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Keshav Dhir, Prabhsimran Singh, Yogesh K. Dwivedi, Sargun Sawhney,
Ravinder Singh Sawhney

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Examining the role of Social Media in Emergency Healthcare Communication: A Bibliometric Approach

Keshav Dhir¹ [0000-0003-2434-4425], Prabhsimran Singh² [0000-0002-1453-3989],
Yogesh K. Dwivedi³ [0000-0002-5547-9990],
Sargun Sawhney⁴, Ravinder Singh Sawhney⁵ [0000-0001-7892-0825]

¹Department of Computer Science and Engineering,

¹Chandigarh University, Gharuan, Mohali, India,

^{1,2,4}Department of Computer Engineering & Technology,

⁵Department of Electronics Technology,

^{1,2,4,5}Guru Nanak Dev University, Amritsar, India,

³School of Management, Emerging Market Research Center (EMaRC),

³Swansea University, Swansea, UK,

³Department of Management, Symbiosis Institute of Business Management, Pune &

³Symbiosis International (Deemed University), Pune, Maharashtra, India.

¹kesdhir@gmail.com, ²prabhsimran.dcet@gndu.ac.in, ²prabh_singh32@yahoo.com,
³y.k.dwivedi@swansea.ac.uk, ⁴sargunsawhney@gmail.com, ⁵sawhney.ece@gndu.ac.in

Abstract. Social media has been extensively used for the communication of health-related information and consecutively for the potential spread of medical misinformation. The aim of this study was to perform a bibliometric analysis of the current literature from Scopus database to discover the prevalent trends and topics related to communication regarding healthcare emergencies via social media. To accomplish this task, the research work has been carried in form of defending three research questions related to most impactful sources, most impactful publications and most impactful authors. The adopted methodology has been successful towards answering the research questions in the light of our collected dataset of Scopus articles.

Keywords: Bibliometric Analysis, Crisis Communication, Emergency Communication, Healthcare Communication, Social Media, Scopus, Twitter.

1 Introduction

COVID-19 pandemic has turned out to be the greatest enemy of the humankind in recent years (Singh et al., 2020a). This pandemic has exposed vulnerability of our medical system. With the advancement in information technology, people were able to combat this deadly pandemic through better communication for information diffusion (Dwivedi et al., 2020). Social media platforms, especially Twitter played an important role in passing the critical information to people around the world in real time breaking the traditional geographical barriers (Haman, 2020; Singh et al., 2018; Xue et al., 2020). The proliferation of Internet has led to exponential rise in social media users worldwide (Singh et al., 2019). Social media has now become more of an information-sharer platform rather than just a media related fun service or a tool. It

has been observed that people now share all sorts of information, whether related to politics, sports, disaster etc (Dwivedi et al., 2018; Kapoor et al., 2018; Singh et al., 2020b).

Medical emergencies at global levels can be threatening to the human race. Extensive use of social media, in the recent years has helped many people across the globe to make use of the shared information related to medical healthcare whether disease specific or the precautionary measures related to an outbreak. People are becoming comparatively more knowledgeable about the crisis management through the information being shared by other people through their own experiences via social media channels or groups. Social media is a competitive differential towards the provision of health services and it has revolutionized the methods how any kind of information can be transferred to the masses (Margus et al., 2021; Riaz et al., 2020).

Hence, this paper explores the use of social media in emergency healthcare communications. To accomplish our research objectives towards completion of this task, we made use of bibliometric analysis. Pritchard and Wittig, 1981 first coined the term “bibliometrics”. This approach has evolved quite well reaching the crescendo towards growth of new age technologies. In order to effectively assess and analyze the overall outcome of the research undertaken by researchers in managing the cooperation among the universities, authors, countries etc., bibliometrics has become an extremely predominant tool (Gutiérrez-Salcedo et al., 2018).

This research work reviews the literature concerning utilization of social media in emergency healthcare communications over a decade between 2014 and 2021. In doing so, we try to investigate and defend the following research questions (RQs):

RQ1: What are the most impactful sources (journals)?

RQ2: What are the most impactful documents (publications)?

RQ3: Who are the most impactful authors?

The rest of the paper is structured as follows: Section 2 describes the methodology and selection criteria. Section 3, deals with various results and findings, followed by discussions in Section 4. Finally, we make concluding remarks in section 5.

2 Methodology

The task of accomplishing the bibliographic analysis is performed in numerous stages. To explore the favorable bibliographic database (e.g. PubMed, EMBase, SpringerLink, Scopus, Web of Science etc.) and to heap up the essential articles as well as journals, is considered as the most crucial stage, and this happens to be our initial stage. Here, it is to be noted that not all the databases provide us with the information or data in order to directly perform the bibliometric analysis. In this study, Scopus database is considered for bibliometrics on the retrieved sources (articles, journals, etc.) as it gives access to the citation data and huge databases related to social sciences, health sciences, physical as well as life sciences. Scopus

database can be accessed through Elsevier website and it covers three types of sources: book series, journals and trade journals.

To gather the data the following search query was used: (*'Social Media' OR 'Twitter' OR 'Tweet' OR 'Social Media Analytic'*) AND (*'Medical' OR 'M-Health' OR 'Health' OR 'Healthcare'*) AND (*'Emergency' OR 'Crisis' OR 'Epidemic' OR 'Pandemic'*) AND (*'Management' OR 'Awareness' OR 'Info-Management'*). In addition to this, the period of publication was selected as 2014-2021, as we wanted to concentrate on the latest literature articles related to the utilization of social media in emergency healthcare communications. Further, only highly rated journal publications were considered for our analysis.

In bibliometric analysis, the data preprocessing and cleaning is an important as well as daunting task that should be performed as the first step. Scopus data collected using the query string resulted in a total of 1273 published articles, which was then refined manually on the basis of reliable titles from the total list, bringing the bibliographic data down to 756 articles. Then to narrow it down further, the remaining articles were filtered one by one on the basis of useful abstracts by reading them individually, bringing the whole count to a solid 251 but after thoroughly analyzing each paper and data munging, which required removal of unwanted keyword data, filtering and manual inspection of every article based on the their abstract, methodology and conclusion, the outcome reduced to a favorable 67 unique articles, on which this whole analysis was conducted. An overview of collected articles is given in Table 1.

Table 1: Overview of Collected Articles

Main Information		Authors		Authors Collaboration	
Sources	56	Authors	300	Single-authored documents	8
Documents	67	Author Appearances	311	Documents per Author	0.233
Average years from publication	2.14	Authors of single-authored documents	7	Authors per Document	4.29
Average citations per documents	13.44	Authors of multi-authored documents	293	Co-Authors per Documents	4.44
Average citations per year per document	3.498			Collaboration Index	4.73
References	3272				

For this research study, an open-source R Package, “bibliometrix” was used which incorporates several analysis options. It is a powerful library that can perform complete bibliometric and scientometric analysis (Aria and Cuccurullo, 2017). Furthermore, it allows us to obtain multiple types of graphs and features not common in other libraries and any non-coder can also use this tool as well.

3 Results and Findings

In this section, we share the results and findings of bibliometric analysis. This section has been divided in four sub-sections. The first sub-section deals with most impactful

sources (journals), while, second sub-section deals with most impactful documents. Third sub-section deals with most impactful authors, while prominent publication themes are discussed in fourth sub-section.

3.1 Impactful Sources

In order to identify the most impactful sources, we first check the relevance of the sources i.e. number of articles published from a particular source in our shortlisted 67 articles (shortlisted local database). The result of this analysis is shown in Table 2. With five articles Journal of Medical Internet Research (Himelein-Wachowiak et al., 2021; Iyu et al., 2021; Margus et al., 2021; Nagar et al., 2014; Park et al., 2021) made the maximum contribution, followed by Plos One (Allen et al., 2016; Buchanan et al., 2021; Hartley et al., 2017; Riviuccio et al., 2021) with four articles.

Table 2: Journals with maximum publications

Rank	Journals	Number of Articles Published
1	Journal of Medical Internet Research	5
2	Plos One	4
=3	International Journal of Environmental Research and Public Health	3
=3	Online Social Networks and Media	3
=5	IEEE Access	2
=5	Indonesian Journal of Geography	2
=5	Journal of Information and Knowledge Management	2

Next, we attempt to identify most locally cited sources. The term locally cited refers to the citations that an article receives from other articles in the review corpus only citations (Donthu et al., 2021). With 45 citations Plos One was the most locally cited source, followed by Journal of Medical Internet Research with 37 citations. The result of top ten locally cited sources is shown in Table 3.

Table 3: Most Local Cited Sources

Rank	Journals	Number of Citations
1	Plos One	45
2	Journal of Medical Internet Research	37
3	Government Information Quarterly	30
4	Science	19
5	Nonprofit and Voluntary Sector Quarterly	18
6	Nature	17
=7	Computers in Human Behavior	16
=7	Public Relations Review	16
9	American Journal of Public Health	15
10	Information	14

3.2 Impactful Documents

In order to investigate the most impactful document, we first find the most globally cited documents. Islam et al., (2020), is the most globally cited article with 198

citations, followed by Gaspar et al., (2016) and Nagar et al., (2014) with 94 citations each. The results most globally cited documents is shown in Table 4.

Table 4: Most Globally Cited Documents

Rank	Publication	Total Citations	Total Citations Per Year	Normalized Total Citations
1	Islam et al., 2020	198	66.000	7.8628
=2	Gaspar et al., 2016	94	13.429	1.9583
=2	Nagar et al., 2014	94	10.444	1.4242
4	Allen et al., 2016	68	9.714	1.4167
5	Sutton et al., 2015	57	7.125	1.0000
6	Plotnick and Hiltz 2016	55	7.857	1.1458
7	Househ, 2016	47	6.714	0.9792
8	Shahi et al., 2021	44	22.000	10.8736
9	Teufel et al., 2020	32	10.667	1.2708
10	Li et al., 2020	21	7.000	0.8339

Next, we compute the most locally cited documents. To our surprise only four documents were locally cited. The results of the most locally cited documents are shown in Table 5. Nagar et al., (2014), was the most locally cited document with three local citations.

Table 5: Most Locally Cited Documents

Rank	Publication	Local Citations (LC)	Global Citations (GC)	LC/GC Ratio (%)	Normalized Local Citation	Normalized Global Citation
1	Nagar et al., 2014	3	94	3.19	2.00	1.42
2	Shahi et al., 2021	2	44	4.55	43.00	10.87
=3	Islam et al., 2020	1	198	0.51	5.50	7.86
=3	Hassan et al., 2020	1	11	9.09	5.50	0.44

3.3 Impactful Authors

In order to identify the most impactful authors, we first check the relevance of the authors i.e. number of articles published by an author in shortlisted local database. There were a total of four authors (Benítez De Gracia, E; Herrera-Peco, I; Jiménez-Gómez, B; Ruiz Núñez, C) who published two articles and coincidentally they authored the same two articles. The results of same is shown in Table 6.

Table 6: Most Relevant Authors

Author	Publications	Number of Articles	Article Fractionalized
Benítez De Gracia, E	Herrera-Peco et al., 2021a; Herrera-Peco et al., 2021b	2	0.34
Herrera-Peco, I	Herrera-Peco et al., 2021a; Herrera-Peco et al., 2021b	2	0.34
Jiménez-Gómez, B	Herrera-Peco et al., 2021a; Herrera-Peco et al., 2021b	2	0.34
Ruiz Núñez, C	Herrera-Peco et al., 2021a; Herrera-Peco et al., 2021b	2	0.34

Next, major question emanates that the authors of which country made the maximum impact. So, in order to investigate this question, we check the corresponding authors'

country. The maximum impact was observed to be created by USA with 18 articles. The results of the same are shown in Table 7.

Table 7: Corresponding Author Country

Rank	Country	Number of Articles	Frequency	Simple Country Publication	Multiple Country Publication	MCP_Ratio
1	USA	18	0.3673	17	1	0.0556
=2	Indonesia	4	0.0816	4	0	0.0000
=2	United Kingdom	4	0.0816	3	1	0.2500
=4	Egypt	3	0.0612	3	0	0.0000
=4	Saudi Arabia	3	0.0612	2	1	0.3333
=6	China	2	0.0408	2	0	0.0000
=6	Korea	2	0.0408	1	1	0.5000
=6	Spain	2	0.0408	2	0	0.0000
=6	Tunisia	2	0.0408	2	0	0.0000

3.4 Prominent Publication Themes

When analysing the multiple articles, it becomes significant to find the most prominent themes in order to cluster them into groups. Further it also helps us to identify the under-explored themes that can be taken by researchers in future work. In order to get themes of these articles, latent dirichlet allocation (LDA) based topic modeling is used (Jeong et al., 2019; Singh et al., 2020b). Three prominent themes were identified namely (a) **Theme-1:** Government use of social media during healthcare emergency (b) **Theme-2:** Public use of social media during healthcare emergency (c) **Theme-3:** Spread of fake news and misinformation during healthcare emergency. Though many can argue that theme-1 and theme-2 overlap each other as both are related to use of social media during healthcare emergency; however, the main difference lies between the context of major stake holders using the social media; in theme-1 it is the government, while in theme-2 it is the general public. The results of topic modeling are shown in Table 8.

Table 8: Results of Topic Modeling

Themes	Total number of Publications	References
Government use of social media during healthcare emergency	21	Adriani et al., 2020; Akbar et al., 2021; Alomari et al., 2021; Al-Sarem et al., 2021; Arpaci et al., 2021; Bélanger et al., 2021; Crook et al., 2016; Ilyas et al., 2021; Islam et al., 2020; Jing et al., 2021; Laserna et al., 2021; London Jr et al., 2021; Machmud et al., 2021; Mansoor et al., 2021; O'Leary et al., 2020; Park et al., 2021; Rivas-De-roca et al., 2021; Santoso et al., 2019; Solnick et al., 2021; Teufel et al., 2020; Thelwall, 2021
Information Diffusion through social media during healthcare emergency	33	Ahmed et al., 2020; Al-Dulaimi et al., 2018; Allen et al., 2016; Andreadis et al., 2021; Botero-Rodríguez et al., 2021; Buchanan et al., 2021; Cherichi et al., 2019; Chong et al., 2021; Enoki et al., 2017; Galindo Neto et al., 2021; Gaspar et al., 2016; Hartley et al., 2017; Haupt et al., 2021; Househ et al., 2016; Li et al., 2020; Lyu et al., 2021; Mann et al., 2021; Margus et al., 2021; Nagar et al., 2014; Nikolovska

		et al., 2020; O'Connor et al., 2021; Plotnick et al., 2016; Priyadarshini et al., 2021; Riaz et al., 2020; Riviuccio et al., 2021; Schweinberger et al., 2021; Shakeri, 2020; Sun et al., 2021; Tsai et al., 2021; Tully et al., 2019; Wang et al., 2021; Wu, 2021;
Spread of fake news and misinformation during healthcare emergency	12	Abdelminaam et al., 2021; Burel et al., 2021; Hassan et al., 2020; Herrera-Peco et al., 2021a; Herrera-Peco et al., 2021b; Himelein-Wachowiak et al., 2021; Jemielniak et al., 2021; Muric et al., 2021; Qureshi et al., 2021; Safarnejad et al., 2020; Shahi et al., 2021; Sutton et al., 2015

4 Discussions

Social media is so deeply embedded in our everyday lives, that we have become helplessly reliant on it for every source of information. This is also true for healthcare related information. This research explores the use of social media in emergency healthcare communication. Our research was based upon three research questions, namely, the most impactful resource, the most impactful document and lastly, the most prominent author(s) and additionally, the country too. According to our results, Journal of Medical Internet Research and Plos One were the most impactful sources (journals). Similarly, Islam et al., 2020 and Nagar et al., 2014 were the most impactful documents (publications). Benítez De Gracia, E; Herrera-Peco, I; Jiménez-Gómez, B; Ruiz Núñez, C were the most impactful authors, while USA was the most impactful country.

This study also reveals that the current subject matter in discussion is not limited to a single domain like information systems (IS), healthcare sciences, information technology (IT) and the social media, but has further advanced into multidisciplinary connotation. People from different disciplines like sciences, healthcare and information systems are working together to explore this area of knowledge.

Like any other research work, this research work also has its own limitations: Firstly, all the sources have been retrieved from a single database, 'Scopus'. The articles from most other prominent databases e.g. PubMed, EMBase, SpringerLink, Web of Science etc. are not considered for bibliometric analysis. Within the selected database, only peer-reviewed articles are ruminated and leaving behind all the other forms of publications, such as conference papers, review papers, book chapters, etc. Secondly, we have considered only the literature written in the English language and no other language is included for the analysis which might have impacted the overall outcome of the findings of this study. Thirdly, the search query used for this study also poses a limitation to the whole analysis as any other combination of search query might have given different results. Finally, even if different initials or surnames have been used by the authors, still, this analysis does not capture common names for active researchers.

Regardless of these limitations, this study can play a vital role in contributing towards the methodological review of active journals published in the area of medical

emergencies, related to the communication via famous social media platforms by performing bibliometrics on them. Furthermore, these limitations can be addressed in future studies.

5 Conclusions

This research analyzes the evolution of research trends in the use of social media for information sharing and communication during global medical emergency situations. In this research work, we have used the bibliometric analysis to investigate and defend our three research questions. Though the limitations of this research work have been listed, yet the purpose of completing this investigation seems fulfilled. Further, as highlighted from our research results that spread of fake news and misinformation during healthcare emergency was under explored research domain, which the researchers can explore in future studies.

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