institutes of national importance in India and applied the bibliometric methods to evaluate the contents, the link structures, and other research areas in Webometrics. He suggested that the webometric techniques are still in the experimental stage. Web link analysis is another important method of webometric study. Different authors[7,8,3,9] used this method of their research to assess the websites of IIT Library websites, various academic institutions, Medical Universities, central Universities, and technical institutes and express their current status. Shukla and Poluru[10] analyzed the websites of 173 Indian state universities for their web presence and find way a high web link to develop their web presence on the web using Socscibot 4 web crawlers. On the other hand, web technology investigation is another important parameter of webometric research[11,12,1,3]. Thelwall[14] compared the API of Google, Live Search, and Yahoo to discover the reliability and irregularity of these three search engines. Web Impact Factor uses to measure the average link frequencies which is one of the quantitative indicators developed by Peter Ingwersen[15] in 1998

and different authors[12,16,17,6] calculated the web impact factor of websites of the diverse fields. Islam and Alam[18] evaluated 44 private Universities in Bangladesh by calculating the impact of websites and their impact factors on the basis of webometric indicators. The results revealed that these colleges did not have much of an impression on the web and one of the private colleges was not very well known internationally due to the low number of link pages. Majhi & Das[19,20] analysed the websites of high courts in India and ranked them based on their web impact factors using different tools like Alexa, Google page rank, Neil Patel SEO analysis, Google search engine, and SocScibot4 for designing In-link, Out-link and mapping visualization of this sites. In another study, authored attempted to analyze and rank South Asian digital repositories using the Google search engine. They used SocSciBot4 for the mapping of the links.

3 OBJECTIVES

The main objectives of this proposed study entitled Webometric analysis of Open Access Repositories of Health and Medical Sciences in the Continent of North America is to critically investigate the following specific objectives:

1. To analyze the selected open accesses digital repositories of Health and Medical Sciences in the Continent of North America extracted from Open DOAR and ROAR repository on the basis of their websites' activity;
2. To find out various types of links, explore the web presence and calculate various web impact factors of websites of the selected open accesses digital repositories of Health and Medical Sciences;
3. To use WISER (**W**eb **I**ndicators for **S**cience, T**e**chnology and Innovation **R**esearch) ranking method to know the visibility and connectivity of the open accesses digital repositories Health and Medical Sciences on the web.

4 SCOPE AND LIMITATIONS

The present study examined the website of 72 unique health and medical science repositories that have been finally selected from ROAR and open DOAR after eliminating all common repositories. In open DOAR and ROAR, 'Health and Medical Sciences' as a key subject covers different fields of medical science.

4 METHODOLOGY

In the study, survey and observation method have been used. Google search engine has been used to collect data from the websites of selected open accesses digital repositories of registered in ROAR and OpenDOAR databases. Before using the list, we checked the access of each open-access digital repository of health and medical sciences. A total of 72 websites of have been selected between 75 health and medical repositories in the continent of North America that are registered on the Open DOAR and ROAR databases. Finally, collected data have been analysed and discussed against pre-defined parameters considering the purpose of the study (Open DOAR & Open ROAR, 2020)[21,22].

41 DATA COLLECTION THROUGH SEARCHING

Data were collected using Google's search engine based on the advanced query syntax of AltaVista from December 2020 through March 2021. The following syntax is used to collect data for each of the selected health & medical repository websites as:

- ***site/domain: url*** *=Total number of WebPages to the websites under the url.*
- ***Link:url*** *=Total number of WebPages linking to the websites i.e. hyperlink pages.*
- ***Link:url AND site:url =****Total number of web pages under the websites i.e. Self-Link pages.*
- ***Link:url AND NOT site:url =****Total number of web pages not under the websites i.e.External-Link pages.*
- ***Link: url NOT site: url*** *- total number of links incoming from other websites, i.e. inlink /backlink pages*
- **Site: url filetype:pdf/ppt/doc=**Report total number of pdf/ppt/doc files

42 CALCULATION OF WEB IMPACT FACTORS (WIF)

Most of the webometric study is based on the web impact factors (WIFs) of either simple WIF (WIFs) or revised WIF (WIFs). The calculation of WIF is as follows

- Simple WIF =Total number of links divided by total number of web pages
- Self-link WIF =Total number self-link web pages divided by total number of web pages
- External-link WIF =Total number of external-link web pages divided by total number of web pages
- InLink / Revised WIF =Total number of in-link web pages divided by total number of web pages

Where A=Total no of WebPages of a given site; B=Total no of external back links to a given site; C=Total no of self link of a given site; D=total no of links to a given site.

43 ***CALCULATION OF WISER INDEX VALUE IS AS FOLLOW***

The activity of medical digital repositories is multi-dimensional which is reflected in its web presence. So these different aspects measures with the help of a group of different indicators which is called WISER Ranking Method for the ranking of these repositories.

Webometrics Rank (position) = 4*Rank V + 2*Rank S + 1*Rank R + 1*Rank Sc

(Where**, V=**Visibility**; S=** Size**; R=** Rich Files and **Sc=** Google Scholar**.)**

Aguillo, et al. (2008) has given the formula for WISER ranking as:

WISER ranking = log (Visibility 50%) + log (Size 20%) + log (Rich files 15%) + log (Scholars 15%).

5 DATA ANALYSIS AND INTERPRETATION

WIF for each Health and Medical digital Repositories have been calculated on the basis of formula which has been discussed (see section 4.2) against four different ways. These are WIF (simple) a ratio of number of total link pages and number of web pages; WIF (Self link)-a ratio of number of total self link pages and number of web pages; WIF (External link)-a ratio of number of total external link pages and number of web pages; WIF (Revised link)-a ratio of number of total in-link pages and number of web pages which reflex of the degree of impact of the domain spaces on the WWW [23]. A matrix may represent the calculation of WIF of different web spaces in different levels shown in four tables (1-4).

Table 1: Simple-Link Web Impact Factor of Websites of H & M Science Repositories

Sl No.	Name of the Health and Medical Science Repositories in the Continent of North America	No of Webpage (A)	Simple Link Pages (B)	Simple Web IF B/A	RANK
1	ACHS, Theses and Capstone Projects	4160	2970	1.400673401	11
2	Aphasiology Archive	3020	77300	0.039068564	64
3	Archie	46700	13900	3.35971223	4
4	Aurora Health Care Digital Repository	3390	28100	0.120640569	49
5	Authors@Fred Hutch repository	2650	59100	0.044839255	62
6	Biological Magnetic Resonance Data Bank	43600	37100	1.175202156	15
7	bioRxiv,	1000000	7120000	0.140449438	46
8	CDC Stacks	150000	585000	0.256410256	39
9	CentraCare Health	1600	9130	0.17524644	44
10	Child Abuse Library Online	3340	8670	0.385236448	34
11	College of Physicians of Philadelphia Digital Library	4340	417	10.40767386	1
12	CU FIND (Campbell University, Catherine W. Wood School of Nursing)	2900	8670	0.334486736	36
13	Digital Collections	86400	116000000	0.000744828	71
14	Digital Commons @ Cortland	4330	12400	0.349193548	35
15	Digital Commons @ EMUI	13600	65400	0.20795107	42
16	Digital Commons @ RU	16800	12600	1.333333333	13
17	Digital Commons@Becker	50800	42600	1.192488263	14
18	DigitalCommons@Lesley	14500	10500	1.380952381	12
19	DigitalCommons@PCOM	13300	12600	1.055555556	17
20	DigitalCommons@SHU	13200	28100	0.46975089	31
21	DigitalCommons@The Texas Medical Center	9320	9250	1.007567568	19
22	DigitalCommons@UNMC	9950	25300	0.393280632	33
23	DigitalHub	13400	138000	0.097101449	52
24	DMACC (Open SPACE @ DMACC)	1200	5390	0.222634508	40
25	Dryad	40700	52000	0.782692308	25
26	D-Scholarship@Pitt	67100	821000	0.081729598	59
27	Duquesne Scholarship Collection (Repository of Duquesne University libraries)	14400	162000	0.088888889	56
28	Electronic Data Methods (EDM) Forum repository	601000	153000	3.928104575	2
29	eScholarship@UMMS	36000	37200	0.967741935	21
30	FOundation LIterature Online	4980	49700	0.100201207	51
31	Himmelfarb Health Sciences Library, The George Washington University	23500	32800	0.716463415	26
32	Hofstra Northwell School of Medicine digital repository	12500	3250	3.846153846	3
33	Humboldt Digital Scholar	3350	35400	0.094632768	54
34	Idun	1320	14000	0.094285714	55
35	Inova Digital e-ArchiveS	960	4390	0.218678815	41
36	InterNano Nanomanufacturing Repository	2890	2020	1.430693069	10
37	International Journal of Medical Students	4440000	4340000	1.023041475	18
38	Jefferson Digital Commons	33400	126000	0.265079365	38
39	Johns Hopkins Bloomberg School of Public Health's OpenCourseWare	4590	32900	0.139513678	47

40	MaineHealth Knowledge Connection	2150	16700	0.128742515	48
41	MEDICA, Digital archive & IR the Medical University of South Carolina	8730	128000	0.068203125	60
42	medRxiv	280,000	1950000	0.143589744	45
43	MEDSpace	63100	34800	1.813218391	6
44	Misericordia Digital Commons	948	16500	0.057454545	61
45	Mouseion at the JAXlibrary	12800	13000	0.984615385	20
46	UASLP Institutional Open Access Repository	1360	778	1.748071979	8
47	NSU Works	52600	63300	0.830963665	23
48	Open Knowledge Repository	349000	179000	1.94972067	5
49	Profiles in Science	11900	75300000	0.000158035	71
50	Providence St. Joseph Health Digital Commons	7030	25000	0.2812	37
51	PubMed Central	78300000	92700000	0.844660194	22
52	Repositorio CUDI	2750	1520	1.809210526	7
53	Repositorio Institucional Investigare PUCMM	11600	14200	0.816901408	24
54	ResearchWorks @ University of Washington	115000	1.5E+08	0.000766667	69
55	Resource Repository	4390	260000	0.016884615	65
56	Rhode Island College Digital Commons	8290	79600	0.104145729	50
57	Rowan Digital Works	13900	22000	0.631818182	29
58	Scholarly Commons @ Baptist Health South Florida	4720	25500	0.185098039	43
59	Scholarly Commons @ Baystate Health	3200	4980	0.642570281	28
60	Institutional repository of Lehigh Valley Health Network	20700	30200	0.685430464	27
61	Sigma Repository	2190	26200	0.083587786	58
62	SMU Digital Repository	259	36400	0.007115385	67
63	SOAR@USA: Scholarship and Open Access Repository	1760	25800000	6.82E-05	72
64	UNF Digital Commons	28100	25700	1.093385214	16
65	University Archives	340	27800	0.012230216	66
66	University of Arizona Campus Repository	41600	26900	1.546468401	9
67	USD RED (University of South Dakota)	1060	872000	0.001215596	68
68	UT Southwestern Medical Center Institutional Repository	10200	21400	0.476635514	30
69	UTDR: University of Toledo Digital Repository	21400	243000	0.088065844	57
70	ValpoScholar	23800	550000	0.043272727	63
71	Via Sapientiae: The Institutional Repository at DePaul University	31000	324000	0.095679012	53
72	YMTDL: The Yale Medicine Thesis Digital Library	22100	52800	0.418560606	32

Note: NWP=No. of Web Page, SWLP=Simple Link Web Page, SWIF=Simple Link Web Impact Factor

The table1 illustrates the rank distribution of medical digital repositories in USA according to their Simple Web Impact Factor (SWIF). Dividing the number of link pages by number of WebPages, the Simple Web Impact Factor for each Medical Repositories has been calculated. The Historical Medical Library of The College of Physicians of Philadelphia (sl.11) occupies the first place with 10.40767386% SWIF. The second and third place goes to the repository of the Electronic Data Methods (EDM) Forum (sl.28) and the digital repository of the Donald and Barbara Zucker School of Medicine Academic Works (sl.32) with 3.9281% and 3.8461% SWIF. Four Medical repositories i.e. National Center for Biotechnological Information (NCBI) at the National Library of Medicine (sl.22), International Journal of Medical Students (IJMS) PROA journal (sl.37), bioRxiv (sl.7) have a large number of web pages but they ranked 33rd, 18th, 46th position based on their SWIFs respectively.

Table2: Self- Link Web Impact Factor of Websites of H & M Science Repositories

Sl No.	Name of the Health and Medical Science Repositories in the Continent of North America	No of Webpage (A)	Self Link Pages (B)	Self Link Web IF (B/A)	RANK
1	ACHS, Theses and Capstone Projects	4160	274	0.065865385	52
2	Aphasiology Archive	3020	59	0.019536424	68
3	Archie	46700	3020	0.064668094	54
4	Aurora Health Care Digital Repository	3390	1270	0.374631268	18
5	Authors@Fred Hutch repository	2650	165	0.062264151	58
6	Biological Magnetic Resonance Data Bank	43600	15700	0.360091743	19
7	bioRxiv	1000000	382000	0.382	16
8	CDC Stacks (IR of the Centers for Disease Control and Prevention)	150000	153000	1.02	3
9	CentraCare Health	1600	137	0.085625	45
10	Child Abuse Library Online	3340	341	0.102095808	40
11	College of Physicians of Philadelphia Digital Library	4340	280	0.064516129	55
12	CU FIND (Campbell University, Catherine W. Wood School of Nursing)	2900	152	0.052413793	63

13	Digital Collections	86400	5490	0.063541667	56
14	Digital Commons @ Cortland	4330	3730	0.861431871	7
15	Digital Commons @ EMUI	13600	2620	0.192647059	24
16	Digital Commons @ RU	16800	36700	2.18452381	1
17	Digital Commons @ Becker	50800	5170	0.101771654	41
18	DigitalCommons @ Lesley	14500	696	0.048	64
19	DigitalCommons @ PCOM	13300	938	0.070526316	50
20	DigitalCommons @ SHU	13200	2170	0.164393939	30
21	DigitalCommons @ The Texas Medical Center	9320	6140	0.658798283	12
22	DigitalCommons @ UNMC	9950	1010	0.101507538	42
23	DigitalHub	13400	882	0.065820896	53
24	DMACC (Open SPACE @ DMACC)	1200	1090	0.908333333	6
25	Dryad	40700	1500	0.036855037	66
26	D-Scholarship@Pitt	67100	35700	0.532041729	14
27	Duquesne Scholarship Collection (Repository of Duquesne University libraries)	14400	1500	0.104166667	39
28	Electronic Data Methods (EDM) Forum repository	601000	2	3.33E-06	72
29	eScholarship @ UMMS	36000	7520	0.208888889	23
30	FOundation LIterature Online	4980	3460	0.694779116	10
31	Himmelfarb Health Sciences Library, The George Washington University	23500	23800	1.012765957	4
32	Hofstra Northwell Academic Works (Hofstra Northwell School of Medicine)	12500	669	0.05352	61

33	Humboldt Digital Scholar	3350	556	0.165970149	29
34	Idun	1320	500	0.378787879	17
35	Inova Digital e-ArchiveS	960	60	0.0625	56
36	InterNano Nanomanufacturing Repository	2890	659	0.228027682	22
37	International Journal of Medical Students	4440000	658	0.000148198	70
38	Jefferson Digital Commons	33400	4440	0.132934132	36
39	Johns Hopkins Bloomberg School of Public Health's Open Course Ware	4590	278	0.060566449	59
40	MaineHealth Knowledge Connection	2150	1560	0.725581395	8
41	MEDICA, Digital archive & IR the Medical University of South Carolina	8730	1210	0.13860252	35
42	medRxiv	280,000	69600	0.248571429	21
43	MEDSpace	63100	217	0.003438986	69
44	Misericordia Digital Commons	948	75	0.079113924	45
45	Mouseion at the JAXlibrary	12800	564	0.0440625	64
46	NSU Works	52600	30800	0.585551331	13
47	Open Knowledge Repository	349000	53500	0.153295129	31
48	Profiles in Science	11900	6040	0.507563025	15
49	Providence St. Joseph Health Digital Commons	7030	1020	0.145092461	33
50	PubMed Central	78300000	54500000	0.696040868	9
51	Repositorio CUDI	2750	0	0	72
52	Repositorio Institucional Investigare PUCMM	11600	44	0.003793103	68

53	ResearchWorks at the University of Washington	115000	6430	0.055913043	60
54	Resource Repository	4390	270	0.061503417	58
55	Rhode Island College Digital Commons	8290	608	0.073341375	48
56	Rowan Digital Works	13900	1960	0.141007194	34
57	Scholarly Commons @ Baptist Health South Florida	4720	319	0.067584746	50
58	Scholarly Commons @ Baystate Health	3200	3490	1.090625	2
59	Scholarly Works of Lehigh Valley Health Network	20700	2480	0.119806763	37
60	Sigma Repository	2190	323	0.147488584	32
61	SMU Digital Repository	259	74	0.285714286	20
62	SOAR @ USA: Scholarship and Open Access Repository	1760	137	0.077840909	46
63	UASLP Institutional Open Access Repository	1360	243	0.178676471	26
64	UNF Digital Commons	28100	19400	0.690391459	11
65	University Archives	340	63	0.185294118	25
66	University of Arizona Campus Repository	41600	7210	0.173317308	27
67	USD RED (University of South Dakota)	1060	102	0.096226415	42
68	UT Southwestern Medical Center Institutional Repository	10200	918	0.09	43
69	UTDR: University of Toledo Digital Repository	21400	650	0.030373832	66
70	ValpoScholar	23800	1850	0.077731092	47
71	Via Sapientiae: The Institutional Repository at DePaul University	31000	5320	0.171612903	28
72	YMTDL: The Yale Medicine Thesis Digital Library	22100	21400	0.968325792	5

Note: NWP=No. of Web Page, SWLP=Self Link Web Page, SWIF=Self Link Web Impact Factor

The table2 show the ranking of Health & Medical Repositories in the continent of North America is based on their Self Link Web Impact Factor. Repository of the Rockefeller University i.e. Digital Commons @ RU occupies the first place with 37600 Self Link Pages and 16800 WebPages with 2.1845% SWIF. The repository of Baystate Health i.e. Scholarly Commons @ Baystate Health and the CDC Stacks (IR of the Centers for Disease Control and Prevention) ranked 2nd and 3rd place with SWIF of 1.090625% and 1.02% respectively. Though the Pub Med Central, International Journal of Medical Students (IJMS) PROA journal, bioRxiv, Electronic Data Methods (EDM) Forum repository, have more number of web Pages (i.e. 78300000; 4440000; 1000000; 601000) compared to all other IDR. But still, they have occupied 9th, 70st, 16th, and 72nd position in the ranking respectively as because their number of Link Pages are very less compared to their number of WebPages.

Table3: External Link Web Impact Factor of Websites of H & M Science Repositories

Sl No.	Name of the Health and Medical Science Repositories in the Continent of North America	Webpage (A)	External Link (D)	EXT-LINK_WIF (D/A)	Rank
1	ACHS, Theses and Capstone Projects	4160	302	0.072596	54
2	Aphasiology Archive	3020	52	0.017219	67
3	Archie	46700	2700	0.057816	60
4	Aurora Health Care Digital Repository	3390	1390	0.410029	18
5	Authors @ Fred Hutch repository	2650	254	0.095849	47
6	Biological Magnetic Resonance Data Bank	43600	15500	0.355505	20
7	bioRxiv,	1000000	366000	0.366	19
8	CDC Stacks	150000	89800	0.598667	13
9	CentraCare Health	1600	171	0.106875	43
10	Child Abuse Library Online	3340	341	0.102096	46
11	College of Physicians of Philadelphia Digital Library	4340	281	0.064747	58
12	CU FIND (Campbell University, Catherine W. Wood School of Nursing)	2900	151	0.052069	63
13	Digital Collections	86400	5970	0.069097	56
14	Digital Commons @ Cortland	4330	3600	0.831409	7
15	Digital Commons @ EMUI	13600	2290	0.168382	30

16	Digital Commons @ RU	16800	36500	2.172619	1
17	Digital Commons @ Becker	50800	5440	0.107087	42
18	DigitalCommons @ Lesley	14500	793	0.05469	61
19	DigitalCommons @ PCOM	13300	1010	0.07594	53
20	DigitalCommons @SHU	13200	19000	1.439394	2
21	DigitalCommons @ The Texas Medical Center	9320	9820	1.053648	3
22	DigitalCommons @ UNMC	9950	1030	0.103518	45
23	DigitalHub	13400	939	0.070075	55
24	DMACC (Open SPACE @ DMACC)	1200	1090	0.908333	6
25	Dryad	40700	1600	0.039312	65
26	D-Scholarship @ Pitt	67100	39300	0.585693	14
27	Duquesne Scholarship Collection	14400	1500	0.104167	44
28	Electronic Data Methods (EDM) Forum repository	601000	2	3.33E-06	71
29	eScholarship@UMMS	36000	7180	0.199444	26
30	FOundation LIterature Online	4980	3460	0.694779	11
31	Himmelfarb Health Sciences Library, The George Washington University	23500	21600	0.919149	5
32	Hofstra Northwell Academic Works (Donald and Barbara Zucker School of Medicine Academic Works)	12500	674	0.05392	62
33	Humboldt Digital Scholar	3350	519	0.154925	31
34	Idun	1320	458	0.34697	21
35	Inova Digital e-ArchiveS	960	520	0.541667	15
36	InterNano Nanomanufacturing Repository	2890	1390	0.480969	17
37	International Journal of Medical Students	4440000	636	0.000143	70
38	Jefferson Digital Commons	33400	4170	0.12485	34
39	Johns Hopkins Bloomberg School of Public Health's OpenCourseWare	4590	303	0.066013	57
40	MaineHealth Knowledge Connection	2150	1560	0.725581	10
41	MEDICA, Digital archive & IR the Medical University of South Carolina	8730	1050	0.120275	39

42	medRxiv	280,000	69600	0.248571	23
43	MEDSpace	63100	217	0.003439	68
44	Misericordia Digital Commons	948	116	0.122363	38
45	Mouseion at the JAXlibrary	12800	560	0.04375	64
46	NSU Works	52600	31600	0.60076	12
47	Open Knowledge Repository	349000	53500	0.153295	32
48	Profiles in Science	11900	6400	0.537815	16
49	Providence St. Joseph Health Digital Commons	7030	941	0.133855	33
50	PubMed Central	78300000	60800000	0.776501	9
51	Repositorio CUDI	2750	0	0	72
52	Repositorio Institucional Investigare PUCMM	11600	16	0.001379	69
53	ResearchWorks at the University of Washington	115000	6820	0.059304	59
54	Resource Repository	4390	358	0.081549	50
55	Rhode Island College Digital Commons	8290	726	0.087575	49
56	Rowan Digital Works	13900	1730	0.12446	35
57	Scholarly Commons @ Baptist Health South Florida	4720	365	0.077331	52
58	Scholarly Commons @ Baystate Health	3200	2970	0.928125	4
59	IR of Lehigh Valley Health Network	20700	2290	0.110628	40
60	Sigma Repository	2190	471	0.215068	25
61	SMU Digital Repository	259	61	0.235521	24
62	SOAR @ USA: Scholarship and Open Access Repository	1760	189	0.107386	41
63	UASLP Institutional Open Access Repository	1360	446	0.327941	22
64	UNF Digital Commons	28100	21900	0.779359	8
65	University Archives	340	63	0.185294	27
66	University of Arizona Campus Repository	41600	7310	0.175721	28
67	USD RED (University of South Dakota)	1060	131	0.123585	36
68	UT Southwestern Medical Center Institutional Repository	10200	954	0.093529	48
69	UTDR: University of Toledo Digital Repository	21400	649	0.030327	66
70	ValpoScholar	23800	1850	0.077731	51
71	Via Sapientiae: The Institutional Repository at DePaul University	31000	5320	0.171613	29
72	YMTDL: The Yale Medicine Thesis Digital Library	22100	2710	0.122624	37

Note: NWP=No. of Web Page, EWLP=External Link Web Page, EWIF=External Link Web Impact Factor

Table3 reveals the rank distribution of Open Access Health & Medical Digital Repositories in the continent of North America based on their External Link Web Impact Factor (ELWIF). DigitalCommons@ RU is a repository of the Rockefeller University occupies the first place with 16800 WebPages, 36500 link pages, and its ELWIF is 2.1726%. Repository of the Sacred Heart University Library, Luxembourg and DigitalCommons@The Texas Medical Center have ranked 2nd and 3rd position with the EWIF as 1.4393 and 1.0536 respectively.

Table4: In-Link Web Impact Factor of Websites of H & M Science Repositories

Sl No.	Name of the Health and Medical Science Repositories in the Continent of North America	No of Webpage (A)	Revised/ Inlink Web pages (E)	RWIF/In-Link (E/A)	Rank
1	ACHS, Theses and Capstone Projects	4160	3080	0.740384615	4
2	Aphasiology Archive	3020	52	0.017218543	67
3	Archie	46700	1910	0.040899358	59
4	Aurora Health Care Digital Repository	3390	1160	0.342182891	9
5	authors@Fred Hutch	2650	123	0.046415094	57
6	Biological Magnetic Resonance Data Bank	43600	11900	0.27293578	14
7	bioRxiv,	1000000	356000	0.356	8
8	CDC Stacks	150000	94700	0.631333333	5
9	CentraCare Health	1600	103	0.064375	48
10	Child Abuse Library Online	3340	194	0.058083832	52
11	College of Physicians of Philadelphia Digital Library	4340	190	0.043778802	58
12	CU FIND (Campbell University, Catherine W. Wood School of Nursing)	2900	67	0.023103448	65
13	Digital Collections	86400	2880	0.033333333	61
14	Digital Commons @ Cortland	4330	337	0.077829099	45
15	Digital Commons @ EMUI	13600	1880	0.138235294	26
16	Digital Commons @ RU	16800	30800	1.833333333	1
17	Digital Commons @ Becker	50800	4710	0.092716535	40
18	DigitalCommons @ Lesley	14500	796	0.054896552	54
19	DigitalCommons @ PCOM	13300	862	0.06481203	47
20	DigitalCommons @ SHU	13200	1420	0.107575758	35
21	DigitalCommons @ The Texas Medical Center	9320	4500	0.482832618	6
22	DigitalCommons @ UNMC	9950	931	0.093567839	39
23	DigitalHub	13400	354	0.02641791	64

24	DMACC (Open SPACE @ DMACC)	1200	945	0.7875	2
25	Dryad	40700	2170	0.053316953	56
26	D-Scholarship@Pitt	67100	20000	0.298062593	13
27	Duquesne Scholarship Collection	14400	1510	0.104861111	37
28	Electronic Data Methods (EDM) Forum repository	601000	4	6.66E-06	71
29	eScholarship @ UMMS	36000	5370	0.149166667	24
30	FOundation LIterature Online	4980	704	0.141365462	25
31	Himmelfarb Health Sciences Library, The George Washington University	23500	7400	0.314893617	12
32	Hofstra Northwell Academic Works (Donald and Barbara Zucker School of Medicine Academic Works)	12500	692	0.05536	53
33	Humboldt Digital Scholar	3350	455	0.135820896	28
34	Idun	1320	261	0.197727273	19
35	Inova Digital e-ArchiveS	960	115	0.119791667	32
36	InterNano Nanomanufacturing Repository	2890	1220	0.422145329	7
37	International Journal of Medical Students	4440000	797	0.000179505	69
38	Jefferson Digital Commons	33400	7150	0.214071856	18
39	Johns Hopkins Bloomberg School of Public Health's OpenCourseWare	4590	332	0.072331155	46
40	MaineHealth Knowledge Connection	2150	699	0.325116279	10
41	MEDICA, Digital archive & IR the Medical University of South Carolina	8730	1190	0.136311569	27
42	medRxiv	280,000	74700	0.266785714	16
43	MEDSpace	63100	148	0.002345483	68
44	Misericordia Digital Commons	948	35	0.036919831	60
45	Mouseion at the JAXlibrary	12800	1390	0.10859375	34
46	NSU Works	52600	12500	0.237642586	17
47	Open Knowledge Repository	349000	47200	0.135243553	29
48	Profiles in Science	11900	1380	0.115966387	33
49	Providence St. Joseph Health Digital Commons	7030	597	0.084921764	41
50	PubMed Central	78300000	61600000	0.786717752	3
51	Repositorio CUDI	2750	0	0	72
52	Repositorio Institucional Investigare PUCMM	11600	2	0.000172414	70

53	ResearchWorks at the University of Washington	115000	6160	0.053565217	55
54	Resource Repository	4390	138	0.03143508	62
55	Rhode Island College Digital Commons	8290	484	0.058383595	51
56	Rowan Digital Works	13900	1460	0.105035971	36
57	Scholarly Commons @ Baptist Health South Florida	4720	108	0.022881356	66
58	Scholarly Commons @ Baystate Health	3200	1020	0.31875	11
59	Scholarly Works of Lehigh Valley Health Network	20700	1750	0.084541063	42
60	Sigma Repository	2190	384	0.175342466	22
61	SMU Digital Repository	259	51	0.196911197	20
62	SOAR@USA: Scholarship and Open Access Repository	1760	110	0.0625	49
63	UASLP Institutional Open Access Repository	1360	110	0.080882353	43
64	UNF Digital Commons	28100	3680	0.130960854	30
65	University Archives	340	43	0.126470588	31
66	University of Arizona Campus Repository	41600	6460	0.155288462	23
67	USD RED (University of South Dakota)	1060	83	0.078301887	44
68	UT Southwestern Medical Center Institutional Repository	10200	1910	0.187254902	21
69	UTDR: University of Toledo Digital Repository	21400	594	0.027757009	63
70	ValpoScholar	23800	1430	0.060084034	50
71	Via Sapientiae: The Institutional Repository at DePaul University	31000	3080	0.099354839	38
72	YMTDL: The Yale Medicine Thesis Digital Library	22100	6010	0.271945701	15

Note: NWP=No. of Web Page, IWLP=In-Link Web Page, RWIF=Revised Link Web Impact Factor

Table 4 exhibits the rank distribution of the 72 Open Access Health & Medical digital Repositories according to their revised web impact factor (RWIF) which has been calculated by putting the following formula i.e. Revised Web Impact Factor=E/A Where E=Internal Link Web Page and A=Number of Web Page. Digital Commons@ RU is a repository of The Rockefeller University again ranked first position with 16800 Web Pages and 30800 in-link web pages and 1.833333333 % RWIF; followed by the repository of Des Moines Area Community College i.e. Open SPACE @ DMACC with 1200 Web Pages and 945 in link web pages and 0.7875% RWIF. The National Library of Medicine's (NLM) National Center for Biotechnology Information (NCBI) i.e. PubMed Central occupied 3rd position with 0.7867% RWIF. Though International Journal of Medical Students and free online archive and distribution service i.e. bio R-xiv of Cold Spring Harbor Laboratory again having maximum number of webpages (i.e. 4440000 & 356000) compared

to all Digital Repositories but it stood at 69th and 08th position due to their less Revised or in-link web impact factor.

WISER Ranking

According to WISER (Web Indicator for Science, Technology and Innovation Research) Ranking method, the four indicators namely ize (S), Visibility (V), Rich Files (R), and Scholar (Sc) have been collected and have been given different weight to each indicator to calculating the rank of repositories. This ranking method is used to know the visibility and connectivity of the open access repositories on the web. The WISER Rank is calculated by using the following formula: WISER Rank = log (Visibility 50%) + log (Size 20%) +log (Rich Files 15%) +log (Scholar 15%) which is recommended by the World Webometrics Group for ranking academic institutions [24].

Table5: Ranking of Health & Medical Repositories in the Continent of North America based on WISER INDICATOR

Sl. No.	Name of the Health and Medical Science Repositories in the Continent of North America	WEBPAGES [A] (S)	IN-LINKS (B) [V]	Total Rich FILES(RC)				GOOGLE SCHOLAR (F) [SC]	WISER INDEX VALUE	RANK
				PDF	PPT	DOC	Total			
1	ACHS, Theses and Capstone Projects	4160	3080	695	0	3	698	0	8.127591	64
2	Aphasiology Archive	3020	52	2610	1	7	2618	277	8.408642	62
3	Archie	280,000	74700	578	0	6	584	2	10.7401	38
4	Aurora Health Care Digital Repository	2640	0	1110	0	2	1112	61	5.906251	67
5	authors@Fred Hutch	2650	123	20600	5	22	20627	166	9.399877	53
6	Biological Magnetic Resonance Data Bank	43600	11900	8280	10	21	8311	3810	13.56779	13
7	bioRxiv,	1000000	356000	240000	4	147	240151	13700	18.42084	2
8	CDC Stacks	150000	94700	177000	88	1110	178198	2850	16.21037	3
9	CentraCare Health	4330	337	377	0	0	377	134	8.219747	63
10	Child Abuse Library Online	340	43	130	0	0	130	51	5.338643	68
11	College of Physicians of Philadelphia Digital Library	2900	67	24	0	0	24	14	5.166995	69
12	CU FIND (Campbell University, Catherine W. Wood School of Nursing)	40700	2170	352	0	0	352	4530	11.50088	30
13	Digital Collections	13600	1880	4670000	622	2700	4673322	332	13.95064	11
14	Digital Commons @ Cortland	14500	796	3940	0	3	3943	236	10.3832	40
15	Digital Commons @ EMUI	4340	190	18200	1	50	18251	3920	11.123	34
16	Digital Commons @ RU	13200	1420	9770	0	46	9816	706	11.46578	31

17	Digital Commons@Becker	13400	354	12900	0	22	12922	3050	11.62392	28
18	DigitalCommons@Lesley	9320	4500	9570	2	9	9581	1250	12.05313	23
19	DigitalCommons@PCOM	7030	597	1240	0	0	1240	2030	10.37603	41
20	DigitalCommons@SHU	28100	3680	4210	2	8	4220	2310	12.35566	21
21	DigitalCommons@The Texas Medical Center	948	35	3930	1	7	3938	4090	9.080058	55
22	DigitalCommons@UNMC	50800	4710	2670	0	1	2671	2040	12.46737	20
23	DigitalHub	3390	1160	1100	0	1	1101	28	8.435786	61
24	DMACC (Open SPACE @ DMACC)	11900	1380	967	0	2	969	142	9.706221	49
25	Dryad	115000	6160	17000	5	35	17040	5720	14.19133	6
26	D-Scholarship@Pitt	52900	1300	234000	6	929	234935	4250	14.18892	7
27	Duquesne Scholarship Collection	67100	20000	13200	1	57	13258	4870	14.28994	5
28	Electronic Data Methods (EDM) Forum repository	601000	4	34700	7	211	34918	50	9.975136	44
29	eScholarship@UMMS	4980	704	6390	0	5	6395	5350	11.43118	33
30	FOundation LIterature Online	23500	7400	3280	1	10	3291	275	11.54914	29
31	Himmelfarb Health Sciences Library, The George Washington University	3350	455	2020	0	10	2030	1790	10.09559	42
32	Hofstra Northwell School of Medicine(Donald and Barbara Zucker School of Medicine Academic Works)	12500	692	1620	0	3	1623	114	9.556422	50
33	Humboldt Digital Scholar	1320	261	2890	3	58	2951	168	8.584676	60
34	Idun	4440000	797	600	1	4	605	1180	12.75466	17
35	Inova Digital e-ArchiveS	10200	638	90	0	0	90	64	7.926026	65
36	InterNano Nanomanufacturing Repository	36000	5370	1120	0	0	1120	206	11.00154	35
37	International Journal of Medical Students	960	115	172000	2	130	172132	126	9.731384	48
38	Jefferson Digital Commons	2150	699	18100	8	97	18205	7170	11.64481	27
39	Johns Hopkins Bloomberg School of Public Health's OpenCourseWare	349000	47200	3690	11	23	3724	845	14.06682	9
40	MaineHealth Knowledge Connection	46700	1910	81	0	0	81	507	9.916025	45
41	MEDICA, Digital archive & IR the Medical University of South Carolina	1600	103	27900	3	104	28007	7	7.861504	66
42	medRxiv	63100	148	33500	1	32	33533	6930	12.68868	18
43	MEDSpace	12800	1390	1480	0	0	1480	27	9.204033	54
44	Misericordia Digital Commons	13300	862	1560	0	1	1561	68	9.437453	52
45	Mouseion at the JAXlibrary	78300000	61600000	377	0	0	377	18700	19.88371	1

49	Providence St. Joseph Health Digital Commons	8290	484	713	0	0	713	877	9.751672	47
50	PubMed Central	1360	110	237000	133	738	237871	605000	13.68521	12
51	Repositorio CUDI	2750	0	279	0	0	279	1	3.538149	71
52	Repositorio Institucional Investigare PUCMM	33400	7150	628	0	2	630	35	10.07364	43
53	ResearchWorks at the University of Washington	8730	1190	52400	0	146	52546	1010	12.0936	22
54	Resource Repository	4390	138	13200	28	85	13313	26	8.673776	58
55	Rhode Island College Digital Commons	16800	30800	24900	1	3	24904	3990	14.06328	10
56	Rowan Digital Works	1060	83	4130	0	1	4131	3750	9.486653	51
57	Scholarly Commons @ Baptist Health South Florida	4720	108	288	0	0	288	1370	8.655662	59
58	Scholarly Commons @ Baystate Health	3200	1020	49	0	0	49	16900	9.784015	46
59	IR of Lehigh Valley Health Network	20700	1750	1930	0	0	1930	1820	11.45682	32
60	Sigma Repository	4590	332	713	0	0	713	438	9.029697	56
61	SMU Digital Repository	9170	616	3960	0	5	3965	1320	10.82295	36
62	SOAR@USA: Scholarship & Open Access Repository	1760	110	615000	92	1840	616932	212	10.75566	37
63	UASLP Institutional Open Access Repository	52600	12500	534	0	0	534	1080	11.93104	25
64	UNF Digital Commons	9950	931	3620	0	0	3620	6230	11.67215	26
65	University Archives	1340	540	7	0	0	7	6	4.834931	70
66	University of Arizona Campus Repository	41600	6460	9940	3	26	9969	1380	12.92004	16
67	USD RED (University of South Dakota)	320000	160	367000	56	1220	368276	455	13.28564	15
68	UT Southwestern Medical Center Institutional Repository	10200	1910	2060	2	0	2062	9	8.910347	57
69	UTDR: University of Toledo Digital Repository	21400	594	989	0	0	989	1230	10.54148	39
70	ValpoScholar	23800	1430	56600	10	212	56822	5310	13.36371	14
71	Via Sapientiae: The Institutional Repository at DePaul University	31000	3080	73100	66	294	73460	8840	14.1446	8
72	YMTDL: The Yale Medicine Thesis Digital Library	22100	6010	1420	1	8	1429	12	3.4778445	72

Note: NWP=No. of Web Page, IWLP=In-Link Web Page, RC=Rich Files, GS-Google Scholar,

An endeavour has been formed to rank the WebPages and links of USA medical repositories using webometric indicators and WISER value, which has already been explained in the research methodology section. Table-6 highlights the position of the health and medical science repositories' websites of Continent of North America based on their WISER value. Website of Mouseion at the JAXlibrary an electronic

archive of research, history, and scholarship assumed the foremost rank with 19.88371 WISER values scored the topmost position. But Mouseion at the JAXlibrary acquired rank 35th in the in-link impact factor with regard to the entire WebPages and holds the 65th positions with a compliment to the total number of self-link WebPages. The bioRxiv (Cold Spring Harbor Laboratory-a-free online archive and distribution service) website with 18.42084 WISER values came on the second position, followed by CDC Stacks i.e. the website of the digital archive of scientific research and literature of the Centers for Disease Control and Prevention (16.21037). At the bottom, the website of the digital archive of scientific research and literature of the Centers for Disease Control and Prevention came with 16.21 WISER values. It also had the least number of in-links of Duquesne Scholarship Collection i.e. the Repository of Duquesne University libraries and appears that the WISER method brings out a more representative and reliable picture in comparison to the web impact factor which is biased towards a smaller number of web pages and in-links.

6 FINDINGS

The results of this study provide valuable information about the nature and characteristics of, and trends for website links of IRs in the health and medical science repositories in the continent of North America. The study reveals that 87.67% of repositories are in a better position than others, due to their higher number of web pages. Google search engine indexes these repository websites during this period, although the number of links with others is minimal. It indicates that digital repositories have accepted the significance of the web and its utility in day-to-day life. The influence on the web of any repository website can be measured from the number of links a repository's website receives and the total number of visitors it attracts. This study calculated and compared the number of web pages, simple links, self links, in-links, external links, and the total and absolute WIF of repositories in the continent of North America. It also analysed the web Impact factors and the WISER values of the websites of health and medical science repositories and ranking based on these webometric indicators. The quantitative examination of any information concerning the WWW is extremely complicated because there are various issues for analysing specific information about the WWW. For the distributed characteristics of the hypertext system of the World Wide Web, all information is unstructured, and there is no chance to monitor or prerequisites for the utilization of mark-up codes. So the energetic and real-time nature of the internet, only an asynchronous analysis is conceivable [24]. During this period, the Google search engine indexed 4340 web pages on the Historical Medical Library of the College of Physicians of Philadelphia website. These pages in general received 417 simple links. Since the WIF is calculated by dividing the total number of simple links by the number of web pages. Therefore, the website of the Historical Medical Library of the College of Physicians of Philadelphia with only 4340 web pages placed at the top of total health and medical science repositories in the continent of North America. The simple WIF of the Historical Medical Library of The College of Physicians of Philadelphia was 10.40767386. Whereas Google search engine indexed the huge number of web pages on the National Library of Medicine's (NLM) National Center for Biotechnology Information i.e. Pub Med Central, the

International Journal of Medical Students PROA journal, bioRxiv websites. So received a huge number of simple links based on their highest number of web pages and ranked 22nd, 18th, 46th respectively. The WIFs are constantly inferential and not absolute. The WIF of a site is not also static, since continuously a few webmasters wipe the old in-links to different websites and others are connecting to unused ones. The total number of links to one site means, the sum of links that is devoted to the website. And the WIF is a form of assessment, which helps to review the capability and identify the relative location of any websites at a national and international level. According to Thelwall [25], measuring the WIF of a domain by AltaVista can be accurate enough if the website has a large number of web pages. He recommends that before using a search engine to calculate WIF for a website, it should be ensured that there are a large number of web pages on the same website. Table 2 contains the different webometric data used to calculate the self-link web impact factor using the proposed formula and shows the final ranking of websites hosting health and medical repositories in the continent of North America. The first three columns of Table 2 (URLs of Health & Medical repositories websites, total no. of Indexed web pages, and the total no. self links) show the metrics used to calculate the web self-link impact factor. The ranking reveals that the best Web sites for health and medical repositories are that the Repository of the Rockefeller University i.e. Digital Commons @ RU, the repository of Baystate Health i.e. Scholarly Commons @ Baystate Health, and CDC Stacks i.e. IR of the Centers for Disease Control and Prevention. This denotes the relationship between information and pages of these repository websites and it was also found that they are better than the other repositories. The greater number of self-link impact factors of these repositories indicate the improved link between the pages and existing information resources inside the website and proper guidance of the users. Besides, the analysis of the external web impact factor of these repository Websites reveals that the Digital Commons@ RU (a repository of the Rockefeller University) occupies the first place (Table 3). Since 16800 WebPages get linked by 36500 WebPages of other websites. It helps in getting the highest external impact factor. Almost all the health and medical science repositories websites have a huge number of indexed web pages. But they are ranked on different levels due to their limitation of getting links from web pages of other websites. Repository of the Sacred Heart University Library, Luxembourg i.e. Digital Commons @SHU and Digital Commons @The Texas Medical Center have ranked 2nd and 3rd position respectively. This result suggests that these two repositories in the continent of North America added reliable and informative high-quality website links to web pages. So more number of external links to the websites of these medical repositories assists to improve the credibility of these websites that denotes the contents of these medical repositories are more valuable. A greater number of external links of the medical repository websites denotes the links to the popular and relevant web pages that are highly related and ranked to the content of the web pages. It also helps to improve the authority of a website, by providing a viewer with references [26]. A hyperlink to a webpage from another webpage is sometimes called a page inlink. A site in-link is a link between pages on a different website. Similarly, a domain inlink is a link between pages with a different domain name. When it is clear from the context whether it is a web page, domain, or site inlink, the term in-link is sometimes used [14]. The repository of the Rockefeller University ranked the first position with 16800 Web Pages and

30800 in-link web pages and 1.8333% RWIF. In-links denotes links coming into the site from other sites like "citation of printed works" [7]. As a result, it serves as an indicator of the relevance and overall importance of a site. The in-links to a webpage helps to get its rank score and the in-links of a page increase its importance. The significance of in-links is threefold: (i) greater visibility on the Web and possibly more traffic to the webpage; (ii) better inclusion via web indexes and (iii) higher positioning in search results. According to the study, the majority of the medical repositories in the United States have a strong web presence with a large number of Web Pages, in-links, and rich content files. Based on these indicators, these repository websites scored a good WISER value during this analysis. On the other hand, there is a need for regular monitoring of the website's functionality and friendliness among the user group. In most cases, the WIF reflects its global recognition and the quality of the website's existing information sources. As a result, it is being used to determine the overall prominence and significance of a site.

7 CONCLUSION

Around the world, the number of digital repositories is growing in different disciplines. And this upward trend also noted in the health and medical sciences repositories. The present study provides detailed information about different link structures and the visibility of health and medical science repositories on the web. The present study focuses on the web impact factor and link analysis of repositories of the continent of North America as it is an unexplored area of webometric research. Moreover, this study concentrates on evaluating the linked structure of repository websites and analyzing the web presence on the web. The present study provides a fair idea and information about the websites of all the 72 health and medical science repositories of the USA. So this study provides a framework for ranking repositories websites in the Continent of North America based on different webometric methods. The study's findings will guide information professionals in evaluating strengths and weaknesses based on the performance of their repository websites. In general, having an adequate number of site pages on the websites can indicate the actual existence of these repository websites on the Internet. That affects their deception through web search tools and the number of external links received.

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