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REVIEW

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ONLINE SUPPORT FROM VIRTUAL COMMUNITIES TOWARDS DIABETES MELLITUS PATIENTS: A BIBLIOMETRIC REVIEW

Apoio *online* de comunidades virtuais ao portador de diabetes *mellitus*: revisão bibliométrica

Apoyo *online* de las comunidades virtuales al portador diabetes *mellitus*: revisión bibliométrica

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ABSTRACT

Objective: The study's main purpose has been to analyze the international scientific production that describes the support of virtual communities for diabetes mellitus, available on the ISI Web of Knowledge/Web of Science™ database. **Methods:** It is a bibliometric study, in the time frame between 1945 and 2018, with descriptive analysis performed with the aid of HistCite™ software. **Results:** There were identified 175 articles, published in 113 different journals, written by 817 authors linked to 322 research institutions located in 30 countries, 7,023 references were used, with an average of 40 references per article. **Conclusion:** Although the number of studies on social media and diabetes is growing, the literature still points to the lack of longitudinal studies that broaden the understanding of the meanings usually attributed to the disease and identify recurrent cognitive lapses in these spaces, as well as the quality of the information that is posted and shared online, thus highlighting the need for future studies that investigate their impact on users.

Descriptors: Diabetes Mellitus, Social Media, Internet, Social Support, Bibliometrics.

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RESUMO

Objetivo: Analisar a produção científica internacional que descreve o apoio de comunidades virtuais voltadas ao portador de diabetes mellitus, disponibilizada na base ISI Web of Knowledge/Web of Science™. **Método:** trata-se de estudo bibliométrico, no recorte temporal entre 1945 e 2018, com análise descritiva realizada com auxílio do software HistCite™. **Resultados:** foram identificados 175 artigos, publicados em 113 periódicos distintos, escritos por 817 autores vinculados a 322 instituições de pesquisa, localizadas em 30 países, foram utilizadas 7.023 referências, com média de 40 referências por artigo. **Conclusão:** embora o número de estudos sobre mídias sociais e diabetes venha crescendo, a literatura ainda aponta carência de estudos longitudinais que ampliem a compreensão dos sentidos usualmente atribuídos à doença e identifiquem lapsos cognitivos recorrentes nestes espaços, bem como a qualidade das informações que são postadas e compartilhadas online, destacando assim, a necessidade de estudos futuros que investiguem seu impacto nos usuários.

Descritores: Diabetes *Mellitus*; Mídias Sociais; Internet; Apoio Social; Bibliometria.

RESUMEN

Objetivo: Analizar la producción científica internacional que describe el apoyo de las comunidades virtuales para la diabetes mellitus, disponible en la base de datos ISI Web of Knowledge / Web of Science™. **Método:** este es un estudio bibliométrico, de 1945 a 2018, con un análisis descriptivo realizado con el software HistCite™. **Resultados:** identificamos 175 artículos publicados en 113 revistas diferentes, escritos por 817 autores vinculados a 322 instituciones de investigación ubicadas en 30 países, utilizando 7,023 referencias, con una promesa de 40 referencias por artículo. **Conclusión:** a medida que crece el número de estudios en redes sociales y diabetes, la literatura muestra una falta de estudios longitudinales que amplíen la comprensión de los significados generalmente atribuidos a la enfermedad y el deterioro cognitivo recurrente en estos espacios, así como la calidad de vida. La información que se publica. Se comparte en línea, destacando la necesidad de futuros estudios que investiguen su impacto en los usuarios.

Descriptores: Diabetes *Mellitus*; Medios de Comunicación Sociales; Internet; Apoyo Social; Bibliometría.

INTRODUCTION

Longevity, physical inactivity and obesity contribute to the increase of non-communicable chronic diseases. Among them, Diabetes Mellitus (DM), a multifactorial condition characterized by persistent hyperglycemia, which causes long-term micro and macrovascular complications. Considered an epidemic because it is present with high prevalence in all continents, it is therefore a public health problem due to social damage and treatment-related costs, in addition to high morbidity and mortality.[1-2]

Because it is a progressive disease, people with diabetes tend to notice the deterioration of their health over time as the complications arising from the disease progress. This perception can profoundly compromise self-esteem leading to depreciation of quality of life due to poor physical state, impaired functional capacity, lower limb pain, lack of vitality, difficulties in social relationship, emotional instability, among others.[3]

People facing chronic health conditions that lead to physical and social restrictions experience decreased interaction with others that can lead to social isolation. However, this has changed due to the advancement of technology regarding communication and connectivity.[4]

Thinking about this social isolation, many DM patients look for the virtual environment as a means of interaction, even if initially passively, through the pages and support groups related to their disease. These spaces, besides providing information about the disease, prevention and support, bring hope for facing the problem, either by sharing experiences or by recognizing and identifying others in the same situation.[5-6]

Given this framework, studies indicate that social networking sites have presented potentialities in the health field, especially with regard to the reach of messages that can be explored not only for dissemination, but also for mobilization around health promotion actions.[6-7] Among social networking sites, Facebook has been highlighted as an important source of information, social mobilization and as a space that promotes actions and debates about health and the exchange of experiences.

Several studies comparing the use of online health platforms with chronic disease management reveal that the interactions established in the virtual space contribute to the patient's better knowledge about the disease, through the sharing of experiences in disease management and/or information. researched in other sites;[8] better self-management of the chronic condition, attributed to the exchange of experiences, counseling and similarity of problems and feelings; and greater social support through positive reinforcement, counseling, and sharing of information and experience.[5-6]

Bearing in mind the aforesaid, it is evident the need to develop studies that better understand the spaces and virtual communities to support the patient with diabetes mellitus. Hence, how is the international literature on virtual communities presented in support of diabetes mellitus? To answer this question, this study meant to analyze the international scientific production that describes the support of virtual communities focused on diabetes mellitus.

METHODS

It is an exploratory and descriptive bibliometric study that was performed in the ISI Web of Knowledge/Web of Science™ database due to its "academic recognition of being considered one of the most comprehensive journal bases covering various areas of scientific knowledge", besides being important and pioneered the gathering of journals from over 100 knowledge areas.[9]

The steps for data analysis followed three procedures: definition of the database to be consulted; determination of the criteria to be used for data collection; data collection; and definition of the representation and analysis of the collected data. The search period available in the database

for complete years (1945-2018) was used to allow replication or updating of this study without having to perform it again from its inception.[9]

The descriptors were defined from the Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH) catalog, and the following search terms were selected: "Social Media *" and (and) "Diabetes *". The quotation marks indicate the exact representation of terms with more than one word and the asterisks the plural possibilities of the descriptors. These descriptors were searched in the fields of "title", "summary", "keywords" and "keywords plus".

After the search, a refinement of the works was performed through the base search filters. There was no refinement filter for knowledge areas, countries or study languages, thus covering all records of publications that had the two terms in association. We excluded from the results articles from events (conference proceedings) or still considered in editing and records from proceedings papers, editorial material and letter, considering only final and complete papers of the article and review types. Thus, 175 studies were identified.

The material was then analyzed by exporting the data to the HistCite™ bibliometric analysis software package to organize the information and facilitate the analysis. The following were analyzed: the annual evolution trajectory of the publications; the journals with the largest number of records; the authors with the largest number of publications; and the number of articles distributed by authors' country of origin. In addition to these data generated by the software, aspects of the 15 most cited articles globally according to the Global Citation Score (GCS), which represents the global citation of the 15 main articles on the subject, were elucidated and received the highest number of citations in the Web of Science™ and of the 15 most cited articles locally, according to the Local Citation Score (LCS), which represents the local citation quotient corresponding to the 15 articles on the theme that received the highest number of citations from the selected articles, in order to identify their main contributions to the theme. related to diabetes and social media.

The ethical principles recommended for research of this nature were adopted, respecting the ideas, citations, the authors and their publications.

RESULTS

The search carried out for the period from 1945 to 2018, only returned the first article result for the year 2010, and for this reason the time frame evaluated in the results from 2010 to 2018.

After performing the bibliometric survey in the main Web of Science™ collection, 175 articles on social media and diabetes were identified. These articles were published in 113 journals indexed to the database in question and were written by 817 authors with links to 322 institutions located in 30 countries. To achieve these articles, 7,023 references were used, with an average of approximately 40 references per article. Table 1 below presents these results.

Table 1 - General Results of the Bibliometric Survey (2010-2018). *Teresina* city, *Piauí* State, Brazil, 2019

Bibliometric Data	Amount
Publications (articles)	175
Indexed Journals	113
Authors	817
Institutions (linked to the authors)	322
Countries	30
References cited	7023

Source: Research data, 2019.

Table 2 shows the list of the most representative journals regarding the number of publications on the topic under study. It is possible to observe the relationship between the number of citations and the number of articles published in each of the journals, and through this indicator it is possible to have an initial information about the impact of the articles identified in these journals on the total of citations received.

Table 2- Top Journals with most articles published (2010-2018). *Teresina* city, *Piauí* State, Brazil, 2019

Journals	Amount of articles	Citations	Citations / Amount
Journal of Medical Internet Research	20	516	25.8
Plos One	6	87	14.5
BMC Medical Informatics and Decision Making	4	32	8
BMJ Open	4	7	1.75
Diabetes Technology & Therapeutics	4	22	5.5
JMIR Research Protocols	4	17	4.25
Journal of the American Medical Informatics	4	9	2.25
American Journal of Health Promotion	3	13	4.33
Contemporary Clinical Trials	3	30	10
Current Diabetes Report	3	5	1.67
Diabetes Educator	3	19	6.33
JMIR MHEALTH and UHEALTH	3	85	28.3
Journal of Biomedical Informatics	3	48	16

Source: Research data, 2019.

Subsequently, the authors with the most publications on the theme, their institutional affiliation and the institution's country of origin were identified, as shown in Table 3.

Table 3- Authors with the largest number of publications (2010-2018). *Teresina* city, *Piauí* State, Brazil, 2019

Authors	Articles	Citations	Affiliation (Bonding Institution)	Country
Arsand E	7	218	University of Tromsø The Artic University of Norway	Norway
Fernandez-Luque L	5	240	Hamad Bin Khalifa University	Qatar
Srinivasa RN	4	0	University of Michigan Health System	USA

Source: Research data, 2019.

The most representative countries, which have most of the scientific production in the studied field, were: United States of America, Australia, United Kingdom and Canada. Although the United States has the largest number of publications and citations, with 89 articles and 1518 citations (Table 4), the most representative author in number of articles and citations is linked to one Norwegian institution (Table 3).

Table 4- Number of articles by country of origin of the authors' affiliation institutions. *Teresina* city, *Piauí* State, Brazil, 2019

Country	Amount	Citations
USA	89	1518
Australia	18	187
UK	18	118
Canada	13	80
Norway	9	240
Saudi Arabia	8	16
China	7	57
Sweden	7	61
India	3	3
Netherlands	3	4

Source: Research data, 2019.

The evolution of scientific production on social media and diabetes is shown in Figure 1, which shows the annual number of publications in the period studied, pointing out that interest in the subject began in 2010 and has been increasing since then, reaching its peak in 2018.

Figure 1 - Distribution of publications (2010-2018). *Teresina* city, *Piauí* State, Brazil, 2019.

The classification of scientific publications by the amount of citations received evidences studies that are considered fundamental bases for the theme. Although it will take some time before articles begin to be cited by other researchers, the evaluation of citations in the present study sought to establish the state of the art in the area of social media and diabetes research based on the articles in the title of the journal. I work the terms used in the searches and indexed in one of the journals with the largest number of citations on the topic, identified earlier.

Using these criteria, 15 articles were selected, which were analyzed with the Historiograph/HistCiteTM software, through which it was possible to identify the articles that are related to each other, mainly due to the references used and/or cited (Figure 2), where each " circle "represents an article whose number identifies the work (author/s, year); each "arrow" shows the links between the articles, and the direction of the arrows indicates the relationship between the work and a subsequent study that cites it; the side "GCS" represents the global citation of the 15 articles on the topic that received the highest number of citations in the ISI Web of Knowledge/Web of Science™; and the lateral "LCS" represents the local citation quotient, corresponding to the 15 articles on the theme that received the highest number of citations from the selected articles. Through this graphical representation, the time line and the main articles of the studied theme were delimited.

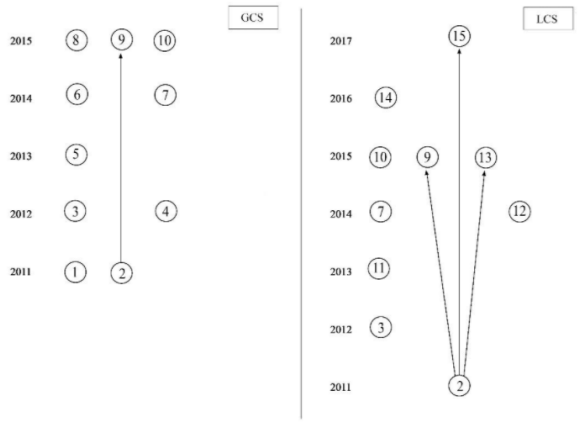

Figure 2 - Top 10 most cited articles in the Web of Science™ (Global Citation Score) and Top 10 most cited articles in the selected article group (Local Citation Score) from the selected set. *Teresina* city, *Piauí* State, Brazil, 2019.

GCS – Global Citation Score (Top 10 articles on the topic that received the highest number of citations in Web of Science™)

LCS – Local Citation Score (Top 10 articles on the theme that received the highest number of citations from the selected articles)

1 – Chomutare *et al.* (2011)[10]
2 – Greene *et al.* (2011)[11]
3 – Cavallo *et al.* (2012)[12]

4 – Carter *et al.* (2012)[13]
5 – Stellefson *et al.* (2013)[14]

6 – Sama *et al.* (2014)[15]
7 – Cotter *et al.* (2014)[16]
8 – Piette *et al.* (2015)[17]
9 – Patel *et al.* (2015)[18]
10 – Eichstaedt *et al.* (2015)[19]

11 – Jones *et al.* (2013)[20]
12 – Ho *et al.* (2014)[21]

13 – Hunt & Koteyko (2015)[22]
14 – George *et al.* (2016)[23]
15 – Abedin *et al.* (2017)[24]

By observing the relationship between the texts, the circles referred to as the "authoritative article" or "base article" can be identified, which are the main references of others that also receive large amounts of citations.[10] In addition to the authoritative articles might also appear "hub articles" or " connecting articles", which are those that condense important information from previous work by connecting it to more recent ones, also receiving large amounts of citations.10 Thus, considering the figure, it is clear that Greene's article et al. (2011)11 behaved as a global authority and locally, there were no hub or connecting articles. Studies number 3[12], 4[13], 5[14], 6[15], 8[17], 9[18], and 10[19] focused on other major diabetes issues, so their analysis will not be detailed in this study.

DISCUSSION

The results of this bibliometric review highlighted the current and growing relevance of scientific production on social media and diabetes. The first registration took place in 2010 and has remained growing to date, indicating that there is renewed interest from the international scientific community in disseminating knowledge in this field of study, however, there are still gaps to be remedied.

The most cited journals (Figure 2) have approximately 36% of the total articles retrieved. The Journal of Medical Internet Research has the largest number of publications, with approximately 11% of the total articles, however the JMIR MHEALTH and UHEALTH has only three publications and 85 citations, which considerably increases its impact factor on the theme studied, since the number of citations that the journal obtained can serve as an indicator of the relevance of the works.

Concerning the most representative authors and institutions on the subject, the most cited authors are gathered in only three universities in three countries, most notably the University of Tromsø The Artic University of Norway, Norway, with three publications, approximately 14% of the papers. As for the countries with the largest representation, the United States of America stood out, with 89 articles published. It is noteworthy that in this relationship did not appear Brazilian institutions.

Although Figure 1 indicates the first record of scientific evidence in 2010, the relationship between the articles in Figure 2 identified that the identified "authoritative article" or "base article" was published in 2011.11 The following discusses the objectives and main conclusions of the articles shown in Figure 2.

Chomutare *et al.* (2011)[10] analyzed mobile applications for the treatment of diabetes, in contrast to the recommendations of the clinical guidelines for self-management of the disease. They found that most of the applications available online are restricted to self-care with insulin application, diet registration and weight control. Interestingly, although clinical guidelines largely refer to the importance of education, this is absent from key functionalities in both cases.

Greene *et al.* (2011)[11] in a qualitative study analyzed the content of communication in Facebook communities dedicated to diabetes. Diabetes patients, family members, and friends use Facebook to share personal clinical information, to request disease-specific guidance and feedback, and to receive emotional support. Approximately two-thirds of posts included unsolicited sharing of diabetes management strategies, over 13% of posts provided specific feedback to information requested by other users, and nearly 29% of posts had a carrier effort to provide emotional support to other people as members of a community. Approximately 27% of the posts featured some type of promotional activity, usually presented as advertising testimonials on "natural" products approved by the Food and Drug Administration. Clinically inaccurate recommendations were infrequent but were generally associated with promoting a specific product or service. 13% of posts contained requests for personal information from Facebook participants.

In a literature review, Cotter *et al.* (2014)[16] identified studies that used internet-based interventions to promote lifestyle change among adults with type 2 diabetes (T2DM) and concluded that seeking diabetes support on the internet leads to improvements in diet, physical activity and glycemic control.

Jones *et al.* (2013)[20] analyzed the literature on social networks as a communication tool and conducted a systematic search of social networking sites to determine if people with type 1 diabetes (DM1) use them to discuss the risks associated with diabetes and drug use and alcohol. The results of the review showed that the search for information about diabetes and alcohol consumption in virtual communities is common and growing among young people, but they drew attention to the legitimacy of the information posted, since the vast majority was not of professional origin, such as study by Abedin *et al.* (2017)[24].

Ho *et al.* (2014)[21] examined 18 online diabetes communities available to adolescents with DM1 and identified five resource categories: social learning and networking, infor-

mation, mentoring, engagement, and sharing of personal health data. While resources associated with improved self--management are present, such as social learning, the results suggest that more guidance or structure would be helpful in ensuring that these processes were focused on promoting positive beliefs and behaviors. Enhancing existing adolescent counseling resources and structure could provide greater opportunities for effective support for diabetes self-management.

Hunt & Koteyko (2015),[22] in a qualitative study, analyzed the representations of social actors and interaction styles on three Facebook pages. People with diabetes are represented as a risk group whose vulnerabilities can be managed through forms of participation specific to their organization. The most popular pages on diabetes are based on the social interaction opportunities offered by Facebook and combine informative and promotional content to promote communication between the organization (companies) and its audience (customers). By encouraging reflective management of diabetes risks, these pages contribute to the construction of 'biological citizens' who interact with their usual interactions on social networks with responsible self-care, health information consumption and health activism.

George *et al*. (2016)[23] conducted a non-experimental study to design, implement and evaluate a social marketing campaign to increase obesity awareness and involvement in prevention, nutrition and fitness programs in T2DM. To this end, ads in English and Spanish encouraging healthier eating habits and advocating better food choices were shown in a virtual Facebook community. At the end of 18 months, there were over 11,000 visits to the Facebook page. The results suggest that participants recognized important advertisements for improving their health behaviors, providing evidence that a culturally adapted health advertisement could have an impact in a short time.

We highlight the pioneering spirit of the present study by addressing the bibliometric indicators of scientific production on social media and diabetes. Although the number of studies on this subject has been growing, the literature devoted to this issue remains scarce.

In this context, it is relevant to consider that online strategies provide a viable option to facilitate diabetes self-management. With Facebook being a widely used social networking system, healthcare professionals could use this platform to support the education of diabetes patients and their caregivers by disseminating useful and authentic diabetes treatment knowledge and information.

The limitations of this study relate to the use of a single database, the ISI Web of Knowledge/Web of Science™, for analysis. Relevant studies published before this period or indexed in other databases may not have been contemplated; and, the study survey was also limited to peer-reviewed literature, so unpublished data such as theses, dissertations, and institutionally owned documents were not included.

CONCLUSIONS

Despite the growing number of studies on the support of virtual communities for people with diabetes, the literature still points to the lack of longitudinal studies that broaden the understanding of the meanings usually attributed to the disease and identify recurrent cognitive lapses in these spaces and the necessary care, as well as the quality of the information that is posted and shared online. The bibliometric indicators used in this article were important for characterizing the state of the art related to the theme.

The potential of social media to improve health and provide DM-centered care is evident. The study in this field is promising, given that there is a change in behavior in society and that further studies in social media are needed, but there is a need for future studies that investigate the legitimacy of information posted online and its impact on users.

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