International Journal of Information Science and Management
Vol. 21, No. 4, 2023, 39-65
DOI: https://doi.org/10.22034/ijism.2023.1977905.0 / DOR: https://dorl.net/dor/20.1001.1.20088302.2023.21.4.3.9

Original Research

Altmetric Indices in the Field of Oncology: Journal Level

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Received: 18 July 2022
Accepted: 28 September 2022

Abstract

The study aims to analyze altmetric indices at the journal level in the field of oncology and also examine the relationship between altmetric indicators and citation-based indicators of the journals. The study includes an analytical approach. Altmetric indices were exported from Altmetric Explorer database, and citation-based indicators of oncology journals were gathered through Scopus in Microsoft Excel. SPSS software was utilized to analyze data inferentially and descriptively. The highest level of altmetric attention score belonged to CA-A CANCER JOURNAL FOR CLINICIANS in 2019. Twitter is the most used social media to share research outputs in oncology. There is a significant, positive, and moderate relationship between Altmetric Coverage and citation-based indicators (SNIP, SJR, and CiteScore). A significant, positive, and moderate relationship exists between Mean Altmetric Score and citation-based indicators (SNIP, SJR, and CiteScore). Journals, including high citation-based indicators in the field of oncology, are more likely to get more visibility via various social media. Researchers and policymakers could use altmetric indices via social media (such as Twitter) to improve health knowledge, connect the public and academics, and share clinical guides to enhance public health and reveal non-traditional scientific impact.

Keywords: Altmetric Coverage, Mean Altmetric Score, Oncology, Social Media, Journal Level, Citation-based Indicators.

Introduction

Due to the ubiquity and freeness of Web 2.0 tools and the rich potential of these tools for sharing content, especially for scientific purposes, researchers in various fields use different social media to communicate with the academic community and the general public (Mas-Balada, Thelwall, Kousha & Aguillo, 2014). This process has various benefits, including free dissemination of scientific content, societal and scientific impact, visibility, and professional communication (Bornmann & Hanschild, 2018). Many people's lives have been revolutionized by social media, attracting the industry and the academic community (Ngai, Tao & Moon, 2015). Thus, new indicators emerged, such as altmetrics, alternative, or social network indicators, to analyze societal and academic impacts (Ortega, 2015; Bornmann, 2014).

Altmetrics measures research impact by including publishing outside of traditional

scholarly publishing (Featherstone, 2014). Altmetrics were introduced to be utilized alongside traditional citation metrics to describe the impact of a study that is not just based on citation counts but rather based on metrics such as article views, downloads, or mentions in social media or news media (Priem, Taraborelli, Groth & Neylon, 2010). However, citations focus on measuring the scientific community's impact but not on other important stakeholders such as policymakers, patients, and the general public (Eysenbach, 2011).

Social media is rapidly used by the biomedical research community and healthcare professionals to convey information to other researchers, practitioners, and public members (Kolahi, Khazaei, Iranmanesh, Kim, Bang & Khademi, 2021). Major health communicators use Twitter to disseminate health information, make communications and relationships, or encourage people to perform health-related actions. Timely, accurate, direct, quick, and accessible health information is critical to improving public health (Han, Zhu & Kothari, 2019). Social media can be utilized to understand patients' views and needs and provide scientific, accurate, and trusted healthcare information (Brown et al., 2020). High attention to articles evaluating treatments via social media impact on public health. Dissemination of medical studies in social networks can affect patients, the public, researchers, physicians, and healthcare providers (Schwartz & Woloshin, 2004).

Altmetrics reflects online public attention but does not reflect the study's originality, quality, and validity. Altmetrics complements, rather than the citations. Researchers and publishers can see how their research is distributed online through social media platforms such as Twitter and Facebook or news articles (Murray, Hellen, Ralph & Raghallaigh, 2020).

The Altmetric scores may provide a broader, or at least different, aspect of research visibility and impact compared to citation counts (Thelwall, Haustein, Larivière & Sugimoto, 2013). The score is derived from an automated algorithm and represents a weighted count of the attention received for research output. It is worth mentioning that 'Altmetric Explorer' database is a commercial product of 'Altmetric LLP' one of the most reputable service providers and aggregators of altmetric data. It works as an enterprise providing social media outreach for individual researchers and publishers. Its goal is to provide information about the attention of a resource in various types of social media such as Twitter, Facebook, Reddit, Video, Pinterest, Google Plus, News Sites, Policy Documents, Blogs, F1000, Weibo, Q&A, etc. The results in a single indicator are visualized by different colors, often termed '*Altmetric Donut', 'Altmetric Badge', and 'Altmetric Attention'*. The 'Altmetric Donut' aims to inform about the quantity and quality of attention each item receives. It referred to a final score, calculated of various weighted scores for each social media by 'Altmetric LLP' (Altmetric, 2015). The altmetrics behavior revealed that there is a relationship between sharing the science published in popular journals or high-impact journals on social media (Ngai et al., 2015). Highly cited articles can be predicted by tweets occurring within the first three days of article publication (Eysenbach, 2011). In addition, social media may provide a supportive tool to enhance health behavior and upgrade the public's quality of life. Twitter can help users be updated on relevant advances in the medical field (Sedrak et al., 2019; Diug, Kendal & Ilic, 2016). In healthcare, Twitter is also used to share clinical guidelines (Priem et al., 2010). In the Twittersphere, well-known healthcare organizations and high-impact biomedical publications are active (Kolahi et al., 2021).

In the field of oncology, social media tools have the potential to be effective in delivering interventions for cancer prevention and management. Moreover, social media usage in cancer

care will encourage improved communication, intensify relationships among patients, caregivers, and clinicians, and improve patient care. Clinicians must take advantage of social media seriously to enhance patient care and clinical results (Han, Lee & Demiris, 2018). The highest share of publications with altmetrics scores is allocated to the biomedical and health sciences field (Costas, Zahedi & Wouters, 2014). Researchers, particularly in biomedicine, are increasingly utilizing social media to share clinical guidelines, enhance health knowledge (Priem et al., 2010), and promote health (Hamm *et al.*, 2013).

Generally, social media (SM) can be fruitful for endorsement and engagement with the cancer experience, psychosocial support, and quick and wide distribution of information. However, some negatives and drawbacks include information overload, privacy breaks, and misinformation via social media (Gentile, Markham & Eaton, 2018). Many social media like Facebook, Twitter, and YouTube have cancer content and particular information (Sedrak et al., 2019). Despite the lack of published data on the health consequences of cancer via social media, a new study reveals that social media can enhance health outcomes (Attai, Cowher, Al-Hamadani, Schoger, Staley & Landercasper, 2015). Altmetrics indicators measure the performance of each scientific output based on the number of views, bookmarks, downloads, likes, clicks, shares, citations, comments, and followers (Holmberg, 2015). Moreover, Priem et al. (2010) believe that altmetric indices complement traditional indicators and are not supposed to replace them but can highlight other dimensions of scientific influence.

It is worth noting that the article level is the main center of attention in altmetrics studies. Holmberg (2015) believed that altmetric indices could be used at different levels of articles and journals. Article-level indicators measure the performance of an article regardless of the publisher and other articles published in that journal. Journal-level indices focus on a journal's activity in various social media environments (Holmberg, 2015; Roemer & Burkart, 2015). The level of the article has been the focus of many studies so far, but the level of the journal has been less studied, especially about scientific subject categories. In other words, altmetric indicators are an emerging measure of research impact. Considering how they correlate to more traditional bibliometrics, particularly at the journal level would be beneficial to enhance and support research impact evaluation. Altmetric indices analyze and measure the immediate impact of research by using a wide range of resources, which is not limited to a specific database or publication (Archambault, Vignola-Gagné, Côté, Larivière & Gingrasb, 2006). Altmetrics can reduce the time it takes for an article to receive citations. Citation-based indicators and altmetric indices (altmetrics) are complementary, with some differences (Roemer & Burkart, 2015). Altmetrics are not dependent on time and can show the immediate effect of scientific production.

Conversely, citation-based indicators depend on the passage of time so that the scientific community can study, use, and cite them. Publishing scientific productions in scientific journals is a very time-consuming process. Altmetrics were introduced to measure scientific products accessible to researchers and even the public through social media to overcome these limitations and expand scientometric techniques (Bornmann & Haunschild, 2018; Erfanmanesh & Hosseini, 2017). Mentions on social media are known to predict and possibly increase citations to articles. Therefore, monitoring altmetrics – which are almost instant - can be useful in indicating the extent to which an article is likely to be cited (Watson, 2016). Any health librarians who support research impact evaluation would benefit from knowing how they relate to more traditional bibliometrics.

The researchers of this study aimed to consider the effect of altmetric indices at the level of journals in the field of oncology to evaluate the relationship between altmetric indices and some citation-based indicators of journals. The study tries to answer whether the citation-based indicators of journals in this field (oncology) affect their mentions in different types of social media. Also, the citation-based indicators of journals in this field are higher. Is it more mentioned for different kinds of social media (does it have a higher altmetric score)? This study used citation-based indicators at the journal level such as SNIP, SJR, and CiteScore. Information on these indicators was collected from *Scopus by searching via the source title* field.

In addition, information about the quantitative indices of 'Altmetric Coverage' and 'Mean Altmetric Score' was collected from 'Altmetric Explorer' database and calculated by researchers. 'Altmetric Coverage' refers to the ratio of the shared articles of a journal to the total number of articles in the journal, and 'Mean Altmetric Coverage' means the average altmetric attention scores (AAS) of all shared articles on various social media. These indicators are described in more detail in the methodology section. The results of this study can be beneficial and practical for researchers, editors, publishers, and policymakers in the field of oncology to improve the performance of journals. To achieve the goals, the following research questions were investigated.

Research Questions

Q1- Which journals in the field of oncology in 2019 had the highest or most complete altmetric coverage percentages?

Q2- Which journals in the field of oncology in 2019 had the most attention on social media?

Q3- What is the status of the social media used to share scientific products published in journals in the field of oncology in 2019?

Q4- Is there a significant relationship between citation-based indicators of journals in the field of oncology in 2019 and their altmetric coverage?

Q5- Is there a significant relationship between citation-based indicators of journals in the field of oncology in 2019 and their mean altmetric score?

Literature Review

The literature review is classified into two sub-topics: article-level and journal-level. All Studies related to article level have reviewed the relationship between altmetric indicators and citations of articles generally and repeatedly. However, the studies of altmetric indices at the journal level have been considered by less research.

Studies in article-level and health science

Giustini, Axelrod, Lucas and Schroeder (2020) investigated the correlation between citations and altmetric indicators at the article level in pediatrics. The result showed a modest correlation between article citations and their altmetric indicators, such as page views and the AAS in the 100 most-cited articles. Moorhead, Krakow and Maggio (2021) conveyed a quantitative analysis of online news stories, including mentions of cancer studies. Findings demonstrated a general discrepancy between cancers notable in news sources and those with the highest mortality rate. Results showed a continuous misalignment between prevalent cancers and cancers mentioned in online news media. Allen, Stanton, Di Pietro and Moseley

(2013) surveyed the effect of social media releases on views and downloads of articles in the clinical pain sciences. They conclude that social media sharing a research article in the clinical pain sciences increases the number of people who view or download it.

Studies focusing on various citation indicators in a specific journal

Murray et al. (2020) surveyed the correlation between Altmetric Attention Score (AAS) and traditional scientific impact, namely journal impact factor (JIF) and article citation counts. Results revealed a moderate positive correlation between journal IF and journal AAS. Additionally, there was a weak positive correlation between the traditional article citation counts and AAS. Xia, Su, Wang, Zhang, Ning and Lee (2016) showed that Twitter clients have a higher concern degree on Nature articles than Facebook users, and Nature articles have a higher and more quickly developing effect on Twitter than on Facebook. Moreover, the relationship between tweets and citations exceptionally relies upon publication year, discipline, and user type. Nuredini and Peters (2016) showed that Twitter, Mendeley, and the news media had the largest Economic and Business journals share.

Syamili and Rekha (2017) recognized the relationship between altmetric score and citation in PLOS ONE journal. The outcomes showed that all the altmetric scores except Twitter have a positive and strong correlation with traditional bibliometric citation. The outcomes of Onyancha (2017) uncovered that the most generally utilized social media were Twitter and Facebook in South African journals. It also concluded that altmetrics may not replace traditional bibliometrics but should be treated as complementary. Naude and van-Biljon (2017) concluded that altmetrics can show the more extensive effect of CI research on social orders and communities that traditional citation metrics cannot estimate. Moreover, there is a relationship between article views, Mendeley readership, and Google Scholar citations of the Journal of Community Informatics.

Studies investigating the significant relationship in the biomedical fields

Haustein, Peters, Sugimoto, Thelwall and Larivière (2014) concluded that tweeting behavior changes between journals and specialties in the biomedical literature. Moreover, the relationships between tweets and citations are low, inferring that impact metrics dependent on tweets are not the same as those dependent on citations. Barbic, Tubman, Lam and Barbic's (2016) results showed a weak positive correlation between citations and altmetric scores for the top papers in EM and other biomedical journals. Makkizadeh, Erfanmanesh and Sarrami (2020) concluded a significant relationship between "Altmetric Coverage and three quality performance indices (SJR, SNIP, and the CiteScore) in the field of medical informatics and health information management. Kolahi et al. (2021) examined the correlations between AAS and citations in health sciences as the first in-depth meta-analysis. This study showed a weak, positive, linear correlation between the number of citations and altmeric scores in the field. The result also indicates that the year of data collection moderates interaction with effect size. As a result, these kinds of studies must mention the year (even date) of data collation for both altmetric scores and the number of citations.

Studies investigating the significant relationship in the non-biomedical fields

Erfanmanesh (2018) uncovered a statistically significant and positive relationship between altmetric activity and the quality performance of the journals in the field of LIS. A study by

Hosseini and Taghizadeh Milani (2020) indicated a positive significant correlation between the 'Altmetric Coverage' indicator and quality performance metrics, as well as the 'Mean Altmetric Score' and quality performance metrics. Twitter was by far the most used social media in social science. Sedighi (2019) showed a significant, positive, and weak relationship between articles in the field of Scientometrics and the altmetric scores of the articles. It is concluded from the literature review that the study of altmetric indicators at the article level has been more focused. Some previous studies have been limited to the article level regarding the studied community or the surveyed social media. The difference of the present study is to focus on the journal level in a specific subject category (oncology).

Materials and Methods

This research is a kind of analytical paper in terms of the approach using altmetric and bibliometric indicators at the journal level. The present study includes data collection, pre-processing, and analysis stages. Data related to altmetric indices and citation-based indicators of journals were collected in August-September 2020, limited to 2019. In the data analysis section, because the distribution was not recognized as normal, the Spearman rank correlation test was used to examine the correlation, described in the fourth and fifth questions in detail.

Data Collection

The oncology category was searched throughout InCites Journal Citation Reports (2019), and 245 journals in this field were exported in Microsoft Excel. Then, each journal was searched in 'Altmetric Explorer' database and limited to 2019. The results were exported in Microsoft Excel. Additionally, some citation-based indicators at the journal level, such as CiteScore, SNIP, SJR, and the number of their published articles were gathered through Scopus limited to 2019.

Data Analysis

At the level of inferential statistics, based on the results of the Kolmogorov-Smirnov test, due to $P<0.05$, the null hypothesis is rejected of normal distribution. As a result, the Spearman correlation test was utilized by SPSS software V22 (IBM Corporation), to examine the significance of the relationship between the citation-based indicators of journals and altmetric indices (altmetric coverage and mean altmetric score). In addition, scatter plots were depicted.

'Altmetric Coverage' (AC) is an indicator obtained from the ratio of the number of articles of a journal shared on at least one social media to the total number of articles published (like the formula below) in 2019. The researchers calculated it.

$$AC = \frac{number\ of\ articles\ of\ a\ journal\ shared\ on\ at\ least\ one\ of\ the\ social\ media}{total\ number\ of\ articles\ in\ a\ year}$$

'Mean Altmetric Score' as the second altmetric indicator is the average attention that articles in a journal receive by sharing on different types of social media. Altmetric Attention Score (AAS) is the score that the 'Altmetric Explorer' database gives to each research output according to its level of activity and its sharing in different types of social networks, which is presented under the name of 'Altmetric Donut'. The researchers calculated the average of these scores to calculate mean altmetric scores.

In addition to the above altmetric indicators, three citation-based indicators of journals were used, namely CiteScore, SNIP, and SJR. CiteScore is a simple way of measuring the citation

impact of sources, such as journals. In an old calculation, before 2020, CiteScore is the number of citations received by a journal in one year to documents published in the three previous years, divided by the Total number of citable items published in that journal during the three preceding years. Five document types (articles, reviews, conference papers, book chapters, and data papers) are used in CiteScore calculation for consistency in the CiteScore in numerator and denominator. It gives a complete picture of citation impact and makes calculation manipulation more difficult. This metric is not field-normalized, so comparing between subject fields using CiteScore is not useful. (Scopus support center, 2021a; Roldan-Valadez, Salazar-Ruiz, Ibarra-Contreras & Rios, 2019; Colledge & Verlinde, 2014).

SNIP, stands for Source-Normalized Impact per Paper and is calculated by dividing a journal's average citation over three years by the citation potential of the subject category. The citation potential is a measure that indicates the likelihood of being cited. The citation potential of a source's subject field is the average number of references per document citing that source. It represents the likelihood of being cited for documents in a particular field. A source in a field with a high citation potential tends to have a high impact per paper (Scopus support center, 2021b). There are some considerations and limitations for SNIP. Document types of a journal affect the values of SNIP. SNIP does not differentiate between typical research articles and review articles. Review articles are likely to be cited considerably more frequently. Journals, including published review articles, tend to have higher SNIP values. Additionally, self-citations are effective on SNIP values. Some journals may increase their citation impact by increasing their number of self-citations. SNIP is not correct for this. SNIP is less reliable for small journals with limited publications than for larger ones (CWTS Journal Indicators, 2021).

Moreover, SJR stands for Scimago journal report and indicates the average citation for a journal three years ago (Roldan-Valadez et al., 2019; Colledge and Verlinde, 2014). In other words, this value is calculated by dividing the number of citations received by the journal in the given year from primary items (articles, reviews, and conference papers) to primary items published in the three previous years. SJR is a measure of the scientific influence or prestige of a journal. Strength points for SJR can be considered as assigning higher value/weight to citations from more prestigious journals. The SJR indicator is an open-access resource based on Scopus data. It lists considerably more journal titles published in various countries and languages than the journal IF (based on Web of Science data) . Its Meaningful benchmark is built in – one as average for a subject. However, in terms of the weight of citations, it depends on the prestige of the citing journal (Roldan-Valadez et al., 2019; Colledge & Verlinde, 2014; Falagas, Kouranos, Arencibia-Jorge & Karageorgopoulos, 2008).

Results

Q1- Which journals in the field of oncology in 2019 had the highest or most complete altmetric coverage percentages?

Of the 245 reviewed journals, 244 had altmetric coverage. In other words, all the articles of these journals received at least one social mention. The Chinese Journal of Cancer Research did not receive the altmetric coverage score because the publishing process has been stopped. 16 publications (6.53%) had 100% altmetric coverage percentages. Table 1 indicates their journal titles:

Table 1
Journal Titles Including 100% Altmetric Coverage

Journal Titles	Altmetric Coverage	ISSN Scopus	EISSN Scopus	Publisher	Quartile JCR-2019	IF JCR-2019	SJR 2019	SNIP 2019	CiteScore 2019
JOURNAL OF CLINICAL ONCOLOGY	100%	1341-9625	1437-7772	Springer Nature	Q1	32.956	1.074	1.267	4.5
CANCER NURSING	100%	0162-220X	1538-9804	Wolters Kluwer Health	Q4	1.850	0.781	0.993	3.5
Journal of Cancer Survivorship	100%	1932-2259	1932-2267	Springer Nature	Q2	3.296	1.608	1.461	6.7
Advances in Cancer Research	100%	0065-230X	-	Elsevier	Q1	5.235	0.893	0.718	8.6
BRITISH JOURNAL OF CANCER	100%	0007-0920	1532-1827	Springer Nature	Q1	5.791	2.445	1.588	10
Cancer Prevention Research	100%	1940-6207	1940-6215	American Association for Cancer Research	Q2	3.473	1.371	0.913	6.3
npj Precision Oncology	100%	2397-768X	-	Springer Nature	Q1	7.717	N/A	N/A	N/A
Cancer & Metabolism	100%	2049-3002	-	BioMed Central	Q1	5.033	N/A	N/A	N/A
CANCER GENE THERAPY	100%	0929-1903	1476-5500	Springer Nature	Q2	4.534	0.93	0.958	8.5
INTERNATIONAL JOURNAL OF GYNECOLOGICAL CANCER	100%	1048-891X	1525-1438	BMJ Publishing Group	Q4	2.095	1.011	0.969	3.8
CANCER EPIDEMIOLOGY BIOMARKERS & PREVENTION	100%	1055-9965	1538-7755	American Association for Cancer Research	Q2	4.344	2.857	1.729	8.2
Medical Dosimetry	100%	0958-3947	1873-4022	Medical Dosimetry	Q4	1.396	0.623	0.807	2.1
CURRENT OPINION IN ONCOLOGY	100%	1040-8746	1531-703X	Wolters Kluwer Health	Q2	3.336	1.275	0.815	5.8
JNCI-Journal of the National Cancer Institute	100%	0027-8874	1460-2105	Oxford University Press	Q1	11.577	5.356	2.96	16.2
CANCER	100%	0008-543X	1097-0142	Wiley-Blackwell	Q1	5.772	3.065	2.139	10.5
Cancer Nanotechnology	100%	1868-6958	1868-6966	Springer Nature	Q2	4.700	1.299	1.373	9.5

After the journals with altmetric coverage of 100%, the highest score belongs to 24 journals that have achieved altmetric coverage between 90-99%. The titles and their altmetric coverage are mentioned in Table 2.

Table 2
Journal Titles Including High Altmetric Coverage In The Field Of Oncology

Rank	Journal title	Altmetric coverage (Percent)	ISSN Scopus	Publisher	Quartile JCR-2019	IF JCR-2019	SJR 2019	SNIP 2019	CiteScore 2019
1	LEUKEMIA	99.68	0887-6924	Springer Nature	Q1	8.665	3.966	1.953	14.7
2	Trends in Cancer	98.90	2405-8033	Elsevier	Q1	11.093	3.961	1.92	14.3
3	Journal of Geriatric Oncology	98.19	1879-4068	Elsevier	Q3	2.761	1.428	1.069	4.3

Rank	Journal title	Altmetric coverage (Percent)	ISSN Scopus	Publisher	Quartile JCR-2019	IF JCR-2019	SJR 2019	SNIP 2019	CiteScore 2019
4	Journal for ImmunoTherapy of Cancer	98.03	2051-1426	BMJ Publishing Group	Q1	10.252	4.194	1.817	8.6
5	npj Breast Cancer	97.87	2397-768X	Springer Nature	Q1	6	3.545	1.704	8.4
6	CLINICAL CANCER RESEARCH	96.96	1078-0432	American Association for Cancer Research	Q1	10.107	5.241	2.038	16.1
7	AMERICAN JOURNAL OF CLINICAL ONCOLOGY-CANCER CLINICAL TRIALS	96.85	0277-3732	Wolters Kluwer Health	Q4	1.907	1.06	0.904	4.6
8	BREAST CANCER RESEARCH	96.07	1465-5411	Springer Nature	Q2	4.988	2.407	1.552	8.5
9	PEDIATRIC BLOOD & CANCER	95.80	1545-5009	Wiley-Blackwell	Q3	2.355	1.143	1.047	4.2
10	Frontiers in Oncology	95.80	2234-943X	Frontiers Media S.A.	Q2	4.848	1.654	1.117	3.5
11	CANCER CELL	95.56	1535-6108	Elsevier	Q1	26.602	11.909	5.086	40.7
12	SEMINARS IN CANCER BIOLOGY	94.54	1044-579X	Academic Press Inc	Q1	11.09	3.476	1.951	14.8
13	NATURE REVIEWS CANCER	94.20	1474-175X	Springer Nature	Q1	53.03	21.287	9.869	70.4
14	PROSTATE CANCER AND PROSTATIC DISEASES	93.97	1365-7852	Springer Nature	Q2	4.311	1.83	1.267	7.8
15	Cancer Immunology Research	92.30	2326-6066	American Association for Cancer Research	Q1	8.728	4.598	1.497	11.8
16	MELANOMA RESEARCH	92.30	0960-8931	Wolters Kluwer Health	Q3	2.75	0.854	0.697	4.3
17	ONCOLOGIST	92.27	1083-7159	AlphaMed Press Inc	Q2	5.025	2.613	1.673	7.2
18	BONE MARROW TRANSPLANTATION	92.04	0268-3369	Springer Nature	Q2	4.725	1.639	1.463	6.3
19	MOLECULAR CANCER THERAPEUTICS	90.79	1535-7163	American Association for Cancer Research	Q1	5.615	2.463	1.24	9.4
20	Targeted Oncology	90.66	1776-2596	Springer Nature	Q2	4.036	1.442	0.93	6.9
21	Journal of Oncology Practice	90.58	1554-7477	American Society of Clinical Oncology	Q2	3.551	1.392	1.171	4.6
22	CANCER TREATMENT REVIEWS	90.41	0305-7372	Elsevier	Q1	8.885	3.619	2.284	16.3

Rank	Journal title	Altmetric coverage (Percent)	ISSN Scopus	Publisher	Quartile JCR-2019	IF JCR-2019	SJR 2019	SNIP 2019	CiteScore 2019
23	Clinical Colorectal Cancer	90	1533-0028	Elsevier	Q3	3.245	1.291	1.202	5.6
24	Clinical Medicine Insights-Oncology	89.47	1179-5549	Libertas Academica	Q4	2.133	1.077	1.14	5.3

Q2: Which journals in the field of oncology in 2019 had the most attention on social media?

The highest level of attention (mean altmetric score) for oncology publications 2019 belongs to CA-A CANCER JOURNAL FOR CLINICIANS, with a score of 111.66. Table 3 shows the top ten journals with the highest mean altmetric score.

Table 3
Top Ten Journals in the Field of Oncology Based on Mean Altmetric Score

Rank	Journal title	The Highest Altmetric Attention Score (AAS)	Mean Altmetric Score	Sum of Altmetric Attention Score (AAS)	Numbers of Mentions	Numbers of Mentioned Articles	ISSN	Publisher
1	Ca-A Cancer Journal for Clinicians	1342	111.66	4020	11130	36	0007-9235	Wiley-Blackwell
2	Jama Oncology	818	68.88	29414	38	427	2374-2437	American Medical Association
3	Cancer Cell	992	59.48	8982	142	151	1535-6108	Elsevier
4	Lancet Oncology	1507	41.91	21796	5005	520	1470-2045	Elsevier
5	Nature Reviews Cancer	319	36.51	4747	471	130	1474-175X	Springer Nature
6	JNCI-Journal of The National Cancer Institute	1387	35.69	7460	65	209	1460-2105	Oxford University Press
7	Nature Reviews Clinical Oncology	169	24.24	3733	40	154	1759-4774	Springer Nature
8	Journal Of Clinical Oncology	1388	21.86	24883	24	1138	1341-9625	Springer Nature
9	Trends in Cancer	138	19.75	1778	510	90	2405-8033	Elsevier
10	Cancer	458	18.87	11457	4674	607	1097-0142	Wiley-Blackwell

The lowest level of attention (zero scores) is related to 13 publications mentioned in Table 4.

Table 4
Journal Titles in the Field Of Oncology in 2019 based on the Lowest Mean Altmetric Score

Row	Journal title	Mean Altmetric Score	ISSN	Publisher	Quartile JCR-2019	IF JCR-2019	SJR 2019		SNIP 2019	CiteScore 2019
1	Chinese Journal of Cancer	0	1000-467X	Springer Nature	Q1	5.76	1.216		0	0
2	Oncologie	0	1292-3818	Springer Nature	Q4	0.052	0.102		0.102	0.4
3	Neoplasma	0	0028-2685	Veda Publishing House of the Slovak Academy of Sciences	Q4	1.721	0.595		0.492	3.2
4	Translational Lung Cancer Research	0	2226-4477	Society for Translational Medicine (STM)	Q1	5.132	1.488		0.926	5.1
5	Translational Oncology	0	1936-5233	Neoplasia Press	Q2	3.558	1.267		0.886	4.7
6	Bladder Cancer	0	2352-3727	IOS Press	Q3	2.778	1.088		0.927	5.5
7	Oncology-New York	0	0890-9091	UBM Medica Healthcare Publications	Q3	2.408	0.472		0.154	2.1
8	Uhod-Uluslararasi Hematoloji-Onkoloji Dergisi	0	1306-133X	Akademi Doktorlar Yayinevi	Q3	2.323	0.124		0.147	0.2
9	Analytical Cellular Pathology	0	2210-7177	Hindawi	Q4	2.052	0.534		0.613	2.3
10	Translational Cancer Research	0	2218-676X	AME Publishing Company	Q4	0.986	0.312		0.225	0.9
11	European Journal of Gynaecological Oncology	0	0392-2936	IMR Press Limited	Q4	0.215	0.171		0.152	0.6
12	Psycho-Oncologie	0	1778-3798	Springer Nature	Q4	0.116	0.113		0.07	0.3
13	Progress in Tumor Research	0	2296-1887	Karger	Q4	0.111	0.254		0.414	2.5

Q3: What is the status of the social media used to share scientific products published in journals in the field of oncology in 2019?

According to the results of Table 5, the most used social media to share articles in the field of oncology was Twitter (91.55%) by far. After that, with a big difference from other media, there was news (5.34%), Facebook (2.03%), and blogs (0.35%), respectively. Additionally, Weibo users, Pinners on Pinterest, CiteULike, Connotea, policy sources, and book reviewers were not commonly used.

Table 5
Mentions And Altmetric Coverage in the Field of Oncology in Various Social Media

Social Media	Numbers of Mentions	Average of Mentions (percent)	Journal with the most usage	Numbers of usages
Twitter	320385	91.55	Annals of Translational Medicine	35801
News Story	18695	5.34	Annals of Translational Medicine	2173
Facebook	7105	2.03	Annals of Translational Medicine	1563
Weblog	1248	0.35	Annals of Translational Medicine	135
Reddit	923	0.26	SUPPORTIVE CARE IN CANCER	69
Google+	665	0.19	ONCOLOGY	252
Wikipedia	268	0.07	ESMO Open	20
F1000 post	259	0.07	International Journal of Clinical and Experimental Pathology	31
peer review site	165	0.04	BMC CANCER	68
Video Uploader	103	0.02	Journal of Oncology Practice	6
Policy Document	65	0.01	Journal of Hepatocellular Carcinoma	11
Patent	43	0.01	Advances in Cancer Research	5
			CARCINOGENESIS	
Q&A threads	1	0.06	Annals of Translational Medicine	1

The findings revealed that Twitter is the most used media for sharing articles in this field of oncology. The top ten journals that have used Twitter most frequently for scientific purposes are listed in Table 6.

Table 6
Journal Titles that Used Twitter Highly to Share Their Published Papers

Rank	Journal titles	Number of Twitter mentions	ISSN	Publisher	IF JCR-2019	Quartile JCR-2019	CiteScore 2019	SNIP 2019	SJR 2019
1	Annals of Translational Medicine	35801	2305-5839	AME Publishing Company	3.297	Q2	N/A	N/A	1.089
2	Chinese Journal of Cancer Research	24956	1000-9604	AME Publishing Company	4.135	Q2	N/A	N/A	0.924
3	Journal of Hepatocellular Carcinoma	19368	2253-5969	Dove Medical Press	4.655	Q2	N/A	N/A	N/A
4	Hematological Oncology	11689	0278-0232	Wiley-Blackwell	2.832	Q3	3.5	0.803	0.728
5	Ca-A Cancer Journal for Clinicians	10217	0007-9235	Wiley-Blackwell	292.278	Q1	435.4	112.17	88.192

6	International Journal of Clinical and Experimental Pathology	8970	1936-2625	e-Century Publishing Corporation	0.252	Q4	N/A	N/A	0.159
7	Cancer & Metabolism	8635	2049-3002	BioMed Central	5.033	Q1	N/A	N/A	N/A
8	Pediatric Blood & Cancer	8532	1545-5009	Wiley-Blackwell	2.355	Q3	4.2	N/A	N/A
9	American Journal of Cancer Research	7732	2156-6976	e-Century Publishing Corporation	5.177	Q1	N/A	N/A	1.562
10	NPJ Breast Cancer	7021	2374-4677	Springer Nature	6	Q1	8.4	1.689	3.545

Q4: Is there a significant relationship between citation-based indicators of journals in the field of oncology in 2019 and their altmetric coverage?

Because of the non-normal distribution of data, the Spearman rank correlation test (as a non-parametric test) was used to answer this question in SPSS software. Hence, the relationship between altmetric coverage and citation-based indicators of journals (including SJR, SNIP, and CiteScore) was tested at a significance level of 0.01. The test results showed that there was a statistically significant, positive, and moderate relationship between the altmetric coverage and the three citation-based indicators of SJR (sig = 0.000, P<.01, and rs = 0.503), SNIP (sig = 0.000, P<.01, rs = 0.449), and CiteScore (sig = 0.000, P<.01, and rs = 0.472).

The test results mean journals with higher citation-based indicators are more likely to have more altmetric coverage. That is, the scientific products that are published on them are more likely to be shared on various social media. Figures 1-3, as the scatter plots, indicate the correlation between the altmetric coverage and the citation-based indicators of the journals. The y-axis shows the altmetric coverage, and the x-axis shows the mentioned indicators. Figure 1, as the scatter plot, depicts the relationship between altmetric coverage and SJR 2019. It shows a statistically significant, positive, and moderate relationship between altmetric coverage and SJR 2019.

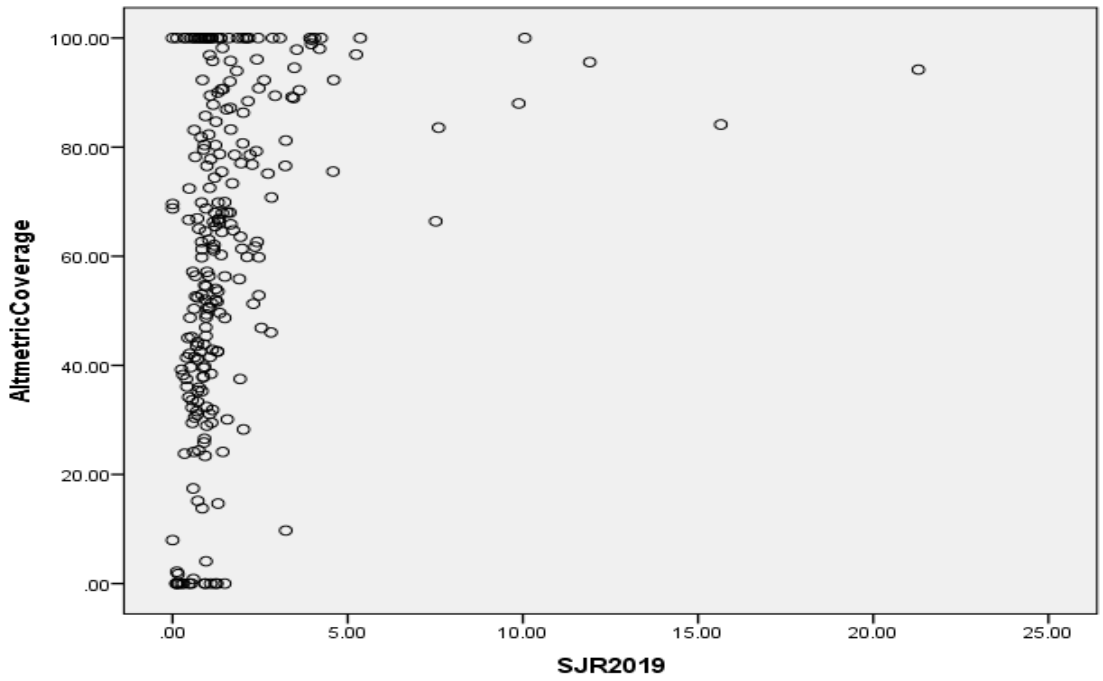

Figure1: The Scatter Plot of Relationship Between Altmetric Coverage and SJR 2019

Figure 2 indicates a statistically significant, positive, and moderate relationship between altmetric coverage and CiteScore 2019.

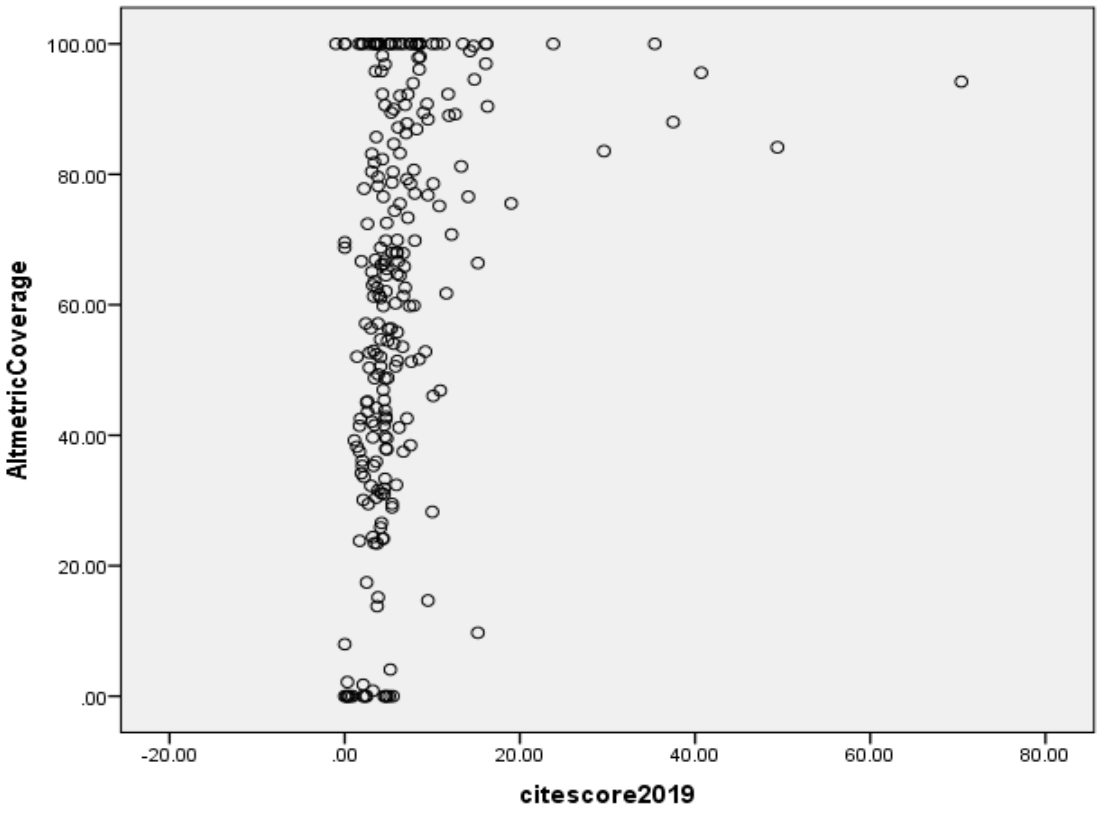

Figure 2: The scatter plot of relationship between altmetric coverage and CiteScore 2019

Figure 3 also represents a statistically significant, positive, and moderate relationship between altmetric coverage and SNIP 2019.

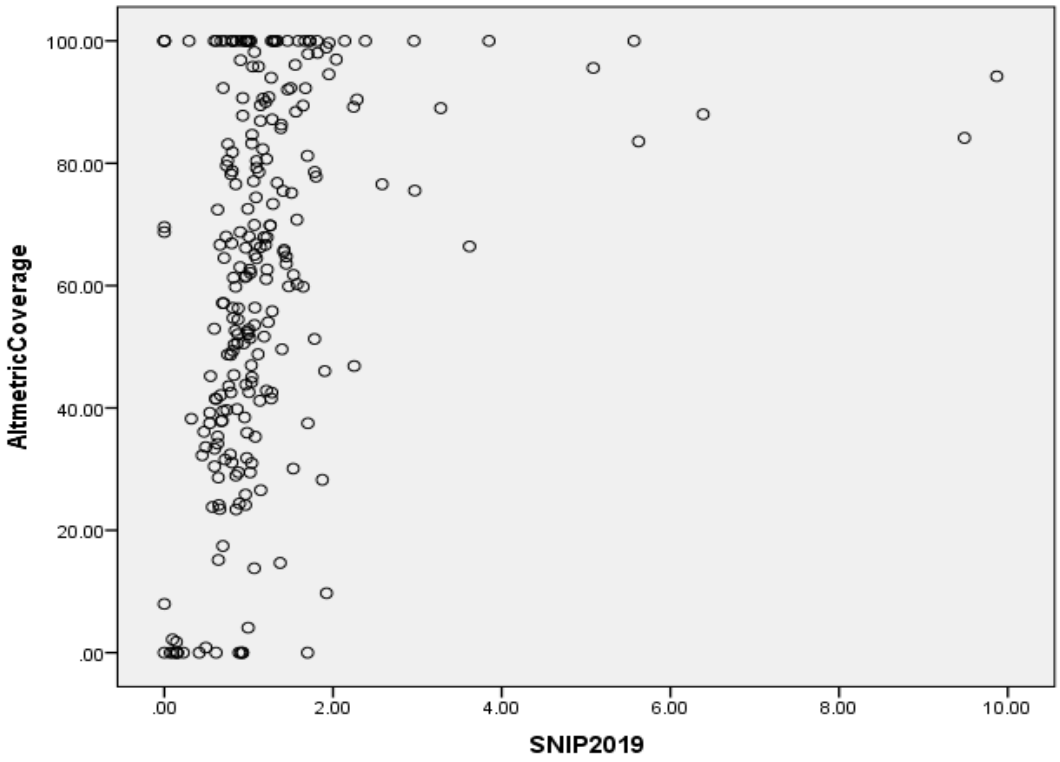

Figure 3: The Scatter Plot of Relationship Between Altmetric Coverage and SNIP 2019

Q5: Is there a significant relationship between citation-based indicators of journals in the field of oncology in 2019 and their mean altmetric score?

The data are not normally distributed. Hence, the Spearman rank correlation test (as a non-parametric test) in SPSS software was used. The relationship between altmetric mean score (the calculated indicator in the second question) and citation-based indicators of journals was tested at a significance level of 0.01. The test results showed that there was a statistically significant, positive, and moderate relationship between the altmetric mean score (mean attention score) and the three citation-based indicators of SJR (sig = 0.000, P<.01, and rs = 0.431), SNIP (sig = 0.000, P<.01, rs = 0.332), and CiteScore (sig = 0.000, P<.01, and rs = 0.436).

It means there is a possibility to improve the citation performance of a publication by sharing it on different types of social media. As a result, its altmetric score goes higher, and it has a more altmetric attention score (AAS). The higher the Altmetric score, the more an article has been shared (Trueger, Thoma, Hsu, Sullivan, Peters & Lin, 2015).

Figures 4-6, as the scatter plots, imply the correlation between the mean altmetric score and the citation-based indicators of the journals. The y-axis shows the mean altmetric score, and the x-axis shows the mentioned indicators. Figure 4, as the scatter plot, shows the relationship between the mean altmetric score and SJR 2019. It indicates a statistically significant, positive, and moderate relationship between the mean altmetric score and SJR 2019.

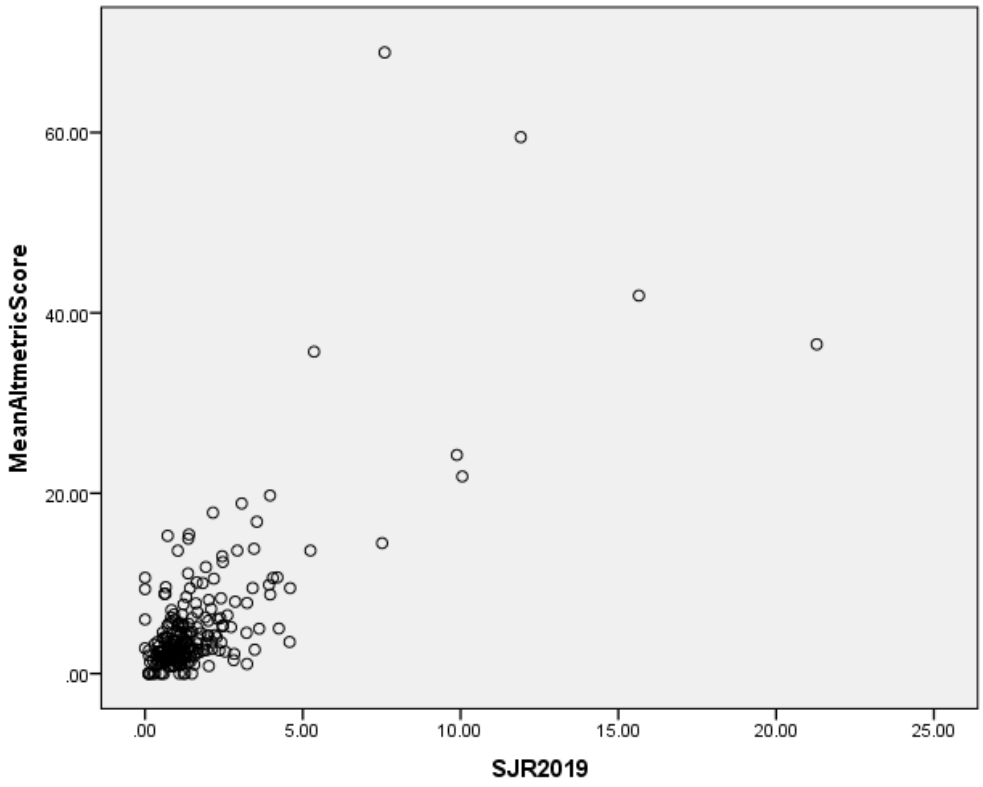

Figure 4: The Scatter Plot of the Relationship Between Mean Altmetric Score and SJR 2019

Figure 5 shows a statistically significant, positive, and moderate relationship between the mean altmetric score and CiteScore 2019.

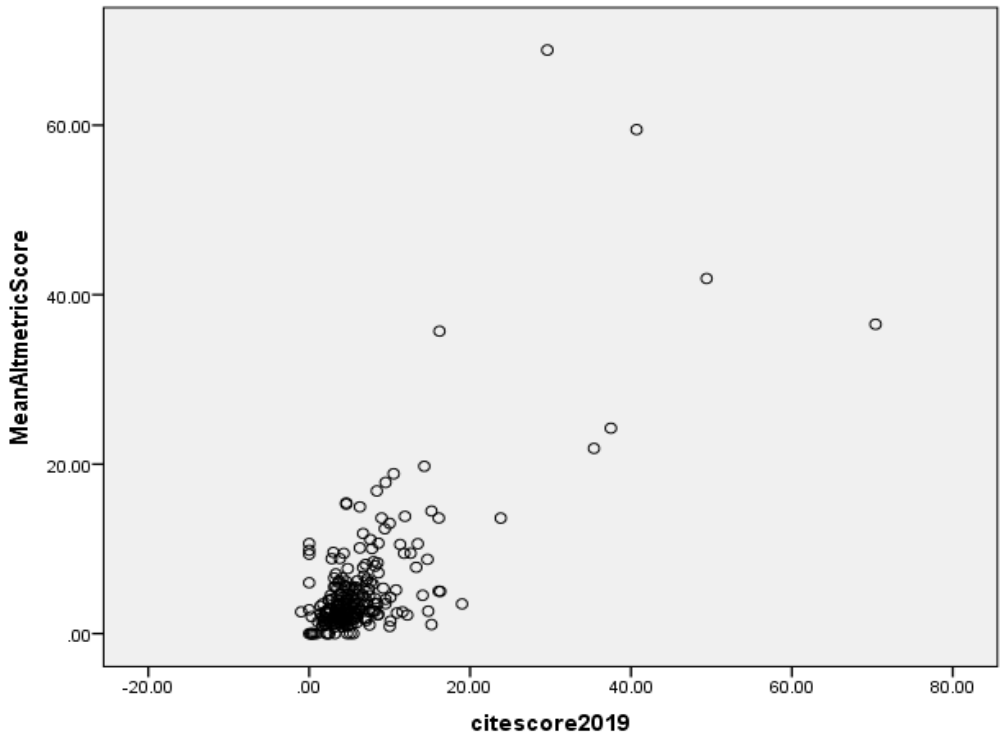

Figure 5: The Scatter Plot of the Relationship Between Mean Altmetric Score and Citescore 2019

Moreover, Figure 6 illustrates a statistically significant, positive, and moderate relationship between the mean altmetric score and SNIP 2019.

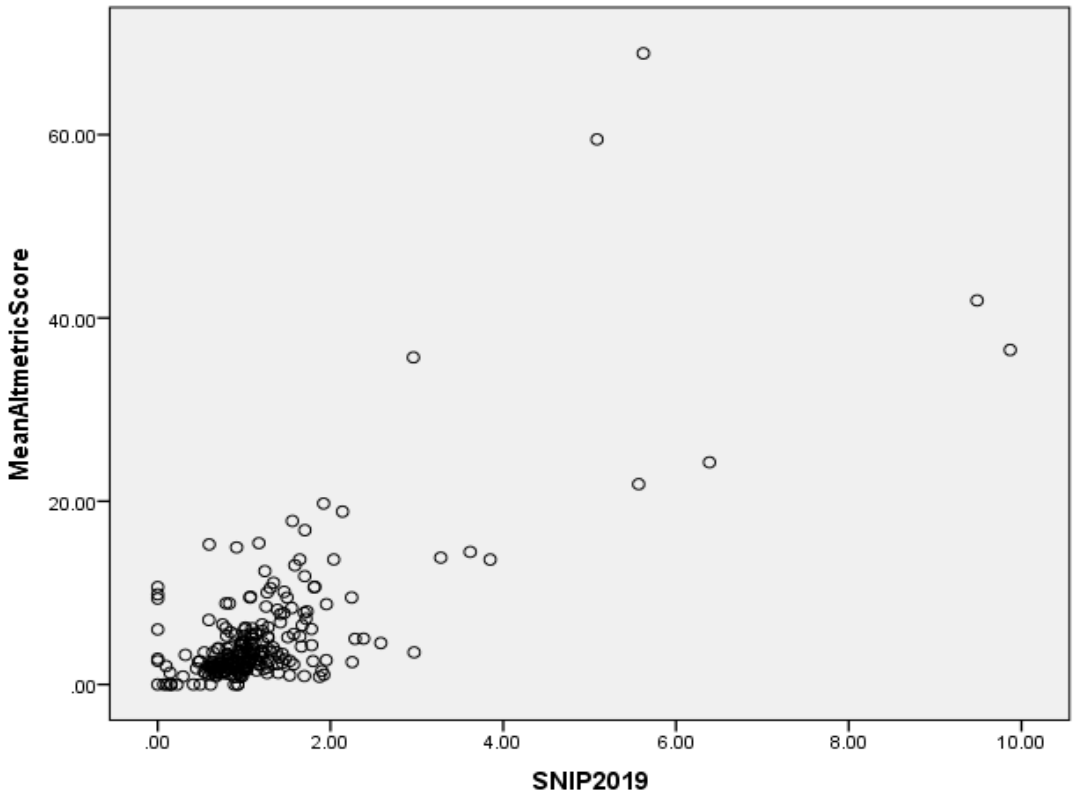

Figure 6: The Scatter Plot of the Relationship Between Mean Altmetric Score and Snip 2019

Discussion

The present study aimed to investigate and analyze the altmetric indices of the journals indexed in the InCites Journal Citation Reports (2019) in the subject category of oncology. Also, the relationship between the studied journals' altmetric indices and citation-based indicators in 2019 was surveyed.

Figure 7 depicts the general perspective and holistic view of the study. More explanations of Figure 7 are expressed in the following, and results are discussed and organized in some sub-topics.

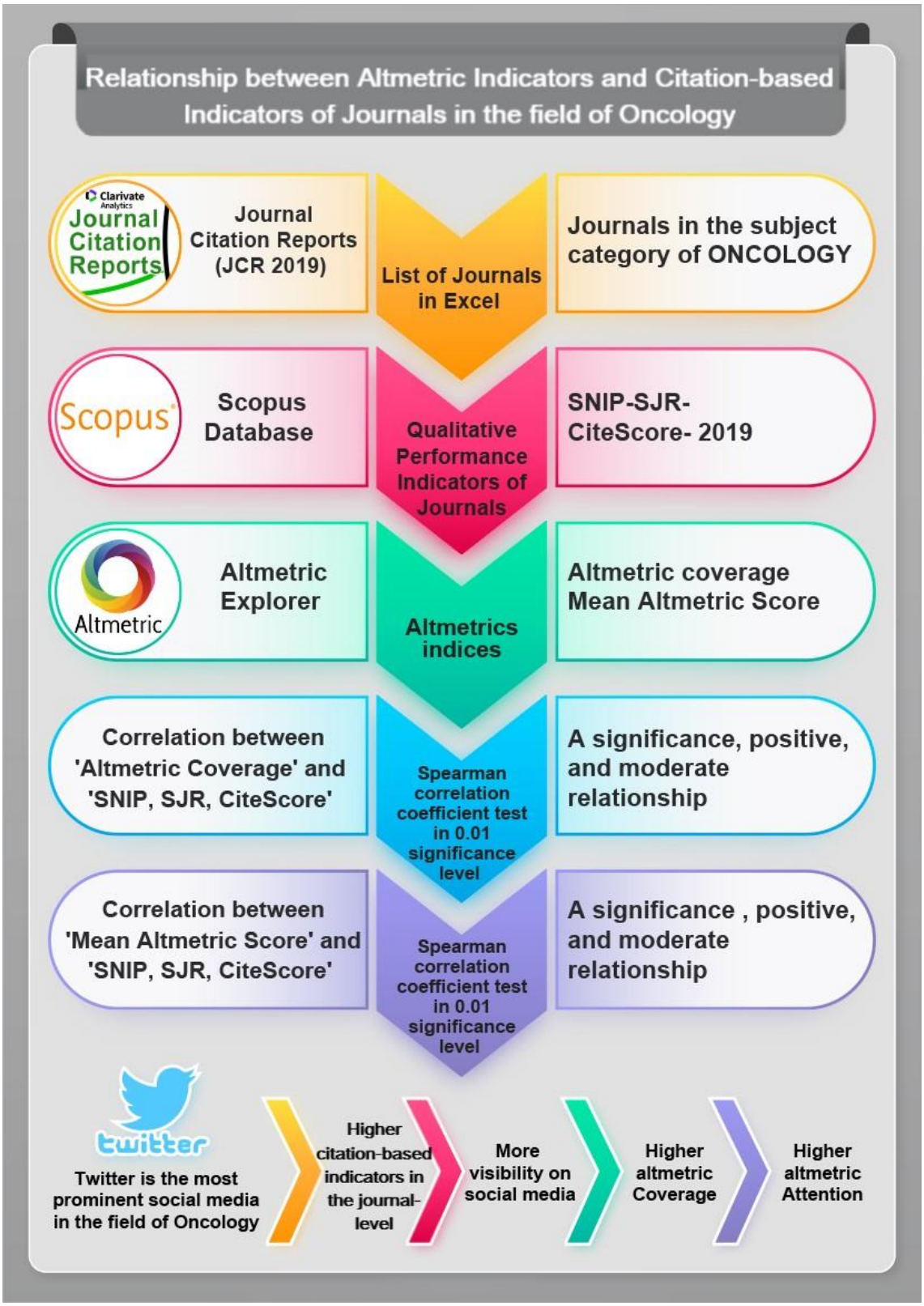

Figure 7: General Perspective of the Study

Role of social media in the field of oncology

The results showed that 16 journals had 100% altmetric coverage; this means that 6.53% of the reviewed journals were fully mentioned on social media. In other words, their published

articles were fully mentioned as research outputs via social media. In general, the results of studies related to health in various social media account for a major share, which is in line with the results of research by Zahedi et al. (2014), Hosseini and Taghizadeh Milani (2018), and Xia et al. (2016). The results of Erfanmanesh, Hosseini and Habibi (2018) also highlighted that the research outputs of medical and interdisciplinary outputs are tweeted more widely. Additionally, Haustein, Costas and Larivière (2015) underlined that fields with more connection to society or argue routines' challenges (like health, biomedical, and health sciences) are more likely to show up via online media and social networks.

Holmberg (2015) also emphasized that the main boundary between the public and the academic community through social media is that scientific activities and the needs of the general public move in the same direction through social media. As a result, health and medical science are one of them. Altmetrics can uncover the commitment of audiences who are not academic, for instance, the public, communities, and partners (Naude; van-Biljon, 2017). Furthermore, social media data may chiefly mirror scientific publications' public interest and results rather than their societal impact (Tahamtan & Bornmann, 2020).

Role of Twitter in the field of oncology

As results showed, the most used social media to share articles in the field of oncology was Twitter (91.55%) by far. After that, News (5.34%), Facebook (2.03%), and Blogs (0.35%) were the most used, respectively. Moreover, Weibo users, Pinners on Pinterest, CiteULike, Connotea, policy sources, and book reviewers were not allocated any mentions.

Various studies in different fields have always emphasized that Twitter, a prominent microblogging tool, is the most used medium for sharing scientific products. This result is consistent with the results of the studies of Erfanmanesh (2018), Xia et al. (2016), Nuredini and Peters (2016), and Erfanmanesh (2018). According to the results, researchers and academicians in the field of oncology utilized Twitter to share their research outputs internationally and virtually. It aligns with previous studies as Attai et al. (2015) revealed that Twitter could be considered an effective tool for breast cancer patient education and support. Moreover, Sinnenberg, Buttenheim, Padrez, Mancheno, Ungar and Merchant (2017) accentuated that Twitter is a valuable resource for health researchers interested in capturing current data about a health topic or harnessing the interactive platform for study recruitment or intervention. Additionally, Gomes and Coustasse (2015) emphasized that using Twitter by hospitals led to savings of resources and enhanced patient communication.

Role of publishers and policymakers

It's worth noting that the role of publishers of academic journals in the context of social media is highly considerable. As Mas-Balada et al. (2014) accentuated that some publishers have turned to altmetrics, because newly published resources can appear more rapidly than citations in social web services. Hence, social media mentions have become a beneficial marketing tool for publishers to improve new high-impact articles. Based on this trick and gaming of altmetric, there is a concern about accurate data on the publishers' side. Therefore, another critical point is related to the effect of this point on authorship. Perhaps authors might consider authorship in a high social media score journal to promote their AAS more rapidly. Moreover, science and technology policy committees can also view these considerations and take advantage of the results. It is worth noting that altmetric indices can act as a complementary

and effective support tool in a collective context in explaining the influence and visibility of publications. Researchers, publishers, and policymakers in the field of oncology can improve citation performance aside altmetric data. This discussion aligns with the analysis of Konkiel, Madjarevic and Lightfoot (2016), who emphasized that altmetrics can occasionally predict later citations and uncover non-traditional scholarly influence.

The study clarified that examining altmetrics at the journal level is necessary insightfully. Previous studies like Thelwall and Kousha (2015) highlighted that many publishers of scholarly journals, such as Nature, ScienceDirect, Sage, Springer, BioMed Central, PLoS, Elsevier, and Wiley, outlined altmetrics for the papers published on their platforms.

Challenges

It is worth mentioning that there are some challenges to taking advantage of Twitter. One considerable concern is that Twitter bots are on the rise, and we need to ensure that human agents dominate this scale. Publishers may also consciously and deliberately try to share their articles on different types of social media to increase the visibility of their publications. Robinson-García, Costas, Isett, Melkers and Hicks (2017) alerted that 74% of articles were automatically tweeted, possibly by bots mechanically retweeting or humans who behave like bots.

Gaming of altmetrics is one of its challenges. Researchers can artificially inflate the AAS by intentionally reaping tweets and extensively disseminating their studies online to increase their visibility (Murray et al., 2020). There is a need for responsible use of altmetrics in research evaluation. It is better to consider more about the 'inorganic' sharing of research (e.g., bots) and oversimplification of previous generations of research impact indicators. Disciplinary differences can be regarded as another challenge. There may be differences in understanding an acceptable degree of risk connected with using altmetric data for those in the social sciences than in STEM areas. Ethics review committees and researchers assess the risk of using social media in research. The quality of altmetrics, such as the lack of accuracy, consistency, and replicability of various altmetrics, are challenges primarily affected by the dynamic nature of social media events and should be enhanced (Christian et al., 2020).

Correlation & Causality

Moreover, this study's results showed a significant, positive, and moderate relationship between altmetric coverage and citation-based indicators of journals in the field of oncology, such as SJR, SNIP, and CiteScore. This accentuated that journals with a higher citation-based indicator are also likely to have more altmetric coverage. In addition, the results revealed a significant, positive, and moderate relationship between the mean attention score and three citation-based indicators SJR, SNIP, and CiteScore. In other words, if the citation-based indicator of a journal is higher, the altmetric score is likely to be higher as well. As Chi et al. (2021) examined that articles published in higher-impact journals in the field of Gynecologic oncology are associated with increased social media visibility and attention. They concluded that AAS might be useful for predicting future citation counts for general oncology publications and gynecologic oncology.

Consequently, perhaps they will be shared on various types of social media. This result is in line with the results of Erfanmanesh (2018), Hastin et al. (2014), Hosseini and Taghizadeh Milani (2020), and Makkizadeh et al. (2020). However, these correlations do not hint at

causation. A cause and effect relationship could not only be concluded from the observed crucial relationship.

Implications

Oncology and cancer context, due to interdisciplinary and multidisciplinary nature, are developing markedly. The study's main implication is that the results and social media platforms will considerably aid as supportive avenues for oncology care professionals and patients from the other. The professionals can benefit from these platforms as a complementary tool to diagnose cancer professionally by accessing new knowledge and increasing the accessibility of their work (as a self-archiving), thereby improving their citation performance. Furthermore, patients can use social media to find supportive charities, groups, and friends to make their cancer journey easier and try to be stronger by accessing more informative, social, and psychological support to remove their concerns and isolation and share their experiences. As Onyancha (2017) and Gentile et al. (2018) also accentuated them. Moreover, policymakers in designing policies can benefit the results to improve their academic systems and research priorities to fortify cancer treatments and immune-oncology therapies and support financial funding agencies and stakeholders. Additionally, it aims to amplify collaborations between the research community and pharmaceutical companies. They can also rapidly access the journals mentioned in the present study via open-access policies for researchers and oncology scientists, particularly in developing countries with a lack of informative sources. De Lorenzo, Wait, Karaca, Britten, van den Bulcke and European Expert Group on Immuno-Oncology (2015) also support similar ideas and indications.

Limitations

The present study has some limitations. It's highly crucial to remember that correlation does not indicate causality. As a result, a cause-and-effect relationship between altmetric score and the number of citations could not be inferred only from the observed significant relationship. Newly developed and upcoming machine learning and deep learning algorithms may be used to evaluate the relevance and relative influence of altmetric indices and usage of various social media on different citation indicators at the article and journal levels. As these algorithms with these aims are accentuated in the study of Kolahi et al. (2021). The altmetric data is restricted to the altmetric explorer aggregator.

Consequently, another limitation is related to Mendeley data. They are not reported in the present study. Additionally, a limitation of the study was the exclusion of some prominent and non-oncological journals such as JAMA (The Journal of the American Medical Association), NEJM (The New England Journal of Medicine), Annals of Internal Medicine, Nature, and the Lancet which publish highly cited medical articles, might oncology topics.

Conclusion

In conclusion, there is a significant, positive, and moderate relationship between Altmetric Coverage and citation-based indicators (SNIP, SJR, and CiteScore), as well as a significant, positive, and moderate relationship between Mean Altmetric Score and citation-based indicators (SNIP, SJR, and CiteScore) in the field of oncology. It does not, however, imply causation. A cause-and-effect association could not be inferred only from the observed significant relationship. It means that journals with higher citation-based indicators are more

likely to have more altmetric coverage. In other words, in the case of a higher citation-based indicator of a journal, the altmetric score is likely to be higher as well. Moreover, it is also concluded that Twitter is the most used social media in oncology. As a result, oncology academicians, policymakers, and researchers should benefit from Twitter purposefully and attentively to uncover non-traditional scholarly influence, improve health knowledge, and make connections between the public and academics. Additionally, they can help the potential of other social media like Weibo users, Pinners on Pinterest, CiteULike, Connotea, and policy sources to enhance their visibility on various social media.

Recommendations

Notably, the results and discussions in the current era of 'alternative facts' must be utilized attentively. As Tahamtan and Bornmann (2020) pointed out, conclusions in research evaluation based on altmetric data should be drawn cautiously and warily. In addition, Araújo, Sorensen, Konkiel & Bloem (2017) announced that the shift from traditional metrics to altmetrics must be addressed judiciously. Xia et al. (2016) and Kolahi et al. (2021) also reported that discipline, user type, and publication years are essential for these studies. It should be highlighted, however, that altmetrics is a relatively new topic among academics. Hence, any awareness rises in researcher culture and skills, focusing on social media usage may strengthen and intensify the correlation, as Kolahi et al. (2021) highlighted, this changed over time.

Other altmetric service providers, such as Plum Analytic and Impact Story, should be considered in future studies on different levels (like article level). Additionally, investigating the relationship between the impact performance of journals (such as impact factor) and altmetric indicators in various fields (different subject categories) in other citation databases (such as Web of Science, Scopus, and Dimensions) is offered for the next steps. Due to the results that Twitter is the most utilized social media in the field of oncology the shared hashtags via Twitter are valuable topics for future works. Studies such as the co-occurrence of hashtags and hashtag coupling analysis can be considered for future works. Additionally, it is offered that publishers and editors of oncology journals consider increasing the visibility of their published scientific papers and take these points into account in their publishing policies and strategies to develop the visibility of their journals in different social networks and improve their citation performance.

Conflict of Interest

The authors declare that there is no conflict of interest.

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