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Original Research

Does Altmetric Attention Score of Articles on Diabetes Mellitus Correlate with their Citations in Google Scholar, Scopus, Web of Science and Dimensions?

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Abstract

This applied altmetric study aimed to analyze the presence of highly-cited documents on diabetes mellitus in online social media and correlate their altmetric attention scores with their received citation counts. Twenty thousand highly-cited documents on diabetes mellitus were identified in Scopus and their altmetric attention scores (ASSs) were extracted from Altmetric Explorer (Altmetric LLP, London, UK). Received citation rates of the documents were extracted from Google Scholar, Scopus, Web of Science and Dimensions. Excell 2016 and SPSS 22 were used for data statistical description and analysis. Out of 19,383 DOI-owner highly-cited documents on diabetes mellitus, 16,076 (82.94%) were shared at least once in social media and had an altmetric attention score. Mendeley ranked first in sharing documents with 16,868 documents (87.02%). Six hundred forty-six thousand one hundred eighty-four tweets were tweeted on the studied documents from 222 countries, with the United States as first-ranked country (17,453 tweets, 18.2%). The highest-mentioned journal was the Lancet, and the highest-mentioned research institute was Harvard University. A significantly positive correlation was found between the altmetric attention scores of the studied documents and their citation counts in Google scholar (r= .842, p <.01), Scopus (r=.855, p <.01), Web of Science (r=.709, p <.05) and Dimensions (r= .841, p < .01). Regarding the central role of presence in social media in increasing the visibility and citability of documents, researchers must use the potentiality of social media and Web 2 tools for more sharing their scientific works and increasing the influence of their research output. In this study the relationship between the presence of documents in online social media and tools and their received citation rates was investigated in a large sample (20,000 diabetes mellitus documents). The results benefit researchers and research administrators for sharing and publicizing research output in social media.

Keywords: Social Media, Altmetrics, Bibliometrics, Citations, Highly-cited Papers.

Introduction

Due to researchers' expanded use of online social media, new metrics have been developed for studying output's scientific and social effectivenesss. These metrics are named alternative metrics or "altmetrics" (Galligan & Dyas-Correia, 2013; Zahedi, 2014). Altmetrics attempts to measure the degree of attention to and presence of scientific works in social networks, regardless of their standard citation rates. It measures the reading rate of a scientific item, too. On 29 September 2010, Jeason Priem coined altmetrics to complement traditional bibliometric indicators (Priem, Groth & Taraborelli, 2012; Priem, Piwowar & Hemminger, 2012; Priem, Taraborelli, Groth & Neylon, 2010). It measures the usability of a research item by counting for example, the rates of its views, downloads, shares, likes, tweets, posts, tags and bookmarks. It has been considered in almost all parts of the Web, such as wikis, news media, weblog platforms, and scientific and social media (Altmetric, 2018; Thelwall, Haustein, Larivière & Sugimoto, 2013). Journals, publishers, academics and research institutes increasingly use the metrics for job promotion, performance evaluation, making editorial policies, and processing grant applications (Haustein, 2014; Haustein, Larivière, Thelwall, Amyot & Peters, 2014; Li, Thelwall & Giustini, 2012; Piwowar, 2013).

Aiming to measure web-based research interactions, altmetrics manifests media used in distribution and analyses the messages about research output (Hammarfelt, 2014; Priem & Costello, 2010; Robinson-García, Torres-Salinas, Zahedi & Costas, 2014). It includes related discussions, links, page analyses and social data for making more search and share (Bar-Ilan, Haustein, Peters, Priem, Shema & Terliesner, 2012; Pooladian & Borrego, 2017) Having a wide audience, measuring real and immediate influence, considering media diversity and including different resources are of main features of altmetrics. In addition, it evaluates individual scientific items, such as a certain journal paper, regardless of its publishing journal (Neylon & Wu, 2009; Saberi, Isfandyari-Moghaddam & Mohamadesmaeil, 2011) as well as providing its immediacy index after its primary online publication (Brigham, 2014; Haustein, Costas & Larivière, 2015; Liu, Xu, Wu, Chen & Guo, 2013; Melero, 2015; Trueger, Thoma,Hsu, Sullivan,Peters & Lin, 2015).

Diabetes Mellitus is one of the main world concerns (Kandimalla, Thirumala & Reddy, 2017), and World Health Organization named it as a silent epidemic (Semeraro, Cancarini, Rezzola, Romano & Costagliola, 2015). It causes a death per 15 seconds and is ranked sixth in ranking mortality factors, resulting in 4 million deaths per year (Ogurtsova et al., 2017). Therefore, this study aimed to study the presence of research output on diabetes mellitus in online social media to highlight the importance of this presence in increasing research visibility and consequent socio-scientific influence.

Literature Review

Many altmetric studies have been conducted in different scientific fields worldwide (AlRyalat et al., 2022; Bonyadi Naeini & Moghiseh, 2021; Chen & Zhang, 2021; Chien et al., 2022; Dagar & Falcone, 2021; Gould et al., 2022; Sener & Polat, 2022; Shamsi, Lund & SeyyedHosseini, 2022). This section reviews some of the main and related studies on the medical field.

In an altmetric analysis of the most-cited 100 articles on the retina published between 2010

and 2020, it was found that the altmetric scores of these articles (with citation counts between 137-809 as counted in Web of Science) ranged from 0 to 1340. No statistical relationship existed between citation counts and altmetric scores (Sener & Polat, 2022).

In evaluating the social media impact of burn research, the bibliometric and altmetric indicators of 285 articles published in Burn Care and Research and Burns were studied. The mean rate of altmetric attention score (AAS) was 6.1, and 156 (55%) articles were mentioned in Twitter as the most influential one. A weak positive correlation was found between articles' AASs and citation counts (Richardson, Park, Echternacht & Bell, 2021).

A study on the possible correlation of altmetrics with citation counts of 1000 most-cited articles in the Nature showed that 989 (98.9%) articles were mentioned at least once in social media and tools. A significantly positive correlation was found between all altmetric indicators and citation counts (Ouchi, Saberi, Ansari, Hashempour & Isfandyari-Moghaddam, 2019).

In examining the correlation between altmetric scores and citations in the urology literature, 15 urology journals with the highest impact factors in 2013 and 2016 found that the correlation between altmetrc scores and citation counts was weak (Nocera, Boyd, Boudreau, Hakim & Rais-Bahrami, 2019).

The result of a study on the altmetric analysis of the top 100 publications published in the 91 journals in in the field of central nervous system inflammatory demyelinating disease showed no significant correlation between Altmetric Attention Score (AAS) and citation counts of the studied publications (Kim, Kim, Park, Yoon & Bae, 2019).

Aimed to identify and analyze research articles about oral cancer that provoked the most online attention, a study found that topics were mainly discussed on Facebook, Twitter, Mendeley, and news outlets. Most articles originated from the USA (n = 46) and Europe (n = 33; mainly from [UK]). Articles were published in 47 journals belonging to different specialities; journals with a social media account had significantly higher altmetric attention scores for their articles than those without an account (Hassona, Qutachi, Dardas, Alrashdan & Sawair, 2019).

As can be seen, in most of these studies, some relationship was detected between altmetric and bibliometric indicators, especially those of the citation count. This issue must be considered in different altmetric databases and various scientific fields to depict a better picture.

Materials and Methods

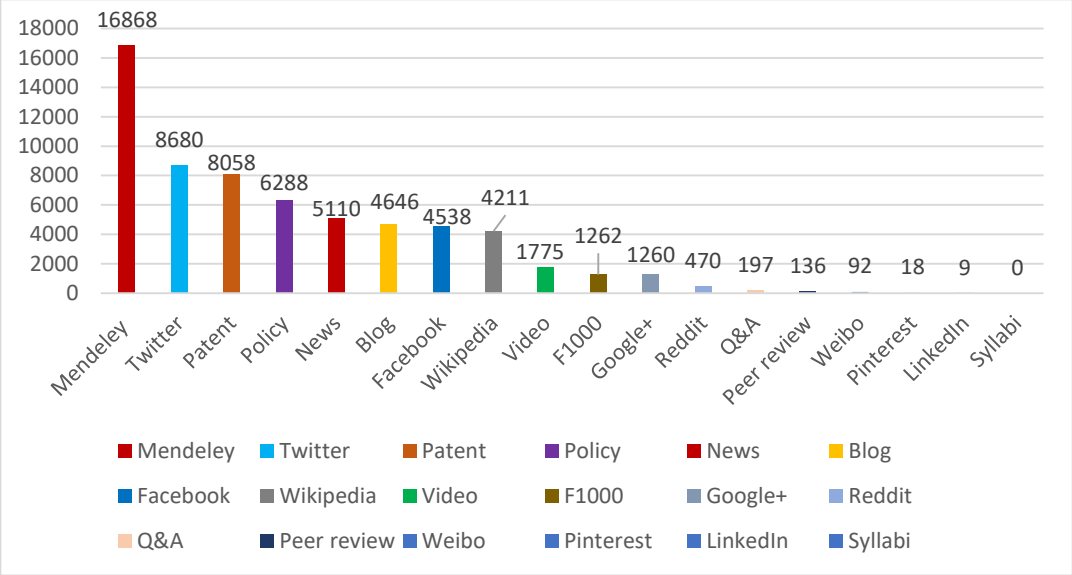
Used databases and data extraction process

This applied research was conducted with taking an altmetric and bibliometric approach. Study population included 20,000 highly-cited documents in diabetes mellitus indexed in Scopus, as a main indexing/abstracting database providing citation-based indicators in all scientific fields (Mokhtari, Barkhan, Haseli & Saberi, 2021; Heshmati, Hashempour, Saberi, Fattahi & Sahebi, 2020). Google Scholar, Scopus, Web of Science and Dimensions were used to extract citation data and Altmetric Explorer to extract altmetric data. Most previous altmetric studies used Altmetric Explorer's data for their analyses (Costas, Zahedi & Wouters, 2015; Robinson-García et al., 2014).

Citation-related data (including DOIs of documents) were extracted from Scopus in 26 April 2022 in CSV format with the search query as follows:

TITLE-ABS-KEY ("Diabetes Mellitus")

No limitation was made for search query. No Mesh–provided acronyms for diabetes mellitus were found, too. Nineteen thousand three hundred eighty-three documents with DOIs were retrieved and traced in Altmetric Explorer (Altmetric LLP, London, UK). Notably, documents with some types of identifiers, such as DOI, can be traced in Altmetric Explorer. As 16,076 documents (82.94%) had altmetric scores, their needed data were extracted in CSV file format. The citation-based data of the documents (received citation count) were extracted from Google Scholar, Scopus, Web of Science and Dimensions. The altmetric attention scores



(AASs) and citation counts of the documents were correlated

Figure 1: Frequency distribution of Altmetric Attention Scores of the studied documents

Data analysis

After extracting data from Altmetrics Explorer and the above databases, Excel 2016 and SPSS 22 software packages were used for achieving descriptive and inferential statist indicators.

Results

Presence in social media

Of the 20,000 studied documents, 19,383 DOI-owner documents could be traced in social media. Sixteen thousand seventy-six documents (82.94%) were shared at least once in social media and had an altmetric attention score. 3,307 ones had no altmetric attention score (17.6%). The sum of altmetric attention scores amounted to 1,018,611. Figure 1 shows the range of altmetric attention scores.

As can be seen, 8,517 documents (53%) were in the altmetric attention score range of 1-10. Range 11-20 (with 2,693 documents) and range 21-30 (with 1,114 documents) ranked 2nd and 3rd, respectively. With an increase in altmetric attention score range, the number of documents decreased, and only 1,678 documents (10.43%) had altmetric attention scores of ≥100.

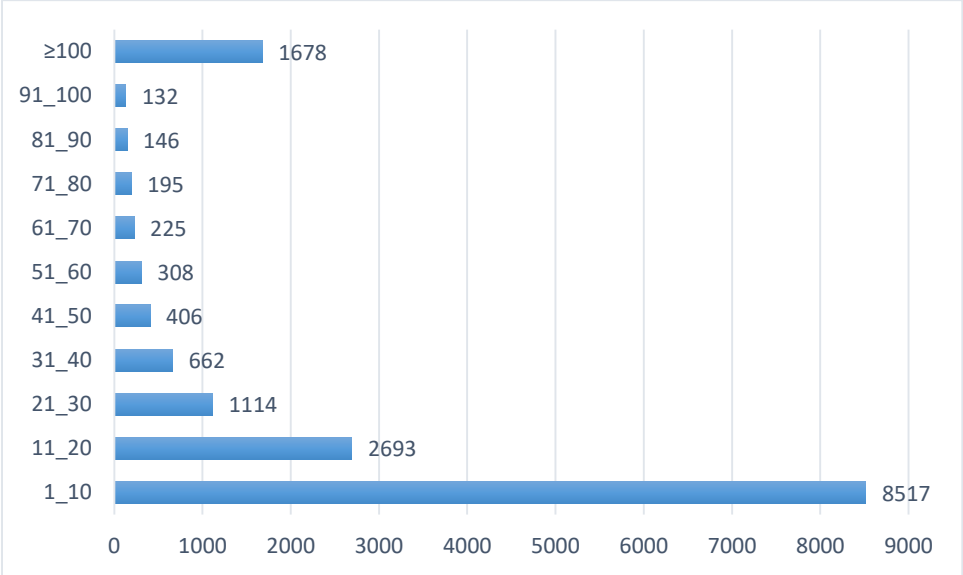


Figure 2: The frequency distribution of used social media in sharing studied documents

Figure 2: depicts the frequency distribution of different social media in distributing the studied documents. Mendeley ranked first by sharing 16,868 documents (87.02%), followed by Twitter with sharing 8,680 documents (44.78%) and Patent with sharing 8,058 documents (41.57%), respectively. Policy (6288), News (5110), Blog (4646), Facebook (4538), Wikipedia (4211), Video (1775), F1000 (1262), Google+ (1260), Reddit (470), Q&A (197), Peer review (136), Weibo (92), Pinterest (18) and LinkedIn (9) were of other sharing media. Syllabi had no role in this regard. Table 1 shows some descriptive statistics indicators of online mentions per source for the studied documents.

Of 17 sharing sources, Mendeley ranked first in mention counts (with 5,531,479 mentions and a mean rate of 285.37 readers per document). Twitter ranked second with 646,484 total mentions and a mean rate of 33.35 per document. The News was in the third rank with 88,894 news stories from different outlets with a mean rate of 4.58 news items per document. Patent ranked fourth with 77,269 mentions and a mean rate of 3.98 mentions per document. Patent ranked third in its use for sharing studied documents, as figure 2 shows.

On the other hand, it ranked fourth in total mention count, as Table 1 shows. It means that the most-used media are not necessarily the most influential ones. As the fourth-ranked medium for sharing, News was third-ranked in total mention count.

Table 1
Descriptive statistics for online mentions of studied documents in social media

Source	NP*	Total Altmetric Events (%)	Mean per NP	Min*	Max*	Rank
Mendeley	19383	5531479	285.37	0	29611	1
Twitter	19383	646184	33.35	0	18459	2
News	19383	88894	4.58	0	1766	3
Patent	19383	77296	3.98	0	988	4
Facebook	19383	33614	1.73	0	1326	5
Policy	19383	21025	1.08	0	113	6

Source	NP*	Total Altmetric Events (%)	Mean per NP	Min*	Max*	Rank
Blog	19383	16724	0.86	0	145	7
Wikipedia	19383	14739	0.76	0	422	8
Google+	19383	7263	0.37	0	1184	9
Video	19383	5919	0.30	0	220	10
F1000	19383	1902	0.09	0	9	11
Reddit	19383	1042	0.05	0	27	12
Weibo	19383	435	0.02	0	132	13
Peer review	19383	427	0.02	0	25	14
Q&A	19383	256	0.01	0	5	15
Pinterest	19383	20	0.001	0	2	16
LinkedIn	19383	10	0.0005	0	2	17
Syllabi	19383	0	0	0	0	18
*NP: Number of Publications; Min: Minimum; Max: Maximum.						

Users' demographic information

The top 10 countries of origin of Twitter, Facebook, News and Policy users having high mentions can be seen in Table 2.

Table 2
Distribution top 10 Countries' Twitter, Facebook, news and policy users based on the number of posts

Tweets and tweeters			Facebook posts and Pages			News stories and outlets			Policy documents and sources		
Country	Total tweets	Unique tweeters	Country	Total Facebook posts	Unique Facebook pages	Country	Total news stories	Unique news outlets	Country	Total policy documents	Unique policy sources
United States	117,453 (18.2%)	44,751 (16.1%)	United States	4,552 (13.5%)	2,155 (18.9%)	United States	58,608 (65.9%)	1,203 (43.6%)	Switzerland	6,302 (30%)	8(5.9%)
United Kingdom	46,522 (7.2%)	17,697 (6.4%)	United Kingdom	635 (1.9%)	258(2.3%)	United Kingdom	8,167 (9.2%)	298(10.8%)	United States	5,473 (26%)	46 (33.8%)
Spain	37,051 (5.7%)	10,151 (3.6%)	Canada	551 (1.6%)	256(2.2%)	Australia	4,410 (5%)	161(5.8%)	United Kingdom	4,214 (20%)	17 (12.5%)
Canada	16,886 (2.6%)	6,761 (2.4%)	Mexico	543 (1.6%)	167(1.5%)	India	3,047 (3.4%)	138(5%)	Australia	1,265(6%)	6(4.4%)
Japan	15,499 (2.4%)	8,659 (3.1%)	Italy	511 (1.5%)	146(1.3%)	Germany	1,764 (2%)	76(2.8%)	Netherlands	1,116 (5.3%)	5(3.7%)
Mexico	11,894 (1.8%)	4,684 (1.7%)	Australia	437 (1.3%)	263(2.3%)	Canada	1,398 (1.6%)	58(2.1%)	Germany	1,002 (4.8%)	2(1.5%)
Australia	11,441 (1.8%)	4,291 (1.5%)	Brazil	375 (1.1%)	145(1.3%)	Turkey	1,196 (1.3%)	5(0.2%)	Italy	583 (2.8%)	3(2.2%)
France	10,806 (1.7%)	4,665 (1.7%)	Spain	273 (0.8%)	114(1%)	New Zealand	931 (1%)	19(0.7%)	Sweden	557 (2.6%)	5(3.7%)
Brazil	9,053 (1.4%)	5,147 (1.8%)	Slovakia	222 (0.7%)	6(0.1%)	Spain	789 (0.9%)	81(2.9%)	Canada	179 (0.9%)	9(6.6%)
India	7,533 (1.2%)	3,693 (1.3%)	Germany	148 (0.4%)	64(0.6%)	France	708 (0.8%)	53(1.9%)	Luxembourg	102 (0.5%)	1(0.7%)

Out of the total of 646,184 tweets tweeted by 278,236 unique tweeters from 22 countries worldwide, the USA ranked first with 117,453 tweets (18.2%) tweeted by 44,751 tweeters (16.1%), followed by the United Kingdom with 46,522 tweets (17.2%) tweeted by 17,697

tweeters (6.4%) and Spain with 37,051 tweets (5.7%) by 10.151 tweeters (3.6%). The country of origin of 268,821 tweets was unknown.

33,614 Facebook posts on diabetes mellitus research output were posted by 11,399 unique Facebook pages dedicated to 109 countries. The first to third ranks belonged to the USA with 4,552 posts (13.5%) posted by 2155 unique pages (18.9%), the United Kingdom with 635 posts (1.9%) and Canada with 551 posts (1.6%), respectively. Twenty-two thousand nine hundred two posts had no information in this regard.

Out of 88,894 news stories on diabetes mellitus research output distributed by 2,760 unique news outlets from 111 countries, the first to third ranks belonged to the USA with 58,608 news stories (65.9%) distributed by 1,203 unique news outlets (43.6%), the United Kingdom with 8,167 news stories (9.2%) and Australia with 4,410 news stories (5.0%), respectively. Four hundred seventy-six news stories had no information in this regard.

In total, 21,025 Policy documents on the topic were produced by 136 unique policy sources in 29 countries worldwide. The first to third ranks belonged to Switzerland, with 6,302 documents (30%) published by 8 documents (5.9%), the United States with 5,473 documents (26.0%) and the United Kingdom with 4,214 documents (20%), respectively.

Top journals in presence rate and mention count

The altmetric features of the top 10 mentioned journals are included in Table 3

Table 3
Features of the top 10 journals in mentioning diabetes mellitus research outputs

Rank	Journal title	Number of mentioned outputs	Total mentions	Country	SJR	Quartile	H-Index
1	The Lancet	489	121250	UK	13.103	Q1	762
2	New England Journal of Medicine	567	95367	US	19.889	Q1	1,030
3	JAMA: Journal of the American Medical Association	404	57709	US	4.688	Q1	680
4	Diabetes Care	1193	38416	US	6.636	Q1	363
5	Nature	202	32331	UK	15.993	Q1	1,226
6	British Medical Journal	182	27200	UK	1.831	Q1	429
7	Circulation	533	26734	US	7.795	Q1	607
8	Journal of Steroid Biochemistry & Molecular Biology	7	17954	UK	1.153	Q1	127
9	Travel Medicine and Infectious Disease	1	16235	US	1.209	Q1	48
10	Cell Metabolism (Science Direct)	111	13391	US	10.326	Q1	266

In total, out of 1,608 related journals present in social media, the Lancet ranked first with 489 documents mentioned 121,250 times in different social media, followed by the New

England Journal of Medicine with 567 documents mentioned 95367 times and JAMA: Journal of the American Medical Association with 404 documents mentioned 57,709 times. All top 10 journals were from the USA and UK and included in Q1.

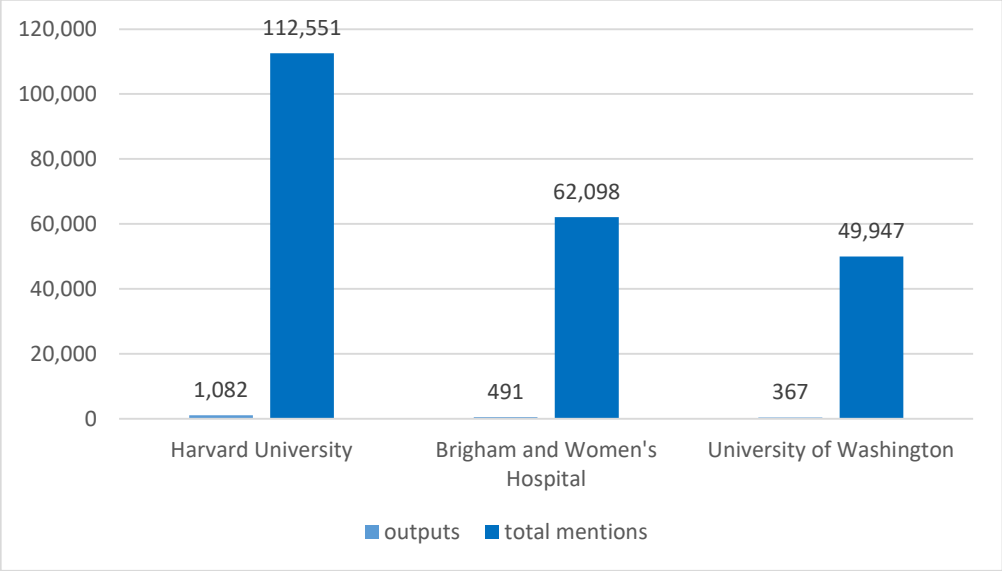


Figure 3: Top 3 affiliations of Diabetes Mellitus Outputs based on total mentions

Top three highly-mentioned institutes

Figure 3 depicts the number of cited documents and their total mention counts for the top three affiliations. As can be seen, with 1082 documents, Harvard University mentioned 112,551 times ranked first. Brigham and Women's Hospital, with 491 documents total, was 62,098 times ranked second, and the third rank belonged to the University of Washington, with 367 documents mentioned 49,947 times.

Correlational matrix of altmetric attention scores and received citation counts

Table 4 shows the correlational coefficients of correlation between the altmetric attention scores and citation counts of studied documents.

Table 4

Correlation between altmetric attention scores and citation counts of studied documents

Altmetric Score		
	Spearman's correlation coefficient	p-value
Google Scholar Citations	.842**	.002
Scopus Citations	.855**	.002
Web of Science Citations	.709*	.022
Dimensions Citations	.841**	.002
**. Correlation is significant at the .01 level.		
*. Correlation is significant at the .05 level.		

There was a significant positive correlation between altmetric attention scores of the studied documents and their citation counts in all studied databases ($p < .05$). In other words, the

presence of the documents in social media increased their citability of them in Google Scholar and Scopus, Web of Science and Dimensions.

Discussion

Aiming to study the presence of research output on diabetes mellitus in online social media for highlighting the importance of this kind of presence in increasing research visibility and consequent socio-scientific influence, we found in this study that out of 19,383 DOI-owner documents on diabetes mellitus, 16,076 (82.94%) were shared at least one time in social media and had an altmetric attention score. This rate is acceptable for the minimum presence in social media and needs to be reinforced regarding the times of sharing the rsearch output. This finding is not by the two studies (Costas et al., 2015; Robinson-García et al., 2014). The former found 15-24% of documents, and the latter found 19% (Robinson-García et al., 2014) being present in online social media at least once. However, 98.9% of 1000 highly-cited articles published in the Nature were mentioned at least once in social media websites and tools (Ouchi et al., 2019), reflecting its high prestige and its authors' tendency to use the facilities of these tools. Such a tendency needs to be encouraged in diabetes mellitus field.

Mendeley was found to be the highly-used medium in sharing scientific data in our study by covering 87.02% of the studied documents. This accords with another study (Ouchi et al., 2019). Usability and being user-friendly and open access can be reasons for more use of Mendeley. Encouraging authors in the field in sharing their works in this social application can be beneficial to the visibility of the papers published in the field.

With 18.2% of all tweets, the United States ranked first in or study. This accords with the findings of another study (Pooladian & Borrego, 2017). However, in a study (Ouchi et al., 2019), the United Kingdom ranked first in tweeting. As publishers and editorial teams make tweeting scientific papers, this is needed to be considered by authors and journal administrators. Authors in countries throughout the World should be encouraged and can use the application for sharing their papers on Twitter.

As the United States, the United Kingdom and Canada ranked in the top of countries using Facebook for posting related items, the scientific communities of these countries fairly use the tool for scientific goals. It is suggested that other countries throughout the World take this into account for more contributions to the research on diabetes mellitus.

The great volume of stories distributed in News (88,894) by 111 countries and documents in Policy (2,105) published by 29 countries as highly-cited documents showed such documents' importance. In news stories, the United States ranked first; in Policy documents, Switzerland ranked the first country. In a study (Hassona et al., 2019), these ranks were dedicated to the USA and the UK, respectively. It seems that News can potentially be an appropriate social forum for distributing research information on diabetes mellitus.

The Lancet, New England Journal of Medicine and JAMA, as top journals in publishing highly-cited documents, were top-ranked journals regarding their presence in social media and mentioning counts. These resources are highly prestigious medical journals with strong influence worldwide in different medical fields. Publishing diabetes mellitus papers in these journals helps distribute research information on the field throughout the World.

A significantly positive correlation was found between the altmetric attention scores of the studied documents and their citation counts in Google scholar, Scopus, Web of Science and Dimensions. In other words, the more the presence of a paper on diabetes mellitus in the studied social media is, the paper receives more citations in the known scientific indexing/abstracting

databases. Such a correlation has been reported in previous studies (Nocera et al., 2019; Ouchi et al., 2019; Repiso, Castillo-Esparcia & Torres-Salinas, 2019; Richardson et al., 2021). However, no correlation was found in one study (Sener & Polat, 2022). It can be said that the presence of research output in social media increases their visibility and, consequently, receives more citations and reach.

Conclusion

The development of online social media has changed researchers' behaviors and caused them to share their research output in these tools to increase their visibility. Research on diabetes mellitus is not an exception. In this study, the altmetric status of 20,000 highly-cited documents in diabetes mellitus was identified, and the relationship between their altmetric scores and received citation counts was investigated. It was found that with some ups and downs, researchers in the field have started using the capacity of social media for better accessibility and visibility of their works. In addition, the presence of diabetes mellitus documents in online social media correlates with their visibility and citation rates in different databases. It is necessary for researchers to ever-increasingly use the potentiality of social media and Web 2 tools for sharing their scientific works and reaching the tremendous influence of their research output.

Altmetric indicators can be used immediately after online publication to measure a scientific item's impact and real placement. For example, a published paper can be tweeted on Twitter or shared in ResearchGate immediately after its pre-publication or online publication. Therefore, these tools complement traditional bibliometric indicators in evaluating scientific authors in different aggregate levels. These indicators can benefit academics, research institutes, journals and authors sharing their research and impacting scientific communities. This is more important in the scientific fields related to human health and biological life, such as diabetes mellitus.

As studying altmetric concepts, tools, approaches and techniques are in their first steps, it is suggested that the indicators are studied in other fields for detecting new relations and approaches.

Conflict of Interests

The authors declare that they have no competing interests.

References

AlRyalat, S.A., Al Oweidat, K., Al-Essa, M., Ashouri, K., El Khatib, O., Al-Rawashdeh, A., Yaseen, A., Toumar, A. & Alrwashdeh, A. (2022). Influenza Altmetric Attention Score and its association with the influenza season in the USA. *F1000Research*, 9, 96. https://doi.org/10.12688%2Ff1000research.22127.3

Altmetric (2018). Patent data in altmetric highlights the commercialization of research– Altmetric. Retrieved from https://www.altmetric.com/press/press-releases/patent-data-in-altmetric-highlights-the-commercialization-of-research/

Bar-Ilan, J., Haustein, S., Peters, I., Priem, J., Shema, H. & Terliesner, J. (2012). Beyond citations: Scholars' visibility on the social Web. *arXiv Preprint arXiv:*1205.5611

Bonyadi Naeini, A. & Moghiseh, Z. (2021). The presence of neuromarketing scientific publications in social media: An altmetric study. *New Marketing Research Journal*, 11(1), 27-44. https://doi.org/10.22108/nmrj.2021.125291.2250 [in Persian]

Brigham, T. J. (2014). An introduction to altmetrics. *Medical Reference Services Quarterly*, 33(4), 438-447. https://doi.org/10.1080/02763869.2014.957093

Chen, J. & Zhang, Q. (2021). An Altmetric Study on Dental Informatics. In Advances in Computer Vision and Computational Biology: Proceedings from IPCV'20, HIMS'20, BIOCOMP'20, and BIOENG'20 (pp. 625-637). Cham: Springer International Publishing.

Chien, J.L., Sabharwal, J., Namoglu, E.C., Ghassibi, M.P., Yuan, M., Gandy, C., Wei, C., Somohano, K., Engelhard, S.B., Petrakos, P. & Van Tassel, S.H. (2022). The 100 most mentioned glaucoma articles online with highest altmetric attention scores. *Journal of Glaucoma*, 31(1), 8-14. https://doi.org/10.1097/ijg.0000000000001939

Costas, R., Zahedi, Z. & Wouters, P. (2015). Do "altmetrics" correlate with citations? Extensive comparison of altmetric indicators with citations from a multidisciplinary perspective. *Journal of the Association for Information Science and Technology*, 66(10), 2003-2019. https://doi.org/10.1002/asi.23309

Dagar, A. & Falcone, T. (2021). Altmetric scores analysis reveals a high demand for psychiatry research on social media. *Psychiatry Research*, 298, 113782. https://doi.org/10.1016/j.psychres.2021.113782

Galligan, F. & Dyas-Correia, S. (2013). Altmetrics: Rethinking the way we measure. *Serials Review*, 39(1), 56-61. https://doi.org/10.1016/j.serrev.2013.01.003

Gould, H.P., Bano, J.M., Rate, W., Civilette, M., Cohen, A.S., Samuelson, E.R., Haislup, B. & Bodendorfer, B.M. (2022). The top 100 most- Impactful articles on the Achilles Tendon: An altmetric analysis of online media. *Foot & Ankle Orthopaedics*, 7(1), 2473011421S2473000218. https://doi.org/10.1177%2F2473011421S00218

Hammarfelt, B. (2014). Using altmetrics for assessing research impact in the humanities. *Scientometrics*, 101(2), 1419-1430. https://doi.org/10.1007/s11192-014-1261-3

Hassona, Y., Qutachi, T., Dardas, L., Alrashdan, M. S. & Sawair, F. (2019). The online attention to oral cancer research: An altmetric analysis. *Oral Diseases*, 25(6), 1502-1510. https://doi.org/10.1111/odi.13111

Haustein, S. (2014). Readership Metrics. In *Beyond bibliometrics: Harnessing multidimensional indicators of scholarly impact*, Blaise Cronin and Cassidy R. Sugimoto (Eds.), 327-392. MIT Press.

Haustein, S., Costas, R. & Larivière, V. (2015). Characterizing social media metrics of scholarly papers: The effect of document properties and collaboration patterns. *PloS One*, 10(3), e0120495. https://doi.org/10.1371/journal.pone.0120495

Haustein, S., Larivière, V., Thelwall, M., Amyot, D. & Peters, I. (2014). Tweets vs. Mendeley readers: How do these two social media metrics differ? *IT-Information Technology*, 56(5), 207-215. https://doi.org/10.1515/itit-2014-1048

Heshmati, B., Hashempour, L., Saberi, M. K., Fattahi, A. & Sahebi, S. (2020). Global research trends of public libraries from 1968 to 2017: A bibliometric and visualization analysis. *Webology*, 17(1), 140-157. http://doi.org/10.14704/WEB/V17I1/a213

Kandimalla, R., Thirumala, V. & Reddy, P. H. (2017). Is alzheimer's disease a type 3 diabetes? A critical appraisal. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease*, 1863(5), 1078-1089. https://doi.org/10.1016/j.bbadis.2016.08.018

Kim, J.-E., Kim, Y., Park, K. M., Yoon, D. Y. & Bae, J. S. (2019). Top 100 publications as measured by altmetrics in the field of central nervous system inflammatory demyelinating disease. *BioMed Research International*,3748091. https://doi.org/10.1155/2019/3748091

Li, X., Thelwall, M. & Giustini, D. (2012). Validating online reference managers for scholarly impact measurement. *Scientometrics*, 91(2), 461-471. https://doi.org/10.1007/s11192-011-0580-x

Liu, C. L., Xu, Y. Q., Wu, H., Chen, S. S. & Guo, J. J. (2013). Correlation and interaction visualization of altmetric indicators extracted from scholarly social network activities: dimensions and structure. *Journal of medical Internet research*, 15(11), e259. https://doi.org/10.2196/jmir.2707

Melero, R. (2015). Altmetrics–a complement to conventional metrics. *Biochemia Medica: Biochemia Medica*, 25(2), 152-160. https://doi.org/10.11613%2FBM.2015.016

Mokhtari, H., Barkhan, S., Haseli, D. & Saberi, M. K. (2021). A bibliometric analysis and visualization of the Journal of Documentation: 1945–2018. *Journal of Documentation*. 77(1), 69-92. https://doi.org/10.1108/JD-08-2019-0165

Neylon, C. & Wu, S. (2009). Level metrics and the evolution of scientific impact. *PLoS Biology*, 7(11), e1000242. https://doi.org/10.1371/journal.pbio.1000242

Nocera, A. P., Boyd, C. J., Boudreau, H., Hakim, O. & Rais-Bahrami, S. (2019). Examining the correlation between altmetric score and citations in the urology literature. *Urology*, 134, 45-50. https://doi.org/10.1016/j.urology.2019.09.014

Ogurtsova, K., da Rocha Fernandes, J.D., Huang, Y., Linnenkamp, U., Guariguata, L., Cho, N.H., Cavan, D., Shaw, J.E. & Makaroff, L.E. (2017). IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. *Diabetes research and clinical practice*, 128, 40-50. https://doi.org/10.1016/j.diabres.2017.03.024

Ouchi, A., Saberi, M. K., Ansari, N., Hashempour, L. & Isfandyari-Moghaddam, A. (2019). Do altmetrics correlate with citations? A study based on the 1,000 most-cited articles. *Information Discovery and Delivery*. 47(4), 192-202. https://doi.org/10.1108/IDD-07-2019-0050

Piwowar, H. (2013). Value all research products. *Nature*, 493(7431), 159-159. https://doi.org/10.1038/493159a

Pooladian, A. & Borrego, Á. (2017). Twenty years of readership of library and information science literature under Mendeley's microscope. *Performance Measurement and Metrics*, 18(1), 67-77. https://doi.org/10.1108/PMM-02-2016-0006

Priem, J. & Costello, K. L. (2010). How and why scholars cite on Twitter. *Proceedings of the American Society for Information Science and Technology*, 47(1), 1-4. https://doi.org/10.1002/meet.14504701201

Priem, J., Groth, P. & Taraborelli, D. (2012). The altmetrics collection. *PloS One*, *7*(11). e48753. https://doi.org/10.1371/journal.pone.0048753

Priem, J., Piwowar, H. A. & Hemminger, B. M. (2012). Altmetrics in the wild: Using social media to explore scholarly impact. https://doi.org/10.48550/arXiv.1203.4745

Priem, J., Taraborelli, D., Groth, P. & Neylon, C. (2010). Altmetrics: A manifesto. Retrieved from http://altmetrics.org/manifesto/

Repiso, R., Castillo-Esparcia, A. & Torres-Salinas, D. (2019). Altmetrics, alternative indicators for Web of Science communication studies journals. *Scientometrics*, 119(2), 941-958. https://doi.org/10.1007/s11192-019-03070-7

Richardson, M. A., Park, W., Echternacht, S. R. & Bell, D. E. (2021). Altmetric attention score: Evaluating the social media impact of burn research. *Journal of Burn Care & Research*, 42(6), 1181-1185. https://doi.org/10.1093/jbcr/irab026

Robinson-García, N., Torres-Salinas, D., Zahedi, Z. & Costas, R. (2014). New data, new possibilities: Exploring the insides of Altmetric.com. *Profesional De La información*, 23(4), 359-366. https://doi.org/10.3145/epi.2014.jul.03

Saberi, M. K., Isfandyari-Moghaddam, A. & Mohamadesmaeil, S. (2011). Web citations analysis of the JASSS: The first ten years. *Journal of Artificial Societies and Social Simulation*, 14(4), 22-23. https://doi.org/ 10.18564/jasss.1803

Semeraro, F., Cancarini, A., Rezzola, S., Romano, M. R. & Costagliola, C. (2015). Diabetic retinopathy: Vascular and inflammatory disease. *Journal of Diabetes Research*, 45(6), 517-527. https://doi.org/10.1016/j.diabet.2019.04.002

Sener, H. & Polat, O. A. (2022). Altmetric analysis of the most-cited 100 articles on the retina published between 2010 and 2020. *Retina*, 42(2), 283-289. https://doi.org/10.1097/iae.0000000000003318

Shamsi, A., Lund, B. D. & SeyyedHosseini, S. (2022). Sharing of retracted COVID-19 articles: an altmetric study. *Journal of the Medical Library Association: JMLA*, 110(1), 97-105. https://doi.org/10.5195%2Fjmla.2022.1269

Thelwall, M., Haustein, S., Larivière, V. & Sugimoto, C. R. (2013). Do altmetrics work? Twitter and ten other social web services. *PloS One*, 8(5), e64841. https://doi.org/10.1371/journal.pone.0064841

Trueger, N. S., Thoma, B., Hsu, C. H., Sullivan, D., Peters, L. & Lin, M. (2015). The altmetric score: A new measure for article-level dissemination and impact. *Annals of Emergency Medicine*, 66(5), 549-553. http://dx.doi.org/10.1016/j.annemergmed.2015.04.022

Zahedi, Z. (2014). Analyzing readerships of international Iranian publications in Mendeley: An altmetrics study. Presented at *the first National Scientometrics Conference*, 21-22 May, 2014, Isfahan University, Iran. Retrieved from https://arxiv.org/ftp/arxiv/papers/1505/1505.01342.pdf [in Persian]