RESEARCH ARTICLE

REVISED Influenza Altmetric Attention Score and its association with the influenza season in the USA [version 3; peer review: 1 approved, 2 approved with reservations]

Previous title: Influenza Altmetric Attention Score and its association with the influenza season in USA

Saif Aldeen AlRyalat[1], Khaled Al Oweidat[1], Mohammad Al-Essa[2], Khaled Ashouri[2], Osama El Khatib[1], Athar Al-Rawashdeh[1], Abeer Yaseen[1], Ahmad Toumar[1], Anas Alrwashdeh[1]

[1]University of Jordan, Amman, Jordan
[2]King Hussein Cancer Center, Amman, Jordan

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Abstract

Background: Altmetrics measure the impact of journal articles by tracking social media, Wikipedia, public policy documents, blogs, and mainstream news activity, after which an overall Altmetric attention score (AAS) is calculated for every journal article. In this study, we aim to assess the AAS for influenza related articles and its relation to the influenza season in the USA.

Methods: This study used the openly available Altmetric data from Altmetric.com. First, we retrieved all influenza-related articles using an advanced PubMed search query, then we inputted the resulted query into Altmetric explorer. We then calculated the average AAS for each month during the years 2012-2018.

Results: A total of 24,964 PubMed documents were extracted, among them, 12,395 documents had at least one attention. We found a significant difference in mean AAS between February and each of January and March ($p < 0.001$, mean difference of 117.4 and 460.7, respectively). We found a significant difference between June and each of May and July ($p < 0.001$, mean difference of 1221.4 and 162.7, respectively). We also found a significant difference between October and each of September and November ($p < 0.001$, mean difference of 88.8 and 154.8, respectively).

Conclusion: We observed a seasonal trend in the attention toward influenza-related research, with three annual peaks that correlated with the beginning, peak, and end of influenza seasons in the USA, according to Centers for Disease Control and Prevention (CDC) data.

Open Peer Review

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1. **Chintan K Gandhi**, Pennsylvania State University College of Medicine, Hershey, USA
2. **Samy A. Azer**, King Saud University College of Medicine, Riyadh, Saudi Arabia
3. **Jafar Kolahi**, Dental Hypotheses, Isfahan, Iran

Any reports and responses or comments on the article can be found at the end of the article.

Keywords
Influenza, Altmetric, Detection, Vaccine, CDC, Infection

This article is included in the Emerging Diseases and Outbreaks gateway.

Corresponding author: Saif Aldeen AlRyalat (saifryalat@yahoo.com)

Author roles: AlRyalat SA: Conceptualization, Data Curation, Methodology, Software, Supervision, Writing – Review & Editing; **Al Oweidat K**: Conceptualization, Methodology, Project Administration, Visualization, Writing – Review & Editing; **Al-Essa M**: Conceptualization, Data Curation, Methodology, Validation, Writing – Review & Editing; **Ashouri K**: Conceptualization, Methodology, Visualization, Writing – Original Draft Preparation; **El Khatib O**: Conceptualization, Methodology, Software, Writing – Original Draft Preparation; **Al-Rawashdeh A**: Methodology, Software, Visualization, Writing – Original Draft Preparation; **Yaseen A**: Data Curation, Methodology, Visualization, Writing – Original Draft Preparation; **Toumar A**: Methodology, Resources, Visualization, Writing – Original Draft Preparation; **Alrwashdeh A**: Methodology, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing

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REVISED **Amendments from Version 2**

In this revision, and as suggested by reviewers, we abandoned the use of "top 10" for tables in this article and reported number of instances according to a scientific explanation:

For Table 2, we provided journals that published more than 100 research output related to influenza during 2019.

For Table 3, we provided research outputs with an Altmetric Attention Scores (AAS) of more than 1000 discussing influenza and their respective metrics.

Any further responses from the reviewers can be found at the end of the article

Introduction

In the last few years, a new way to measure the attention brought by journal articles, termed altmetrics (a shortening of "alternative metrics" or "article-level metrics"), was adopted. It was also considered an "alternative" to the conventional citation-based measures. Altmetrics measure the impact and attention of an individual article[1]. Altmetrics are increasingly recognized tools with an aim to measure the real-time influence of an academic article[2]. Altmetrics measure the impact of journal articles by tracking social media, Wikipedia, public policy documents, blogs and mainstream news activity, after which an overall Altmetric attention score (AAS) is calculated for every journal article[3]. Altmetrics have been used to measure the impact of articles on a disease[4], or even the impact of article on a whole field[5]. Altmetric.com is one of the providers of altmetrics and was found to have the best coverage of blog posts, news, and tweets. It pulls data from social media (e.g. Twitter and Facebook), traditional media (e.g. The Guardian and New York Times), blogs for individuals and organizations (e.g. Cancer Research UK), and online reference managers (e.g. Mendeley and CiteULike), policy documents published by official websites (e.g., .gov). The AAS is a quantitative measure of the quality and quantity of attention an output has received, it provides an indicator of the amount of attention a research has received. It weights the amount of attention received by each source based on an algorithm.

Each country has its own influenza detection center; the U.S has the Centers for Disease Control and Prevention (CDC), Europe has the European Influenza Surveillance Scheme (EISS), and Japan has the Infectious Disease Surveillance Center (IDSC)[6]. The problem of influenza detection and prediction can be tracked back to Serfling's work in 1963 in epidemiology, which tried to find a threshold for influenza breakout[7]. Since then, various approaches have been proposed for flu detection and prediction in multiple situations[7–9]. A previous project by Google in cooperation with the CDC was able to track in a population based on influenza-related web form queries on the Google search engine[10]. This approach has paved the way for many new approaches designed using the same concept of using search engines for flu detection in the USA[11]. In this study, we aim to assess the AAS for influenza related articles. Moreover, we will assess the top articles and journals publishing about influenza in terms of attention they brought.

Methods

Search strategy

This study used the openly available Altmetric data by Altmetric.com. Accordingly, this study was exempted from institutional board review IRB approval. We conducted the search on June, 5th 2019. To retrieve all articles indexed in PubMed related to influenza, we used MeSH database to extract influenza-related terms, and the following were identified:

- Grippe
- Human Flu
- Human Influenza
- Influenza
- Influenza in Humans

We then searched PubMed database in the following steps:

1- All influenza entry terms mentioned above were used as "MeSH terms".

2- Language: English.

3- Publication type: Journal articles.

4- Search period: from 1/1/2000 to 31/12/2018.

The following query resulted:

(((((((Grippe[MeSH Terms]) OR Human Flu[MeSH Terms]) OR Human Influenza[MeSH Terms]) OR Influenza[MeSH Terms]) OR Influenza in Humans[MeSH Terms]) AND "english"[Language]) AND ("2000/01/01"[Date - Publication] : "2018/12/31"[Date - Publication])) AND "journal article"[Publication Type]

It is important to note that the filter "Journal article" used in the search query only include original article, and exclude review articles, editorials …etc. We screened the searched results for articles discussing the use of databases to detect influenza in USA.

Altmetric data

We inputted the resulted search query into Altmetric Explorer, a web-based platform that enables users to browse and report all attention data for every piece of scholarly content. It provides the function of inputting search results already retrieved by the PubMed database[12].

Data can be filtered and presented for countries and in specific time periods. We filtered influenza mentions for the USA as a country, to correlate with influenza frequency detected by the CDC, then we measured the AAS for each month in the period from 2012 to 2018, we then calculated the average AAS for each month.

We observed regular monthly mentions of the research output only after January 2012, thus we only included mentions from

January 2012 and on. We filtered the search for US mentions only. We collected US mentions of influenza related articles in each month in the years from 2012 to 2018, and we then calculated the average AAS score for each month.

We observe peak AAS scores, which defined as the highest score in a month compared to its previous and next months.

Statistical analysis

We used SPSS version 21.0 (Chicago, USA) in our analysis. We used mean (± standard deviation) to describe continuous variables (e.g. AAS). We used count (frequency) to describe other nominal variables (e.g. countries). We performed one-way ANOVA followed by Tukey's post-hoc test to analyze the difference in the mean AAS score between each month, we presented the results in mean difference with 95% confidence interval (CI). All underlying assumptions were met, unless otherwise indicated. We adopted a p-value of 0.05 as the significance threshold.

Results

A total of 24,964 PubMed documents were extracted. Among them, 12,395 documents had at least one Altmetric point. The total number of mentions for the included documents was 185,744, of which 152,899 were from social media, 20,499 were from news and blogs, 10,608 were from policy and patents, 1,309 were from other sources and 479 were from academic sources. The USA contributed to 28,001 (20.4%) of the total mentions, followed by UK 12,007 (8.8%), and Japan 8,684 (6.3%). The average US mentions for the influenza related articles each month from 2012-2018, and their total mentions are shown in Table 1.

Table 1. Average US mentions of influenza-related articles each month in the years 2012 to 2018.

Month	Mean	Total mentions	Std. Deviation
January	959.0805	4274	626.92688
February	1076.5216	4331	614.63388
March	615.8514	3056	276.20525
April	593.2094	3037	288.99383
May	464.7877	2694	170.46013
June	586.1891	2930	271.08380
July	423.5106	2162	196.47219
August	408.3328	2368	141.68444
September	742.6760	3611	346.54126
October	831.4399	4237	441.88501
November	676.6112	3668	253.31778
December	693.9009	3623	369.53838
Total	712.6055	39991	441.73627

On one-way ANOVA, we found a significant difference between the months ($p< 0.001$). Following post-hoc analysis, we found a significant difference in mean AAS between February and each of January ($p< 0.001$, mean difference of 117.4 with 95% CI: 89.7 to 145.2) and March ($p< 0.001$, mean difference of 460.7 with 95% CI: 430.2 to 491.1). We also found a significant difference between June and each of May ($p< 0.001$, mean difference of 1221.4 with 95% CI: 87.0 to 155.8) and July ($p< 0.001$, mean difference of 162.7 with 95% CI: 126.1 to 199.2). We also found a significant difference between October and each of September ($p< 0.001$, mean difference of 88.8 with 95% CI: 59.6 to 118.0) and November ($p< 0.001$, mean difference of 154.8 with 95% CI: 125.8 to 183.9). As shown in Figure 1, there are three peaks for the AAS; the highest is observed in February with a mean AAS of 1076.5 (±614.6), the second highest peak is in October with a mean AAS of 831.4 (±441.9), and the third peak is in June with a mean AAS of 586.2 (±271.1).

The journals publishing articles with highest AAS scores were PLOS ONE with a total AAS of 872 for 979 research outputs, followed by Vaccine with 842 for 1015 research outputs, and Influenza & Other Respiratory Viruses with 465 for 465 research outputs. Table 2 shows the journals that published more than 100 influenza-related research during 2019.

The top research article in terms of AAS is entitled "Infectious virus in exhaled breath of symptomatic seasonal influenza cases from a college community" published in "Proceedings of the National Academy of Sciences of the United States of America" in January 2018, with an AAS of 2927. Table 3 shows research outputs discussing influenza by AAS with an AAS of more than 1000.

We found around 49 articles discussing the use of websites to detect influenza in USA (Figure 2).

Discussion

The research on influenza attracted considerable attention, as measured by the AAS, with the USA the source of the greatest attention. For influenza research from the USA, we observed three peaks for the AAS. The highest peak is observed in February, with a mean AAS of 1076.5 (±614.6), which corresponds to the peak of influenza season as reported by CDC; the second peak is in October with a mean AAS of 831.4 (±441.9), which corresponds to the beginning of the influenza vaccination season; and the third is in June with a mean AAS of 586.2 (±271.1), which corresponds to the end of the influenza season. Almost 10,608 were from policy and patents, representing 5.7% of total attention score, which reflect influenza mentions in official and policy websites (e.g., websites ending with .gov).

Previous studies have used several analytic methods to correlate with influenza season. One of the first studies that brought significant public attention was the one that based its influenza surveillance on Google search engine query data[9]. in a study co-authored by Google Inc. and CDC researchers. The idea

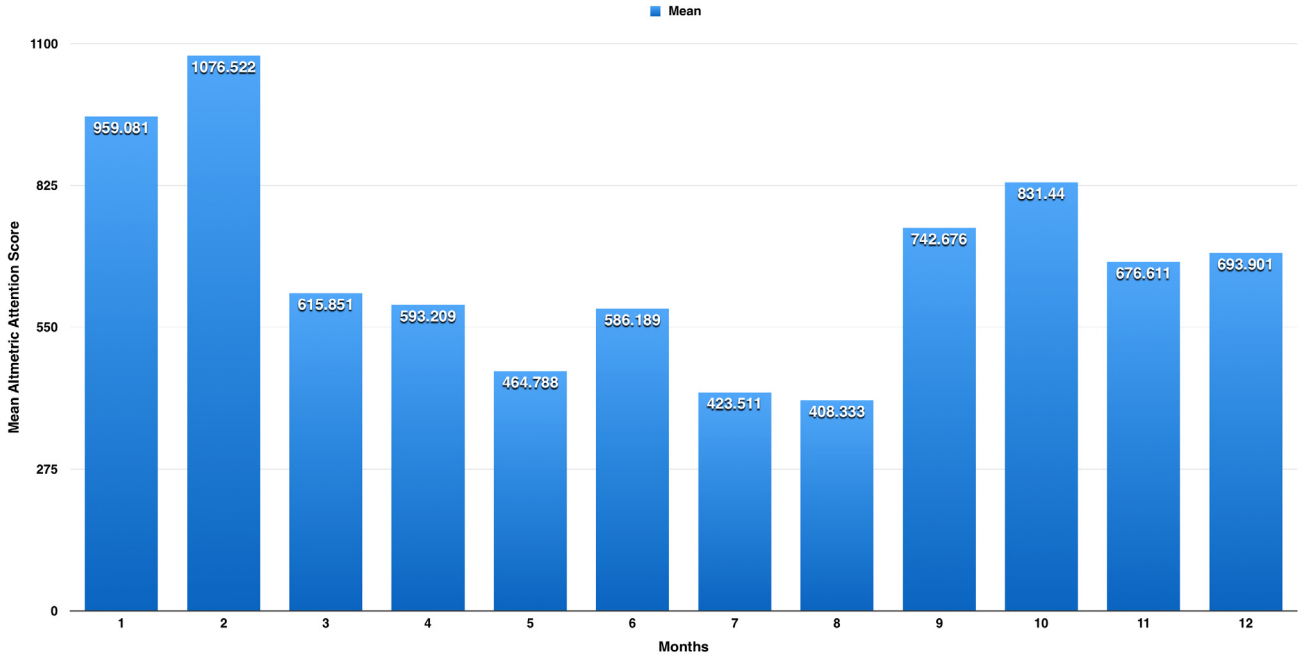

Figure 1. Average Altmetric Attention Score (AAS) for each month from years 2012 to 2018. There are three peaks for the AAS; the highest is observed in February with a mean AAS of 1076.5 (±614.6), the second peak is in October with a mean AAS of 831.4 (±441.9), and the third is in June with a mean AAS of 586.2 (±271.1).

Table 2. Journals that published more than 100 research output related to influenza during 2019.

Journal	Output
Vaccine	1015
PloS ONE	979
Influenza & Other Respiratory Viruses	507
Journal of Virology	350
Journal of Infectious Diseases	348
Emerging Infectious Diseases	324
Clinical Infectious Diseases	291
BMC Infectious Diseases	272
BMC Public Health	178
Epidemiology & Infection	175
Eurosurveillance	175
Human vaccines immunotherapeutics	171
Journal of Clinical Virology	136
Proceedings of the National Academy of Sciences of the United States of America	131
MMWR: Morbidity & Mortality Weekly Report	128
The Pediatric Infectious Disease Journal	123
Pediatrics	117
New England Journal of Medicine	110
Infection control and hospital epidemiology (Online)	109
PLoS Pathogens	103
Journal of Clinical Microbiology	102
Scientific Reports	101

behind this surveillance system was detecting health-seeking behavior in the form of queries to online search engine, where this system managed to estimate weekly influenza activity with only a one-day lag from the CDC actual data. Other studies that used similar estimation techniques followed, where a study by Dugas *et al.* correlated queries to Google search engine with ILI cases reported by emergency departments[13]. This approach of estimating influenza infection trends based on search engine query was also found to be accurate in other countries, for instance, Europe[14], China[15], and South Korea[16]. Other authors also used the Yahoo search engine query to yield similar estimations[17]. Several studies also used Twitter massages and tweets to detect trends that may correlate with

Table 3. Research outputs with an Altmetric Attention Scores (AAS) of more than 1000 discussing influenza and their respective metrics.

Title	AAS	Journal	Publication date	Citations	Tweets	News mentions	Mendeley readers
Infectious virus in exhaled breath of symptomatic seasonal influenza cases from a college community	2927	Proceedings of the National Academy of Sciences of the United States of America	January 2018	24	2524	250	64
Chasing Seasonal Influenza — The Need for a Universal Influenza Vaccine	2478	New England Journal of Medicine	January 2018	46	1013	309	82
Acute Myocardial Infarction after Laboratory-Confirmed Influenza Infection	2075	New England Journal of Medicine	January 2018	74	1649	148	202
Influenza Vaccine Effectiveness Against Pediatric Deaths: 2010–2014	1889	Pediatrics	April 2017	41	829	249	76
Deposition of respiratory virus pathogens on frequently touched surfaces at airports	1696	BMC Infectious Diseases	August 2018	2	209	246	26
The Japanese Experience with Vaccinating Schoolchildren against Influenza	1686	New England Journal of Medicine	March 2001	611	15299	3	188
Interim Estimates of 2017–18 Seasonal Influenza Vaccine Effectiveness — United States, February 2018	1627	MMWR: Morbidity & Mortality Weekly Report	February 2018	57	870	185	55
1918 Influenza: the Mother of All Pandemics	1391	Emerging Infectious Diseases	January 2006	770	27	231	3
Prevention and Control of Seasonal Influenza with Vaccines	1347	MMWR Recommendations & Reports	August 2016	240	240	164	159
The biggest pandemic risk? Viral misinformation	1346	Nature	October 2018	4	1949	10	33
Potent protection against H5N1 and H7N9 influenza via childhood hemagglutinin imprinting	1278	Science	November 2016	102	148	163	189
An Amphibian Host Defense Peptide Is Virucidal for Human H1 Hemagglutinin-Bearing Influenza Viruses	1167	Immunity	April 2017	16	133	142	86

ILI trends as detected by CDC[11,18–21]. Other studies used text mining to extract influenza-related blogs from several web and social media sources[22]. In another approach, several authors used Wikipedia access logs to achieve accurate, real time estimation of influenza cases[23,24]. In a study by Santillana *et al.*, the authors combined data from search engines, social media and hospital visits to estimate influenza activity in USA[25].

During our literature review, we found around 49 articles discussing the use of websites to detect influenza in USA (Figure 2). Using search engines as a source of data (e.g. Google and Yahoo) has limited the data provided[17,19], compared to micro-blogging websites (e.g. twitter), which contain more semi-structured metadata enabling a more detailed statistical analysis (e.g. cities, gender, age)[26]. Several papers proposed different models for detecting flu using Twitter-based methods. Ritterman *et al.* showed that twitter can improve the accuracy of market forecasting by detecting early external events like H1N1[27], followed by another study which used twitter, multiple regression, and document filtering to detect relationship

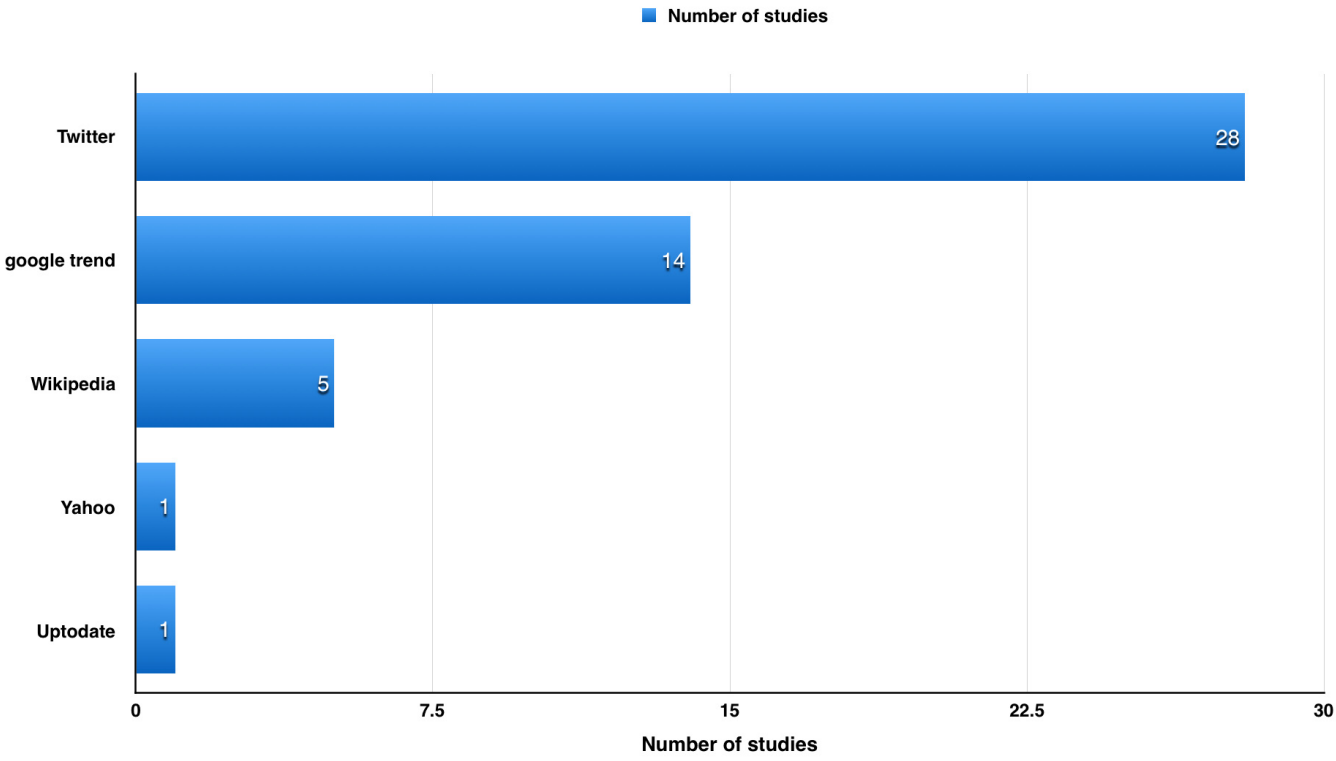

Figure 2. Article discussing the use of websites to detect influenza in USA.

between tweets and national data statistics[26]. In another study, Broniatowski *et al*. created a new supervised classification model that separates tweets indicating influenza infection from those indicating influenza awareness or concern[20].

In general, the interest in publishing about influenza has increased in the recent years[28], with USA being the top country in terms of influenza research production[29,30]. From the overall influenza research output, influenza vaccine was one of the main topics researched and Journal of Virology and Vaccine journal published the highest number of research articles since 1900[29]. We also found that PLOS ONE was the top journal in terms of AAS followed by Vaccine.

With the recent emergence of the coronavirus (COVID-19), severe studies used the altmetric analysis to gain insight about its related publications and public's response to such new publications[31]. An altmetric analysis of COVID-19 articles found several factors affecting article's attention, including the title and how positive were the results[32]. Another article also showed a higher attention for articles published in high quality journals[33]. Such higher attention and impact of articles published in higher quality journals might be related to the dedicated social media centers in these journals to publicly promote published articles[34].

Some limitations to the present study need to be taken into account. The search queries in these models are not exclusively submitted by users experiencing influenza-like symptoms, thus the correlations observed might be only meaningful across large populations. In addition, despite strong historical correlations, these systems remain susceptible to false alerts caused by a sudden increase in ILI-related queries. An unusual event, such as a drug recall for a popular cold or flu remedy, announcing a new flu strain, etc., could cause such a false alert[19]. Disease mentions sometimes depend on social events, which might not be related to disease spread, like holding a conference about flu pandemic. Another limitation to using web-based tools is coverage. Additionally, much of the world is currently excluded from the current systems, which can only process English-language tweets[20]. Future studies should further assess the validity of our descriptive results by performing sensitivity analysis using the number of articles published each year or proceeding years and correlate AAS score with weekly flu activity data. Moreover, other confirmatory studies may assess the validity of our results by assessing data for influenza in other countries such as Australia and New Zealand, where the influenza seasons are different in timing to those to the USA.

The use of social media interaction to describe epidemiological studies has been evolving. We observed a seasonal trend in the attention toward influenza-related research, with three annual peaks that correlated with the beginning, peak, and end of influenza seasons in USA, according to CDC data. We believe that analyzing the attention of influenza related research may aid in detecting influenza season's peaks, which may be a useful tool in areas with limited on-site detection centers. While this study is a descriptive data and its results provide preliminary data, its results should be cautiously interpreted due to the descriptive nature of the study.

Data availability

Underlying data

Harvard Dataverse: Altmetric Attention Score for influenza publications in USA. https://doi.org/10.7910/DVN/XCQ8WO[35].

This project contains the following underlying data:

- Altmetric - Data.tab (A list of articles found on PubMed that discuss influenza and have at least one Altmetric point)

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Open Peer Review

Current Peer Review Status: ? ✓ ?

Version 3

Reviewer Report 13 April 2022

https://doi.org/10.5256/f1000research.122122.r126660

✓ **Samy A. Azer**
Department of Medical Education, King Saud University College of Medicine, Riyadh, Saudi Arabia

I thank the authors for submitting an amended version and addressing the points raised. The amended version is acceptable. I have no other comments.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 2

Reviewer Report 15 February 2022

https://doi.org/10.5256/f1000research.120137.r120398

? **Samy A. Azer**
Department of Medical Education, King Saud University College of Medicine, Riyadh, Saudi Arabia

Thank you for submitting an amended version of the manuscript. The authors have partly addressed the issues raised by the reviewer.

The main problem is limiting the results in the tables to 10 papers or ten journals. What is the scientific basis behind this selection of ten rather than showing a significant number of the results

in the tables or appendices? We know that there are errors like these in other publications, but we can not leave such errors repeating.

For example, Table 2 does not show the Journals stated in Table 3. The New England Medical Journal is stated three times among the ten mentioned in Table 3, but not in Table 2 even once; the authors can apply this to other journals. The reason is showing small samples of each.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Medical informatics. I have published on this area.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 04 Mar 2022

Saif Aldeen AlRyalat, University of Jordan, Amman, Jordan

Thank you for your productive comments throughout the review process. We agree with the reviewer that choosing “top 10” in general has no scientific basis, rather a haphazard number commonly used by research. Accordingly, we abandoned the “top 10” in this article and reported according to a scientific explanation.
For table 2, we provided journals that published more than 100 research output related to influenza during 2019.

For table 3, we provided research outputs with an Altmetric Attention Scores (AAS) of more than 1000 discussing influenza and their respective metrics.

Competing Interests: None

Version 1

Reviewer Report 06 October 2021

https://doi.org/10.5256/f1000research.24402.r91751

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Jafar Kolahi

Dental Hypotheses, Isfahan, Iran

1. Keywords should be revised. General terms such as “detection” and “CDC” are not useful.

2. Descriptions about Altmetric resources must be removed from the methods and could be presented in the introduction section.

“It pulls data from:

- *Social media (e.g. Twitter and Facebook).*
- *Traditional media (e.g. The Guardian and New York Times).*
- *Blogs for individuals and organizations (e.g. Cancer Research UK).*
- *Online reference managers (e.g. Mendeley and CiteULike).*

The AAS is a quantitative measure of the quality and quantity of attention an output has received, it provides an indicator of the amount of attention a research has received. It weights the amount of attention received by each source based on an algorithm. "

1. The main weakness of this manuscript is its statistical methods. The authors aimed to assess the correlation between two longitudinal data “*We filtered influenza mentions for the USA as a country, to correlate with influenza frequency detected by the CDC*”. Yet do not perform any statistical analysis in this regard. I suggest the usage of https://play95.shinyapps.io/Repeated_Correlation/

2. **Table 2.** To my knowledge, Altmetric institution does not provide Altmetric Attention Score for journals. The only number of mentioned articles and total mentions calculate at the journal level.

3. **Table 3.** Please provide more details for top articles such as the number of Twitter mentions or the number of Mendeley readers, etc.

4. **Figure 2.** This is a finding out of the aims and methods of this study. Please describe methods to reach this data in detail. Why is this important? Presentation of a new findings in the discussion section is not recommended.

5. **152,899 were from social media.** Please describe which social media. Analyze active Twitter accounts in this regard.

6. **10,608 were from policy and patents.** This finding is very important. Please describe policy resources.

7. Please describe the limitations of the study and suggestions for future research in the discussion section.

8. What is the clinical relevance of the findings of this research?

9. Usage of new methods e.g. keyword co-occurrence network analysis or co-citation network analysis is popular among altmetric papers. The authors could consider these methods to increase the values of their research.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?
No

Are sufficient details of methods and analysis provided to allow replication by others?
No

If applicable, is the statistical analysis and its interpretation appropriate?
No

Are all the source data underlying the results available to ensure full reproducibility?
No

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Altmetrics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 08 Jan 2022

Saif Aldeen AlRyalat, University of Jordan, Amman, Jordan

1. Keywords should be revised. General terms such as “detection” and “CDC” are not useful.

Response: Thank you for the suggestion, we edited the keywords.

1. Descriptions about Altmetric resources must be removed from the methods and could be presented in the introduction section.

“It pulls data from:

- *Social media (e.g. Twitter and Facebook).*
- *Traditional media (e.g. The Guardian and New York Times).*
- *Blogs for individuals and organizations (e.g. Cancer Research UK).*
- *Online reference managers (e.g. Mendeley and CiteULike).*

The AAS is a quantitative measure of the quality and quantity of attention an output has received, it provides an indicator of the amount of attention a research has received. It weights the amount of attention received by each source based on an algorithm. "

Response: We performed the suggested edits accordingly.

1. The main weakness of this manuscript is its statistical methods. The authors aimed to

assess the correlation between two longitudinal data "*We filtered influenza mentions for the USA as a country, to correlate with influenza frequency detected by the CDC*". Yet do not perform any statistical analysis in this regard. I suggest the usage of https://play95.shinyapps.io/Repeated_Correlation/

Response: Thank you for the suggestion. Our study is mainly a descriptive analysis of the attention scores. We agree with the reviewer that such studies have a strong limitation in its design, which usually does not support inferential statistics. We edited the conclusion and further elaborated on the limitations so that reader keep this limitation in mind upon interpreting the results.

1. **Table 2.** To my knowledge, Altmetric institution does not provide Altmetric Attention Score for journals. The only number of mentioned articles and total mentions calculate at the journal level.

Response: The Altmetric database analyze the attention score at the article level as the reviewer mentioned, and they accordingly calculate the journal level AAS from their respective articles.

1. **Table 3.** Please provide more details for top articles such as the number of Twitter mentions or the number of Mendeley readers, etc.

Response: Thank you for the important suggestion. We provided Citations, Tweets, news mentions, Mendeley readers for top articles.

1. **Figure 2.** This is a finding out of the aims and methods of this study. Please describe methods to reach this data in detail. Why is this important? Presentation of a new findings in the discussion section is not recommended.

Response: We agree with the reviewer, and we added further details in the methods, and we transferred the figure to the results. The articles mentioned in figure 2 were retrieved through the same search described in the methods.

1. **152,899 were from social media.** Please describe which social media. Analyze active Twitter accounts in this regard.

Response: We agree with the reviewer on the importance of such details. However, details on twitter accounts can't be retrieved from the altmetric database. Data regarding other social media mentions and details on calculated attention score was provided in the supplementary data associated with the publication.

1. **10,608 were from policy and patents.** This finding is very important. Please describe policy resources.

Response: Thank you. We further elaborated on this result in the introduction and discussion.

1. Please describe the limitations of the study and suggestions for future research in the discussion section.

Response: We elaborated on the limitations and provided suggestions for future projects: "Future studies should further assess the validity of our descriptive results by performing sensitivity analysis using the number of articles published each year or proceeding years and correlate AAS score with weekly flu activity data. Moreover, other confirmatory studies may assess the validity of our results by assessing data for influenza in other countries such as Australia and New Zealand, where the influenza seasons are different in timing to those

to the USA."

1. What is the clinical relevance of the findings of this research?

Response: We elaborated on the conclusion to further explain the clinical and epidemiological significance of our study, and at the same time, we further explain the inherent limitation of the descriptive nature of our study, and the need for further confirmatory studies.

1. Usage of new methods e.g. keyword co-occurrence network analysis or co-citation network analysis is popular among altmetric papers. The authors could consider these methods to increase the values of their research.

Response: We agree with the reviewer on the importance of such methods, and we will work on implementing them in future work.

Competing Interests: None

Reviewer Report 29 April 2021

https://doi.org/10.5256/f1000research.24402.r84107

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Samy A. Azer
Department of Medical Education, King Saud University College of Medicine, Riyadh, Saudi Arabia

Influenza Altmetric Attention Score and its association with the influenza season in USA

Thank you for inviting me to review the above-titled study. The authors have submitted valuable research to the reader of this journal. However, some issues need the authors' attention:

The title needs to change "USA" to "the USA".

The abstract, methods need to state, "We filtered influenza mention in the Atmetric data to those related to the USA."

Introduction:

1. The authors must mention after the paper mentioned [Ref 10] that their study is designed along with this principle. They will filter the influenza mention in the Altmetric data obtained to only those related to the USA. This must be mentioned otherwise; a significant criticism could come to the reader's mind.

2. The writing needs editing for the English.

Methods:

1. What do the authors mean by "Journal article"? A journal article can be an article, a perspective, a review, a systemic review, a personal view etc. Which one(s) do they mean?

2. What were the inclusion and exclusion criteria?

3. Altmetric data: "We inputted the resulted search queries into Altmetric Explorer" the statement not clear. Did the authors identify the Altimetric score for each paper for all papers together? How? Did they perform this by themselves or the Altmetric team?

Results: Needs organisation and presenting it to mirror the items in the methods.

Discussion:

1. The study discussion could be strengthened and improved.

2. Language editing is needed.

3. The discussion of findings against other studies in the literature that correlated seasonal findings against the Altmetric scores could be discussed and explaining differences.

4. The limitation of the study - The authors may add they did not study or filter data for influenza in other countries such as Australia and New Zealand, where the influenza seasons are different in timing to those to the USA and tested whether their hypothesis is correct or not.

References: Could be improved and adding other related studies on the Altmetric scores.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Medical informatics. I have published on this area.

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 08 Jan 2022

Saif Aldeen AlRyalat, University of Jordan, Amman, Jordan

Influenza Altmetric Attention Score and its association with the influenza season in USA

Thank you for inviting me to review the above-titled study. The authors have submitted valuable research to the reader of this journal. However, some issues need the authors' attention:

The title needs to change "USA" to "the USA".
Response: Done, thank you.

The abstract, methods need to state, "We filtered influenza mention in the Atmetric data to those related to the USA."
Response: Done, thank you.

Introduction:

1. The authors must mention after the paper mentioned [Ref 10] that their study is designed along with this principle. They will filter the influenza mention in the Altmetric data obtained to only those related to the USA. This must be mentioned otherwise; a significant criticism could come to the reader's mind.

Response: Done, thank you.

1. The writing needs editing for the English.

Response: We reviewed the article for potential grammatical mistakes, which is also done by the F1000 team.

Methods:

1. What do the authors mean by "Journal article"? A journal article can be an article, a perspective, a review, a systemic review, a personal view etc. Which one(s) do they mean?

Response: We provided the explanation for this filter. The filter “Journal article” used in the search query only include original article, and exclude review articles, editorials ...etc.

1. What were the inclusion and exclusion criteria?

Response: We provided the details in the methods as follows: “We observed regular monthly mentions of the research output only after January 2012, thus we only included mentions from January 2012 and on. We filtered the search for US mentions only. We collected US mentions of influenza related articles in each month in the years from 2012 to 2018, and we then calculated the average AAS score for each month.”

1. Altmetric data: "We inputted the resulted search queries into Altmetric Explorer" the statement not clear. Did the authors identify the Altimetric score for each paper for all papers together? How? Did they perform this by themselves or the Altmetric team?

Response: The Altmetric explorer provide the function of inputting the search results already retrieved by the PubMed database. We provided further details in the methods.
Results: Needs organisation and presenting it to mirror the items in the methods.

Response: We've relocated part of the results in the methods to provide better organization.

Discussion:

1. The study discussion could be strengthened and improved.

Response: We further elaborated on the discussion from recently published articles.

1. Language editing is needed.

Response: We reviewed the article for potential grammatical mistakes, which is also done by the F1000 team.

1. The discussion of findings against other studies in the literature that correlated seasonal findings against the Altmetric scores could be discussed and explaining differences.

Response: Thank you for the suggestion, we further elaborated on the discussion. However, the studies already mentioned in the discussion represent the main literature related to altmetric use in epidemiology.

1. The limitation of the study - The authors may add they did not study or filter data for influenza in other countries such as Australia and New Zealand, where the influenza seasons are different in timing to those to the USA and tested whether their hypothesis is correct or not.

Response: Thank you for the suggestion, we further elaborated on the study limitations to include this suggestion.
References: Could be improved and adding other related studies on the Altmetric scores.

Competing Interests: None

Reviewer Report 29 June 2020

https://doi.org/10.5256/f1000research.24402.r65403

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Chintan K Gandhi

Department of Pediatrics, Pennsylvania State University College of Medicine, Hershey, PA, USA

I commend the author for carrying out this important study and a very interesting study premise. However, there are a few points that need to be addressed.

Major comments:

Introduction: The entire second paragraph is irrelevant to the current study. Most of the literature cited in the second paragraph is about flu surveillance activity based on objective hospital data such as hospital deaths, pharmacy use, confirmatory laboratory test. Authors should look for literature about social media use or other similar findings to justify their study. Citation 10 and 11 are appropriate. This paragraph does not support the problem at hand nor justify the study premise.

Method: The author has written this aim in the introduction, "we aim to assess the AAS for influenza related articles and its relation to the influenza season in USA. Moreover, we will assess the top articles and journals publishing about influenza in terms of attention they brought.". Methods provided can justify the second objective but not the first one. Authors need to carry out sensitivity analysis to correlate AAS score and flu vaccine. For example, CDC releases weekly data about flu activity, author can show the correlation of that particular week with AAS score. In the current method, the author can state that this is a descriptive study of AAS during the flu season in the last couple of years. Author can not fulfill the first objective without sensitivity analysis and correlation with flu activity.

Results: This entire paragraph should be in the method section, "We observed regular monthly mentions of the research output only after January 2012, thus we only included mentions from January 2012 and on. We filtered the search for US mentions only. We collected US mentions of influenza related articles in each month in the years from 2012 to 2018, and we then calculated the average AAS score for each month. This is shown in Table 1." Basically, author is describing what they did for the study. I am not sure Table 1 is necessary. You can add standard deviation of table 1 in Figure 1. It is a duplication of information.

I have trouble understanding results, particularly this section. "As shown in Figure 1, there are three peaks for the AAS; the highest is observed in February with a mean AAS of 1076.5 (±614.6), the second peak is in October with a mean AAS of 831.4 (±441.9), and the third is in June with a mean AAS of 586.2 (±271.1)." What do authors mean by "peak"? As far as I can see from Figure 1, the mean AAS score was highest in February, January, October, September, December in that order. Why the author stated that the second peak was in October and then 3rd peak was in June. It seems figure 1 and the reported result are not correlating. What does "peak" mean? Please clarify. It seems authors trying to fit their data with CDC surveillance data.

Author has mentioned this in Method, " We filtered influenza mentions for the USA as a country, to correlate with influenza frequency detected by the CDC, then we measured the AAS for each month in the period from 2012 to 2018, we then calculated the average AAS for each month."

The cited material here showed that flu activity peaked in February and there is minimal to no activity in April, May, and rest of the summer. If the author is stating that their findings help for flu activity surveillance then accordingly their AAS score should be minimal during those months but

instead, the author reported "peak" in June.

It is not surprising to see higher AAS during flu season in US. The bottom line is "study findings are overstated." The objective and conclusion of the study are not supported by methods use and reported results, respectively.

I would advise authors to turn it around and report this study as a descriptive study of AAS during flu seasons.

Based on the method and results, it is difficult to justify that author's findings will help CDC and/or other surveillance agency to monitor flu activity. For that, authors need 1) to do sensitivity analysis using the number of articles published each year or proceeding years and correlate AAS score (increasing or decreasing) with weekly flu activity data, 2) to choose denominator such as the number of articles published preceding years or something like that rather than just mean AAS score. They need to think out of the box for this, 3) finally, validation of the findings.

Discussion: Again, the author mention other surveillance studies but they have mostly reported pharmacy data, hospital, ED visits, and lab data. This should change according to method and results.

Authors need to make major revisions to the article before it can be accepted for publication.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
No

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Trends in outcome data, Surfactant protein A

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 08 Jan 2022

Saif Aldeen AlRyalat, University of Jordan, Amman, Jordan

I commend the author for carrying out this important study and a very interesting study premise. However, there are a few points that need to be addressed.

Major comments:

Introduction: The entire second paragraph is irrelevant to the current study. Most of the literature cited in the second paragraph is about flu surveillance activity based on objective hospital data such as hospital deaths, pharmacy use, confirmatory laboratory test. Authors should look for literature about social media use or other similar findings to justify their study. Citation 10 and 11 are appropriate. This paragraph does not support the problem at hand nor justify the study premise.
Response: Thank you for the suggestion. We omitted the irrelevant part of the introduction, so that only relevant information on influenza detection kept to be more relevant to the current study.

Method: The author has written this aim in the introduction, "we aim to assess the AAS for influenza related articles and its relation to the influenza season in USA. Moreover, we will assess the top articles and journals publishing about influenza in terms of attention they brought.". Methods provided can justify the second objective but not the first one. Authors need to carry out sensitivity analysis to correlate AAS score and flu vaccine. For example, CDC releases weekly data about flu activity, author can show the correlation of that particular week with AAS score. In the current method, the author can state that this is a descriptive study of AAS during the flu season in the last couple of years. Author can not fulfill the first objective without sensitivity analysis and correlation with flu activity.
Response: We agree with the author on the importance of sensitivity analysis. Due to the absence of such analysis, we modified the aim to be in line with the conducted analysis: “In this study, we aim to assess the AAS for influenza related articles. Moreover, we will assess the top articles and journals publishing about influenza in terms of attention they brought”

Results: This entire paragraph should be in the method section, "We observed regular monthly mentions of the research output only after January 2012, thus we only included mentions from January 2012 and on. We filtered the search for US mentions only. We collected US mentions of influenza related articles in each month in the years from 2012 to 2018, and we then calculated the average AAS score for each month. This is shown in Table 1." Basically, author is describing what they did for the study. I am not sure Table 1 is necessary. You can add standard deviation of table 1 in Figure 1. It is a duplication of information.
Response: We agree with the reviewer that this part of results is better fitted within the methods. We made the required changes. Table 1 also mentions the total mentions, which is used in the discussion of our results.

I have trouble understanding results, particularly this section. "As shown in Figure 1, there

are three peaks for the AAS; the highest is observed in February with a mean AAS of 1076.5 (±614.6), the second peak is in October with a mean AAS of 831.4 (±441.9), and the third is in June with a mean AAS of 586.2 (±271.1)." What do authors mean by "peak"? As far as I can see from Figure 1, the mean AAS score was highest in February, January, October, September, December in that order. Why the author stated that the second peak was in October and then 3rd peak was in June. It seems figure 1 and the reported result are not correlating. What does "peak" mean? Please clarify. It seems authors trying to fit their data with CDC surveillance data.
Response: We provided a definition to the “peak” we used in the results section, which is the relatively higher AAS compared to previous and next months. Accordingly, the highest is observed in February with a mean AAS of 1076.5 (±614.6), the second highest peak is in October with a mean AAS of 831.4 (±441.9), and the third peak is in June with a mean AAS of 586.2 (±271.1). The months mentioned by the reviewer has highest absolute values.

Author has mentioned this in Method, " We filtered influenza mentions for the USA as a country, to correlate with influenza frequency detected by the CDC, then we measured the AAS for each month in the period from 2012 to 2018, we then calculated the average AAS for each month." The cited material here showed that flu activity peaked in February and there is minimal to no activity in April, May, and rest of the summer. If the author is stating that their findings help for flu activity surveillance then accordingly their AAS score should be minimal during those months but instead, the author reported "peak" in June.
Response: We agree that the AAS data is not completely explained by the CDC data related to infection cases. The small peak in June was hypothesized to be related to the end of influenza season. This is further stressed in the limitations.

It is not surprising to see higher AAS during flu season in US. The bottom line is "study findings are overstated." The objective and conclusion of the study are not supported by methods use and reported results, respectively. I would advise authors to turn it around and report this study as a descriptive study of AAS during flu seasons.
Response: We agree with the reviewer that the AAS were not completely correlating with the CDC data, and the results should not over-emphasize the findings. We further elaborated on the study limitations and re-worded the conclusion to be in line with these limitations.
Response: We further elaborated on the study limitations and conclusion to emphasize on the descriptive nature of the study and its findings.

Based on the method and results, it is difficult to justify that author's findings will help CDC and/or other surveillance agency to monitor flu activity. For that, authors need 1) to do sensitivity analysis using the number of articles published each year or proceeding years and correlate AAS score (increasing or decreasing) with weekly flu activity data, 2) to choose denominator such as the number of articles published preceding years or something like that rather than just mean AAS score. They need to think out of the box for this, 3) finally, validation of the findings.
Response: Thank you for the great suggestions. We added the suggestions to as what future studies should do to confirm our descriptive results.

Discussion: Again, the author mention other surveillance studies but they have mostly

reported pharmacy data, hospital, ED visits, and lab data. This should change according to method and results.
Response: We added further discussion related to our results from recent literature. However, the studies already mentioned in the discussion represent the main literature related to altmetric use in epidemiology.

Competing Interests: None