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## Suicide prevention research: A bibliometric analysis from 1982 to 2021

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### Abstract

**Background:** Suicide is the most extreme outcome of a mental health crisis and should therefore be a key priority in any mental health prevention response. **Objective:** the aim of this study was to identify the scientific production and its temporal evolution related to suicide prevention. **Method:** To do this, a quantitative, descriptive and bibliometric type study was carried out, allowing us to know the current situation regarding this issue. The analysis was performed using Scopus' own metrics and the use of the Bibliometrix software. **Results:** The sample to be analyzed constituted 272 papers. The results indicated a progressive growth of productivity levels, with 2018 being the most prolific year of that decade. The United Kingdom and the United States were the geographical territories with the greatest scientific production on the subject. The discipline that has studied suicide the most throughout the 40 years of research is the area of medicine, representing 60.2%. **Conclusions:** Overall, our analyses shed light on the strong growth of research in suicidology. We believe that these bibliometric analyses can be useful in guiding researchers, institutions, and countries in the prevention of suicide.

### Keywords

Bibliometrics, suicide, suicide attempt, ideation suicide, prevention.

## Recerca sobre la prevenció del suïcidi: una anàlisi bibliomètrica del 1982 al 2021

### Resum

**Antecedents:** el suïcidi és el resultat més extrem d'una crisi de salut mental i, per tant, hauria de ser una prioritat clau en qualsevol resposta de prevenció en aquesta àrea. **Objectiu:** l'objectiu d'aquest estudi ha estat identificar la producció científica relacionada amb la prevenció del suïcidi i la seva evolució temporal. **Mètode:** per a això s'ha elaborat un estudi quantitatiu, descriptiu i de tipus bibliomètric, que ens ha permès conèixer la situació actual a l'entorn d'aquest tema. L'anàlisi s'ha dut a terme utilitzant les mètriques de Scopus i el programari Bibliometrix. **Resultats:** s'han obtingut 272 articles que han constituït la mostra per analitzar. Els resultats han indicat un creixement progressiu de la productivitat, i el 2018 ha estat l'any més prolífic. El Regne Unit i els Estats Units han estat els territoris geogràfics amb més producció científica sobre el tema. La disciplina que ha estudiat més el suïcidi al llarg dels quaranta anys de recerca és l'àrea de la medicina, que ha representat un 60,2%. **Conclusions:** en general, les nostres anàlisis treuen a la llum el fort creixement de la recerca en suïcidiologia. Creiem que aquestes anàlisis bibliomètriques poden ser útils per orientar investigadors, institucions i països en la prevenció del suïcidi.

### Paraules clau

Bibliometria, suïcidi, intent de suïcidi, ideació suïcida, prevenció.

## Investigación sobre la prevención del suicidio: un análisis bibliométrico de 1982 a 2021

### Resumen

**Antecedentes:** El suicidio es el resultado más extremo de una crisis de salud mental y, por lo tanto, debería ser una prioridad en cualquier respuesta de prevención en esta área. **Objetivo:** El objetivo de este estudio fue identificar la producción científica y su evolución temporal relacionada con la prevención del suicidio. **Método:** Para ello se realizó un estudio cuantitativo, descriptivo y bibliométrico, que nos permitió conocer la situación actual en torno a este tema. El análisis se realizó utilizando las métricas de Scopus y el *software* Bibliometrix. **Resultados:** Se obtuvieron 272 artículos, que constituyeron la muestra que se iba a analizar. Los resultados indicaron un crecimiento progresivo de la productividad, y que 2018 fue el año más prolífico. El Reino Unido y los Estados Unidos fueron los territorios geográficos con mayor producción científica en relación con esta cuestión. La disciplina que más ha estudiado el suicidio a lo largo de los cuarenta años investigados es Medicina, que representa el 60,2%. **Conclusiones:** En general, nuestros análisis arrojan luz sobre el fuerte crecimiento de la investigación en suicidología. Creemos que estos análisis bibliométricos pueden ser útiles para orientar a investigadores, instituciones y países en la prevención del suicidio.

### Palabras clave

Bibliometría, suicidio, intento de suicidio, ideación suicida, prevención.

## SUICIDE PREVENTION RESEARCH: A BIBLIOMETRIC ANALYSIS FROM 1982 TO 2021

**S**uicide and suicidal behavior are serious public health issues. Suicide is one of the leading causes of death worldwide, and approximately one million people die from it each year (WHO, 2018). Roughly 10 to 20 times more people attempt suicide, which is the most robust predictor of eventual death by suicide (Hawton & van Heeringen, 2009). Several risk factors for suicide mortality have been identified and classified as primary (e.g. psychiatric conditions), secondary (e.g. adverse life events) and tertiary (demographic factors like gender and older age) (Droogers et al., 2020). However, as a potentially preventable cause of premature death, suicide prevention is of primary importance (Hawton & Pirkis, 2017; Zalsman et al., 2016).

In this context, the World Health Organization (WHO) has emphasized that different countries in the world should introduce suicide prevention proposals within their health policies (WHO, 2014). Most strategies recommend a comprehensive approach to suicide prevention that encompasses different levels of action. This should include universal (aimed at the entire popu-

lation), selective (aimed at groups or communities considered to be at higher risk of suicide), and indicated (directed at individuals who display suicide-related behaviors) approaches (Robinson et al., 2013). In fact, prevention measures in the field of suicide have shown their effectiveness, proving that suicide is preventable (Brodsky et al., 2018; O'Connor & Pirkis, 2016). This has been demonstrated in a recent systematic review by Zalsman et al. (2016) on the effectiveness of approaches to suicide prevention and intervention, which included studies published between 2005 and 2014. This work concludes that awareness programs, restriction of lethal means, evidence-based treatments, and monitoring and follow-up would reduce suicidal ideation and suicide attempts. It should be noted that in recent years, there has been a growing interest in this area of study, with a notable increase in scientific production in the field of Suicidology (Astraud et al., 2020). Thus, it is relevant to analyze the characteristics of these efforts. Through this bibliometric analysis, we aim to identify the scientific production related to the prevention of suicide. Additionally, this study

also aims to provide an overview and highlight the evolution of the existing research on this topic.

## Bibliometric study

Bibliometry is a very important tool, since it allows the evaluation of scientific actors and the impact of research, through the mapping of science in order to register structural and dynamic aspects of scientific research (Andersen & Lund, 2020; Da Costa et al., 2020). In this kind of study, a search for statistically regular behaviors is carried out within a timeframe, study area, among others (Chien et al., 2020; Sweileh, 2018). According to Solano et al. (2009), bibliometrics is carried out based on its relationship with statistical methods, and any written source that refers to, for example, authors, title of publication, type of document, language, abstract and keywords or descriptors, is considered essential in performing a scan and first approach to a subject of study, based on the need to carry out a recount of existing publications; furthermore, it is considered as the set of quantitative techniques used in documentary analysis, producers and consumers, and as an instrument by which the state of the scientific literature at a given level of specific specialization is being observed (Ruiz et al., 2020; Sweileh et al., 2018).

Regarding suicidology, bibliometric evidence is limited. Cardinal (2008) assessed 30 years of publications extracted from the sole journal *Suicide and Life-Threatening Behavior*. Goldblatt et al. (2012), conducted a qualitative evaluation of the production of three journals specialized in suicidology over five years only. Similarly, Da Costa et al. (2020) assessed suicide mortality rates in the context of the UN's third Sustainable Development Goal (SDG). This study collected a total of 3126 documents on mental health and suicide mortality rate in the context of the SDGs. *Plos One* was the source that presented the highest number of publications on this research topic. Most of the documents retrieved originated in the United States ( $n = 896$ ). On the other hand, Astraud et al. (2020) evaluated 30 years of publications in Suicidology. These authors identified 41,276 documents from between 1989 and 2018. The main findings highlight that United States ranks first in number of publications with 38.7% of world production, followed by the United Kingdom (10.7%) and Australia (5.9%). Psychiatry and psychology were the dominant research areas. The top four journals in terms of total citations were: *Suicide and Life-Threatening Behavior*, *American Journal of Psychiatry*,

*Journal of Affective Disorders* and *British Journal of Psychiatry*. The most prominent institutions were Harvard University, Columbia University, and the University of London. Finally, it is worth highlighting the significant gender gap found by these authors, showing that only 28% of women are among the most productive researchers between 1989 and 2018 in the last 30 years in this area.

To our knowledge, to this date, there is no research through bibliometric analysis focused on identifying and quantifying the scientific production related to suicide prevention. In this context, the present study aimed to carry out a bibliometric analysis on publications indexed in the Scopus database, in the context of suicide prevention, considering the period from 1982 to 2021. In this sense, it should be noted that the Scopus database collection is highly valued for bibliometric studies, mainly due to coverage and scope (Codina et al., 2020). Also, another distinctive aspect of Scopus is that it considers a unified index, without distinction of areas, having weighted lists that adjust the metrics to the citation habits of each major area: humanities, social sciences, experimental and technological sciences (Ferrada et al., 2020).

## METHOD

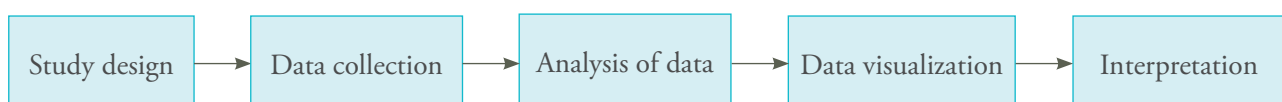
### Study design

A quantitative study was proposed based on the analysis of bibliometric indicators, also known as bibliometrics (Pritchard, 1969). The methodology proposed by Zupic & Carter (2015) was considered, which considers five stages as shown in [Figure 1](#).

A search for English-language articles was carried out using Scopus. The studied period spans from 1 January 1982 to 31 December 2021. We chose to exclude non-suicidal self-injury, assisted suicide, euthanasia and suicide bombing, which appeared to us to be outside the scope of this article.

For an in-depth analysis of the articles included in this study, the following bibliometric indicators were studied: documents per year; analyses by research areas; documents by study type; average citations of articles per year; plot of three fields; production of the best authors over time (authors, year); quote of joint occurrence of authors; Lotka's law (frequency distribution of scientific productivity, percentage of authors, written documents);

Figure 1. Flowchart used in the bibliometric review process



documents by country; co-authorship countries complete count method; word dynamics of abstracts; annual occurrences *vs.* years.

## Data collection

In this study we decided to consider the widest possible coverage concerning publications associated with suicide prevention. Consequently, Scopus was the chosen database. In addition, Scopus is the largest abstract and citation database.

The search equation (Table 1) that has been used, considered key terms for the subject, from the UNESCO thesaurus, corresponding to: *attempted suicide, suicide, suicidal behavior, suicidal ideation, suicidal thoughts, deliberate self-harm, self-injurious behavior, self-harm, prevention, gatekeeper training, cognitive behavior therapy, screening programmes, school-based programs, community-based programs, suicide prevention, supportive therapy, psychotherapy.*

An initial search term was defined using terms found in relevant articles and documents and then calibrated through testing attempts considering separate and combined terms. The final search expression was accomplished with the TITLE-ABS-KEY filter as follow:

## Data analysis

The information of each of the selected articles was stored in a template of the Microsoft Excel program of the Office 2016 package for Windows 10. For the analysis and representation of the results, the Bibliometrix R package (Aria & Cuccurullo, 2017) was used, in its R version for Windows. Bibliometrix R and VOSviewer (2020) includes analysis at two levels: metric, and structures. The first refers to the analysis of sources, authors and documents, while the second involves the analysis of three aspects: conceptual, intellectual and social structures.

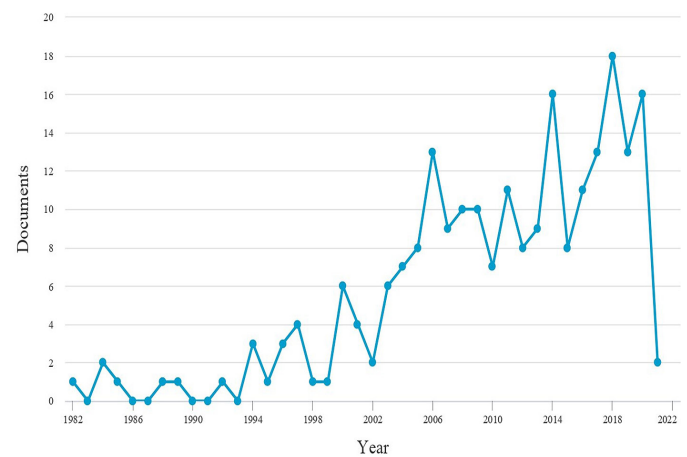
## RESULTS

The main results obtained in this study are presented below.

## Documents per year

Through the results analyzed over the last 40 years (1982 to 2021), it is possible to see how scientific production in the area shows a growing trend. Around the 1990s this topic started to appear more regularly in literature, but only in the twenty-first century have the number of publications increased considerably. Since 2014 ( $n = 16$ ), publications have obtained even more attention from researchers, as seen in Figure 2. The largest increase in publications occurred between 2018 and 2020, with 18 and 16 documents, respectively.

Figure 2. Evolution by years of production



## Analyses by Research Areas

Of the 272 documents, 10 different research areas were found, as defined by Scopus, in relation to suicidology: 60.2% ( $n = 206$ ) of publications were classified as general internal medicine, followed by psychology ( $n = 26.0$ ; 89%), neurosciences/neurology ( $n = 13$ ; 3.8%), social sciences ( $n = 12$ ; 3.5%), arts and humanities ( $n = 5$ ; 1.5%), environmental science ( $n = 5$ ; 1.5%), nursing ( $n = 4$ ; 1.2%), pharmacology, toxicology and pharmaceutical ( $n = 4$ ; 1.2%), and biochemistry, genetics and molecular biology ( $n = 3$ ; 0.9%).

Table 1. Scopus database search equation

Database	Equation
Scopus	TITLE-ABS-KEY (attempted suicide) AND TITLE-ABS-KEY (suicide* OR suicidal behavior* OR suicidal ideation* OR suicidal thoughts* OR deliberate self-harm* OR self-injurious behavior* OR self-harm*) AND TITLE-ABS-KEY ( "prevention" OR "gatekeeper training" OR "cognitive behavior therapy" OR "screening programmes" OR "school-based programs" OR "community-based programs" OR "suicide prevention" OR "supportive therapy" OR "psychotherapy" OR "suicidal behavior")

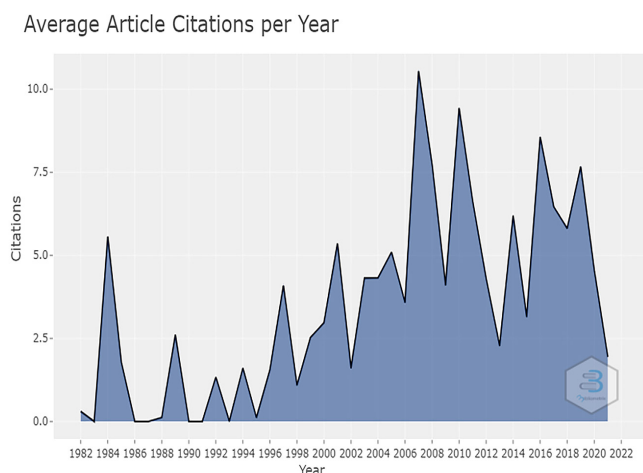
## Documents by Study Type

The most frequent types of publications shown in the results belonged to the “article” category ( $n = 183$ ; 80.6%), and the second place was represented by “review” ( $n = 36$ ; 15.9%), followed by “book chapter” ( $n = 5$ ; 2.2%). Other types of publications, with a lower score, were “letter” ( $n = 1$ ; 0.4%), “book” ( $n = 1$ ; 0.4%), and “editorial” ( $n = 1$ ; 0.4%).

## Average article citations per year

When analyzing the average number of citations shown by the documents in recent years, according to the line that marks the average of the research citations, the years 2008, 2011 and 2016 are the periods with the greatest impact in the research field. In this way, **Figure 3** shows the average line of citations and the years according to their evolution.

**Figure 3. Average of citations according to years of production**



## Plot of three fields: Countries, keywords and affiliations

The Sankey diagram illustrates quantitative flows and relationships, which allows analyzing the information from important publications in a field or for a topic focusing on the links between, for instance, keywords, authors, countries, affiliations, among others. This allows researchers to identify relationships between different fields that lead to obtaining the current state of the art in a given area or concerning a given topic. Considering this, an analysis of the application field of the relevant topics for the document was carried out, so the most used keywords in the analyzed publications were identified. This information was related to the main author affiliations and the coun-

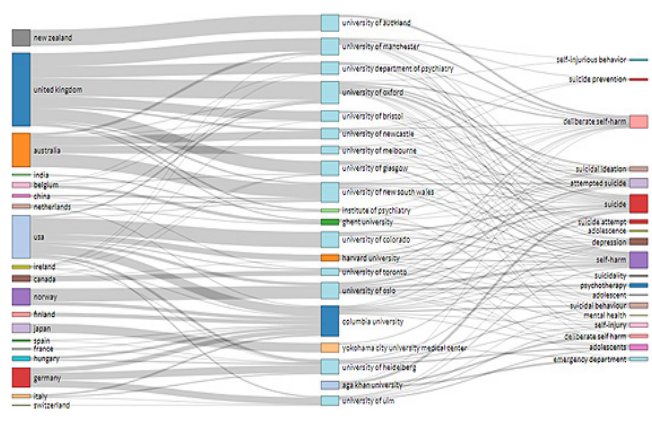
tries in which the research was carried out. The intensity of each flow is shown in Figure 4, revealing many concurrence connections between them.

**Figure 4** shows the relationship between countries (20), affiliations, and the relationship with the main keywords used by the authors. The United Kingdom (31%), the United States (24%) and Australia (19%) stand out as the predominant countries in production and research in this area of study.

It is possible to see that Oxford University, Manchester University and Glasgow University are featured as the top affiliated institutions in the UK. While in the United States we find the main universities are: Columbia University, Harvard University and University of Colorado. Finally, in Australia the main university networks were found to be: Melbourne University, New South Wales University and Newcastle University.

The articulating concepts between the countries and academic institutions analyzed were: suicide, self-harm, deliberate self-harm and attempted suicide, representing the main lines of research in this field.

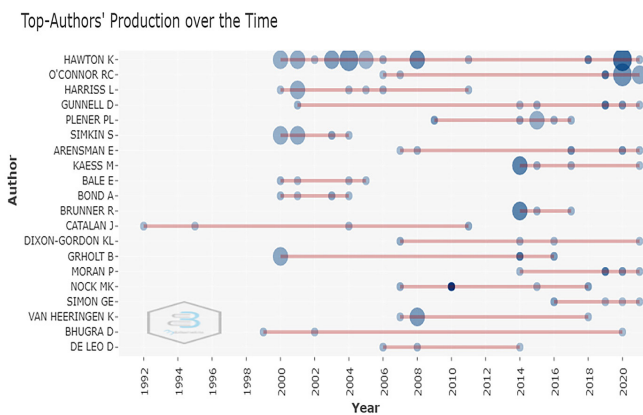
**Figure 4. Sankey diagram for countries, affiliations and keywords**



## Analyses by Authors

Among the most prominent authors in the area of suicide prevention are Hawton (2000 to 2020) (20 articles), researcher at the University of Oxford Medical Sciences Division, Department of Psychiatry (Oxford, United Kingdom); followed by Harris (2000 to 2011) (7 articles), from the United Kingdom and affiliated with the University of Oxford Medical Sciences Division (Oxford), and finally Plener (2009 to 2017) (6 articles), from Austria and affiliated with Medizinische Universität Wien, Vienna (see **Figure 5**).

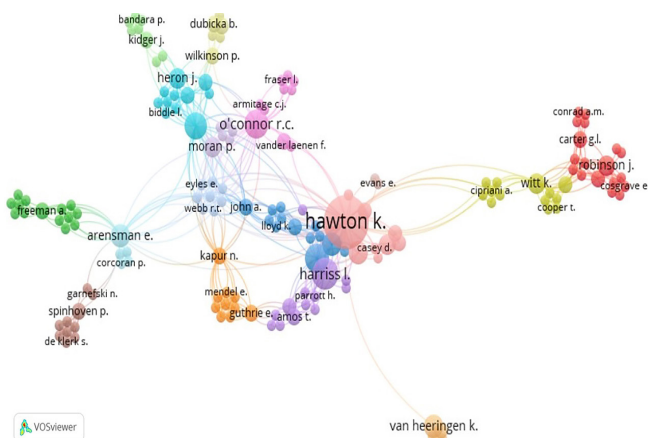
Figure 5. Productivity of the main first authors over time



### Quote of joint occurrence of authors

Among the 964 authors and collaborators present in this research, there were 22 documents signed by a single author and 942 documents by several authors. The main referents in collaboration with other researchers were Hawton (20 articles) and Harris (7 articles). The relationship is represented in Figure 6.

Figure 6. Collaboration network between authors



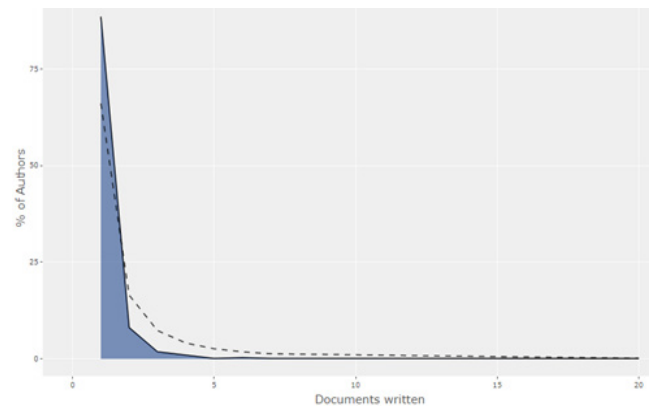
Note. Own work through VOSviewer (2020).

### Lotka's law (frequency distribution of scientific productivity, percentage of authors and written documents)

Lotka's Law shows that the greatest number of authors publish the least number of documents and, in turn, the least number of authors publish a greater number of investigations, this being the most prolific group (Alvarado, 2005). In this way, this law of the distribution of authors according to their productivity is reflected in this scenario, where it is evidenced that 853 authors (and co-authors) have participated in at least 1 document, 78 authors or co-authors in 2 investigations, and 18 authors

or co-authors in 3 research papers. In this way, it is appreciated how Lotka's Law is fulfilled for this bibliometric research carried out in the Scopus database (Figure 7).

Figure 7. Author productivity according to Lotka's Law



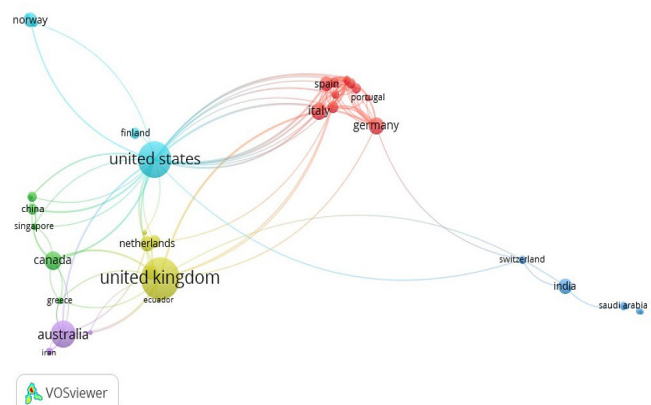
### Documents by Country

The country assessment considered the country of affiliation of the first author of the articles as a unit of analysis. The majority of the documents retrieved originated in the United Kingdom ( $n = 70$ ). In second place was the United States with 54 publications. The top 10 most-publishing countries are completed by Australia ( $n = 29$ ), Canada ( $n = 14$ ), Germany ( $n = 13$ ), Italy ( $n = 13$ ), India ( $n = 9$ ), Netherlands ( $n = 9$ ), Belgium ( $n = 8$ ) and Norway ( $n = 8$ ).

### Co-authorship countries complete count method

Figure 8 indicates the productivity relationship between the main research countries; the nodes show that the United Kingdom has the highest relationship and collaboration between countries, being a benchmark in this research line, followed by the United States and Australia.

Figure 8. Network showing social structure

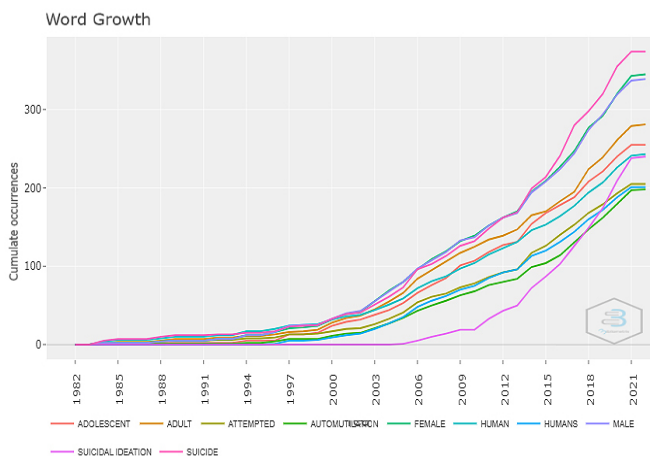


Note. Own work through VOSviewer (2020)

## Word dynamics of abstracts, annual occurrences vs. years

The terms suicide (53), suicidal (30), and self-harm (24) represent the most used words throughout the years of research in the field of prevention, representing a growing evolution over time. Figure 9 shows the continual growth in the handling of the recurring terms in the research analyzed.

Figure 9. Keyword growth and evolution



## DISCUSSION

In total, 272 papers were obtained that meet the inclusion criteria proposed for this research. In relation to the thematic areas where the research developed is disseminated, the discipline of Medicine is observed as the most prominent (60.2%), followed by Psychology (26%), and ranked third, although to a lesser extent than the previous ones, is the discipline of Neurosciences (3.8%). This result is not surprising, given that historically suicide has been linked to mental disorders, based on a biologicist conception, a vision that has dominated medicine since the middle of the last century. However, there is currently quite a consensus among researchers, pointing out that there would not be a single cause for suicide, but rather that it would be a complex, dynamic and multidimensional problem, where biological, psychological, social and cultural elements converge (Carballo et al., 2019), which makes the incorporation and the efforts of other disciplines in the understanding of this phenomenon necessary. Just as suicide has no one single cause, there is no single prevention activity that will prevent suicide. To be successful, prevention efforts must be comprehensive and coordinated across organizations and systems. As with other health promotion efforts, suicide prevention programs should be culturally attuned and locally relevant.

According to the publication format, articles are the most frequent format (80.6%), followed by reviews (15.9%). As demonstrated, the proportion of research and review articles increased considerably over the years. To explain the increase in review articles, one could easily assume that, given the substantial increase in knowledge over time, suicidologists have felt the need to periodically take stock of the situation through literature reviews. On the other hand, the number of authors per article studied increased over the years, a trend already observed in other bibliometric research (Cardinal, 2008). This could be explained by the fact that research in the field has become increasingly complex, requiring a greater degree of specialization by researchers and the integration of researchers from different disciplines.

In general, suicidology emerges as a dynamic field of research in bibliometric terms, where it is possible to see how scientific production presents an increasing trend, highlighting 2018 as the period of highest productivity. One aspect that generates concern was that we observed that the area is clearly dominated by developed countries, representing almost 67% of all publications in the last 40 years. Another interesting finding that emerges from the results of the geographical distribution is the scarce or non-existent presence of certain regions, particularly Africa, Latin America, and Muslim countries. Among the possible explanations for this low participation by the aforementioned territories, we can hypothesize that in some cases it is due to the lack of funds available for research or the little attention paid to this social phenomenon. Other explanations for these differences include language barriers and the desire to write in their own language, which might encourage authors to submit their manuscripts to journals published in their native language. The absence of these regions of the world was also observed in other similar bibliometric studies (As-traud et al., 2020; Cardinal, 2008). Finally, it should be added that the most commonly used keywords in the field of prevention were the terms suicide, suicidal, and self-harm. In this regard, it should be noted that several years ago Kessler and colleagues (Kessler et al., 1999) observed and quantified the transitions between suicidal ideation, planning, and suicidal behavior. According to their studies, 90% of unplanned and 60% of planned attempts occur in the first year after the onset of suicidal ideation (Kessler et al., 1999). However, the term "suicidal ideation" does not appear among the most prominent words in our research, being that it is well documented that suicidal thoughts and early suicide attempts predict subsequent suicide and it is essential to intervene as early as possible (O'Connor & Nock, 2014). On the other hand, our bibliometric analysis highlights the importance of revising the nomenclature in suicidology. Terminology and definitions are the two elements that constitute a standard nomenclature and it is in both of these areas that suicidology is currently confusing (De

Leo et al., 2006). A satisfactory nomenclature of suicide should be applicable and usable both within and across all domains in which it is to be employed, whether the focus is research, clinical practice or public health.

Our study had some limitations, such as the restraint of our search to only peer-review publications and the need of further consultations in other databases for relevant publications indexed and not retrieved by Scopus. Regardless, this bibliometric analysis identifies a large volume of publications and offers a useful representation of the state of the art on the subject.

## CONCLUSION

There are three main conclusions that can be drawn from the results of this bibliometric analysis. Firstly, there has been a notable increase in the number of publications on Suicidology over the last 40 years and, in particular, since the beginning of the 2000s. Secondly, the dominance of scientific production in this area by developed countries stands out, particularly the United Kingdom, the United States and Australia, which are also the countries that have the greatest relationship and collaboration between countries being a reference in this line of research. Lastly, a notable gender gap is evident, being predominantly men who have a greater number of publications in the area. These results are in line with those obtained recently by Astraud et al. (2020) through bibliometric analysis.

The need to prevent avoidable deaths and contain the emotional impact generated by suicidal behavior requires studies to better understand the phenomenon in order to increase the effectiveness of preventive and interventional strategies. Based on our results, we can suggest conducting a more detailed systematic review in order to obtain more precise information on the current state of matter regarding the prevention of suicidal behavior.

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