

Lifestyle risk behaviors of university students: a bibliometric analysis
Comportamentos de risco de estilo de vida de estudantes universitários: uma análise bibliométrica
Conductas de riesgo en el estilo de vida de los estudiantes universitarios: un análisis bibliométrico

Received: 09/20/2020 | Reviewed: 09/20/2020 | Accept: 09/20/2020 | Published: 09/21/2020

Tassia Teles Santana de Macedo

ORCID: <https://orcid.org/0000-0003-2423-9844>

Escola Bahiana de Medicina e Saúde Pública, Brasil

E-mail: tassiamacedo@bahiana.edu.br

Debra Sheets

ORCID: <https://orcid.org/0000-0002-6467-0682>

University of Victoria, Canada

E-mail: dsheets@uvic.ca

Wilton Nascimento Figueredo

ORCID: <https://orcid.org/0000-0003-2066-0914>

Universidade Estadual de Feira de Santana, Brasil

E-mail: wntfigueredo@uefs.br

Michaela Eickemberg

ORCID: <https://orcid.org/0000-0002-3625-2221>

Escola Bahiana de Medicina e Saúde Pública, Brasil

E-mail: mieickemberg@yahoo.com.br

Jules Ramon Brito Teixeira

ORCID: <https://orcid.org/0000-0002-8443-7810>

Universidade Estadual de Feira de Santana, Brasil

E-mail: julesramon@gmail.com

Fernanda Carneiro Mussi

ORCID: <https://orcid.org/0000-0003-0692-5912>

Universidade Federal da Bahia, Brasil

E-mail: femussi@uol.com.br

Abstract

Objective: Examine the evolution of publications on the lifestyle risk behaviors of university students. **Methods:** Bibliometric research was carried out on using 9011 articles retrieved from the SciELO and Web of Science database. The analyses included, the trend of the production, the most productive countries, journals, institutions, and the relevant information was extracted based on frequency of co-occurrence of keywords between 2009 and 2019 using the bibliometric software, namely VantagePoint, VOSviewer, NetDraw and UCINET. **Results:** The study revealed a significant concentration of publications between 2014 and 2018 in North American countries, especially the United States. However, the most productive institution was the University of São Paulo (Brazil). Stress, physical inactivity, obesity, and smoking were the risk behaviors most used as keywords in the articles, and these have a strong relationship with other keywords subsets related to mental health, forms of treatment, the study population and lifestyle behaviors. **Conclusion:** The scientific map of lifestyle risk behaviors among university students was supported by exhaustive research. It was possible by the establishment of research networks between the various centers of knowledge production, especially with the American researchers.

Keywords: Students; University; Risk factors; Lifestyle; Bibliometry.

Resumo

Objetivo: Examinar a evolução das publicações sobre comportamentos de risco no estilo de vida de estudantes universitários. **Métodos:** Foi realizada pesquisa bibliométrica com base em 9011 artigos recuperados da base de dados SciELO e Web of Science. As análises incluíram a tendência da produção, os países mais produtivos, periódicos, instituições, e as informações relevantes foram extraídas com base na frequência de co-ocorrência de palavras-chave entre 2009 e 2019 utilizando o software bibliométrico, nomeadamente VantagePoint, VOSviewer, NetDraw e UCINET. **Resultados:** O estudo revelou uma concentração significativa de publicações entre 2014 e 2018 em países da América do Norte, principalmente nos Estados Unidos. No entanto, a instituição mais produtiva foi a Universidade de São Paulo (Brasil). Estresse, sedentarismo, obesidade e tabagismo foram os comportamentos de risco mais usados como palavras-chave nos artigos e têm forte relação com outros subconjuntos de palavras-chave relacionados à saúde mental, formas de tratamento, população em estudo e comportamentos de estilo de vida. **Conclusão:** O mapa científico dos comportamentos de risco no estilo de vida entre estudantes universitários foi apoiado por pesquisas exaustivas.

Isso foi possível pelo estabelecimento de redes de pesquisa entre os diversos centros de produção de conhecimento, principalmente com os pesquisadores americanos.

Palavras-chave: Estudantes; Universidade; Fatores de risco; Estilo de vida; Bibliometria.

Resumen

Objetivo: Examinar la evolución de las publicaciones sobre las conductas de riesgo en el estilo de vida de los estudiantes universitarios. Métodos: Se realizó una investigación bibliométrica utilizando 9011 artículos recuperados de la base de datos SciELO y Web of Science. Los análisis incluyeron, la tendencia de la producción, los países, revistas, instituciones más productivas y la información relevante se extrajo con base en la frecuencia de co-ocurrencia de palabras clave entre 2009 y 2019 utilizando el software bibliométrico, a saber, VantagePoint, VOSviewer, NetDraw y UCINET. Resultados: El estudio reveló una concentración significativa de publicaciones entre 2014 y 2018 en países de América del Norte, especialmente Estados Unidos. Sin embargo, la institución más productiva fue la Universidad de São Paulo (Brasil). El estrés, la inactividad física, la obesidad y el tabaquismo fueron los comportamientos de riesgo más utilizados como palabras clave en los artículos, y estos tienen una fuerte relación con otros subconjuntos de palabras clave relacionadas con la salud mental, las formas de tratamiento, la población de estudio y los comportamientos de estilo de vida. Conclusión: El mapa científico de las conductas de riesgo en el estilo de vida entre los estudiantes universitarios fue respaldado por una investigación exhaustiva. Fue posible mediante el establecimiento de redes de investigación entre los diversos centros de producción de conocimiento, especialmente con los investigadores estadounidenses.

Palabras clave: Estudiantes; Universidad; Factores de riesgo; Estilo de vida; Bibliometría.

1. Introduction

University years represent a unique stage in the life of a young adult. During this period, the expansion in new experiences, family distance, changing networks of friendship, inequities in social support, and academic demands can influence behavioral changes (Prodanov & Cimadon, 2016). Thus, university students experience a confluence of changing circumstances that may favor the adoption of risky health behaviors (Morawiec, Janikowski, & Lelonek, 2016; Santos et al., 2015).

Risky health behaviors related to lifestyle include smoking, poor nutrition, physical inactivity, excessive alcohol, inadequate sleep and illicit drug use (Sociedade Brasileira de

Cardiologia, 2013). World data reveal that 40% of premature deaths (Saint Onge & Krueger, 2017) are associated with lifestyle behaviors pointing to the importance of early identification, prevention and intervention measures.

Traditionally, identification of health risks has focused on middle aged and older adults. However, the high prevalence of health risk in young adults (Santos et al., 2015; Zajac-Gawlak et al., 2016), a population that includes university students (Cruz-Sánchez et al., 2016; Macedo et al., 2020; Morawiec et al., 2016; Torquato et al., 2016) has garnered the attention of health professionals and researchers as a modifiable behavior that amenable to early intervention to prevent illness and avoidable deaths.

In recent years, the number of publications on risk behaviors in the university population has grown more than 100%. Knowing the research trends and characteristics of these publications is important to identifying gaps in knowledge and to assessing how themes have evolved in the production of science in this area (Avena & Barbosa, 2017; Giménez-Espert & Padro-Gascó, 2019).

Bibliometry or literature bibliometric analysis is an important field of information science that offers a method for making inferences about bibliographic production. Through statistical analyses, bibliometry and bibliometric indicators quantify information about the scientific production of an area or certain topics (Ravelli et al., 2009; Zeleznik & Kokol, 2017).

Currently, bibliometric studies are increasingly used for the quantification and analysis of scientific knowledge in a wide range of fields, including health (Avena & Barbosa, 2017; Giménez-Espert & Padro-Gascó, 2019). The interpretation of bibliometric indicators is essential to support decision-making on funding strategies to support the best return in investment that to champion scientific quality and productivity (Giménez-Espert & Padro-Gascó, 2019; Simão et al., 2008).

Network maps are another important indicator for evaluating scientific production. Collaboration charts and maps, the analysis of specific co-occurrences such as citations and key words, can systematically illustrate how the network behaves and what attributes, previously implicit, are important to consolidate knowledge (Ravelli et al., 2009; Zeleznik & Kokol, 2017).

Thus, the visualization of network maps allows the scientific evaluation of a given area of knowledge, allowing discovery of changes, evolution, behavior and gaps over time, as well as trends (Avena & Barbosa, 2017; Giménez-Espert & Padro-Gascó, 2019; Ravelli et al., 2009).

Indicators of bibliometric production can contribute to the management of Graduate Programs (Maciel, Faria, Milanez, & Lança, 2018) and to academic success by mapping the most cited articles, the most productive institutions, the preferred journals (Ravelli et al., 2009; Zeleznik & Kokol, 2017), current topic trends, growth in knowledge (Avena & Barbosa, 2017), as well as identifying relationships between subjects and areas of knowledge (Iqbal et al., 2019; Shi, Miao & Si, 2019).

According to a previous survey of the scientific literature, bibliometric analysis and mapping methods have not yet been used to analyze the literature on lifestyle risk behaviors, which constitutes an important research domain with university students.

This study highlights the usability of bibliometric analysis to understand the scope of publications on this theme with university students, as well as the characteristics and the trend of publications, besides serving as a guide or example for other studies. Thus, the objective of this study is to examine the evolution of publications on the lifestyle risk behaviors of university students.

2. Materials and Methods

This study refers to the national and international bibliographic production on the lifestyle risk behaviors of university students, between 2009 and May 2019. The study is a bibliographic, descriptive, and quantitative approach research.

The bibliographic metric analysis included the identification of the number of publications per year, countries, institutions with the largest number of publications, journals with the most articles, in addition to mapping the co-occurrence of the keywords.

2.1 Database

The Web of Science (WOS) and the Scientific Electronic Library Online (SciELO) database were used as a source of information for the elaboration of indicators of scientific production of the lifestyle risk behaviors of university students in its wide and varied number of scientific records.

The WOS is one the world-leading scientific citation search and competing analytical information databases. Also, It is an increasingly significant scientific instrument across countries/regions and knowledge domains, being the database dataset for large-scale

data-intensive studies with thousands of published academic studies over the past 20 years (Li, Rollins, & Yan, 2018).

The SciELO provides academic literature in sciences, social sciences, arts, and humanities, published in the main open-access journals in Latin America, Spain, Portugal, the Caribbean, and South Africa, in English, Spanish and Portuguese languages.

When connected to the multidisciplinary citations on the Web of Science™ platform, the SciELO Citation Index offers a full citation network to connect with superior accurately and confidently to the highest quality multidisciplinary research. Therefore, researchers from more and more and knowledge domains are involved in the use of the WOS and SciELO.

2.2 Search strategy

A specific search strategy was developed using the keywords (single words or key words) related to lifestyle risk behaviors, indexed in the Health Sciences Descriptors (DeCS) to locate, and retrieve the articles from the databases.

After establishing the sets of primary keywords, that is, the keywords that correspond to the central concept of the document, the wildcard character was defined, represented by the asterisk (*), which was used in searches to locate plurals and variants of words. Moreover, the terms were associated with the Boolean operators “and”, “or” and “not”(DeCS, 2016), as shown in Table 1.

Table 1. Search strategy used in the study.

Search strategy	Date	Number of papers
<i>TS= (((((diet* or "nutrition status" or "alcohol drinking" or "alcohol drinking in college" or smoking* or "tobacco smoking" or "cigarette smoking" or obesity* or overweight* or "body mass index" or exercise* or "physical activity" or hypertension* or "blood pressure" or stress* or "diabetes mellitus" or dyslipidemia*)) and (student* and university*)) not ("middle school" or adolescent* or child* or teenager*))</i>	09/05/2019	11.587
Filter = full papers available <i>on-line</i>		9.125
Deleting replicas		9.011

Source: Research data.

The inclusion criteria adopted for sample selection were publications between 2009 and 2019, and complete articles that were available online. Repeated publications, book chapters, reports, review articles, editorial, abstracts, theses and dissertations were excluded.

2.3 Elaboration and analysis of indicators

The 11,587 publications were downloaded from the database as text file format (.txt) and exported to VantagePoint software® (version 5.0). VantagePoint is a powerful data analysis tool that can organize, clear, and analyze the imported data to provide lists, statistical maps and matrices that identify production indicators. This software can quickly clarify questions such as who, what, when and where the publications occurred, transforming the data into information and knowledge (Dudziak, Fausto, & Costa, 2014; VantagePoint, 2016). After verifying and deleting repeated publications, the 9,011 articles were analyzed as lists, the matrices were built in VantagePoint and transferred to Microsoft Excel 2007 to support the preparation of basic indicators, presented as tables and graphs.

For network analysis, UCINET software (version 6.0) was used, allowing the quantitative analysis of scientific collaboration networks through two-dimensional or three-dimensional graphs. After this phase of organization and systematization of networks, the data were sent to the NetDraw software (version 2.10) for visual analysis of the map. NetDraw is integrated into the UCINET package and is used to maximize the perception of relationships between the variables observed in collaboration networks (Borgatti, Everett, & Freeman, 2002).

Network maps were also developed with the support of VOSviewer software (Visualization of Similarities version 1.6.11). This software has been widely used in bibliometry and allows analyzing large-scale data sets and buildings complex networks according to the connection strength. The analysis of the keywords was performed based on all the keywords that the authors used in the abstracts of the articles. The standard value of ten occurrences was considered as a cut-off point for inclusion in the co-occurrence network. The word font size and circle size describe the number of documents related to each key word, and VOSviewer allows grouping the terms into clusters to facilitate the interpretation of co-occurrences.

3. Results

The results of the analysis of the 9,011 articles are presented below, highlighting the production of 10 key words, countries, institutions and means of dissemination with the highest number of publications associated with the theme (i.e. lifestyle risks in university

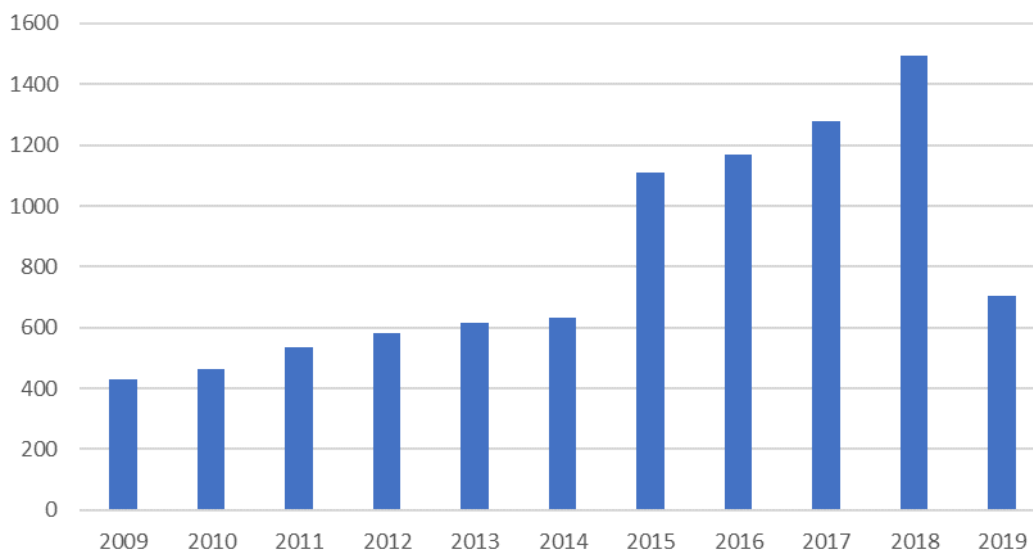
students). This presentation of results allows a better mapping of science, thus facilitating the comparison between those considered “Top 10” within the study area.

3.1 Chronology of the number of publications

Quantitative evolution of world publications in the period 2009-2019

In the first half of the analyzed period, between 2009 and 2014, there was a growth of 48.1% in the number of publications (428 in 2009 and 634 in 2014).

Figure 1. Number of worldwide publications according to the year of publication.



Source: Excel

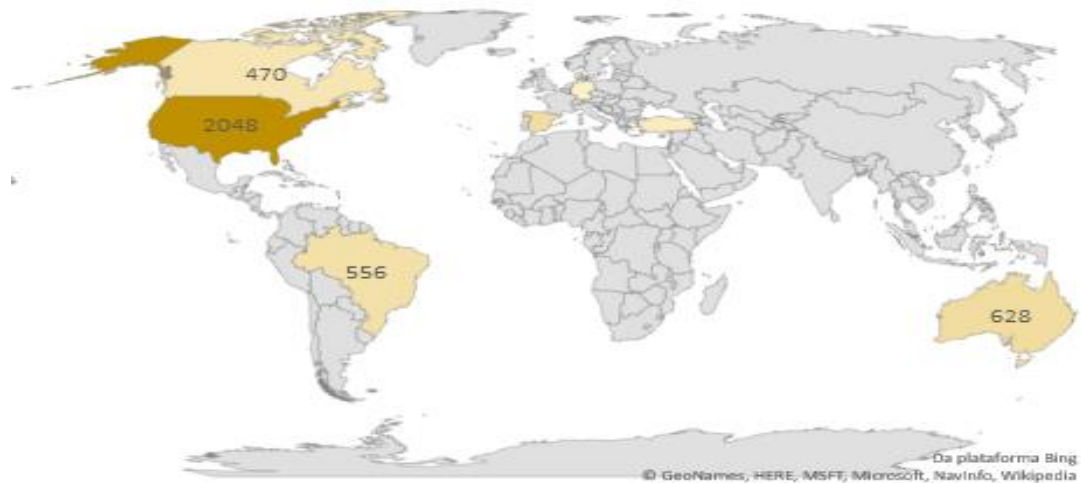
After 2014, there was an important peak of publications in 2015 (1,111 articles) representing an increase of about 129.0% when compared to 2009. Another significant number of publications was identified in 2018 (1,495 articles), which represented an increase of more than 174.0% in the number of published articles (Figure 1).

3.2. Geographic location of publications

Top 10 countries with the highest number of publications (2009-2019)

Figure 2 is a visualization of the ten countries with the highest number of publications on the topic in the years 2009-2019. The American continent had the largest number of publications, primarily in the United States of America (USA).

Figure 2. Number of publications according to the Top 10 countries.



Source: Excel

The USA, along with Australia and Spain, accounted for more than 50% ($n = 4,505$) of world production. Also, in these three countries, it was possible to observe that 2018 was the most productive in number of publications for the USA ($n=302$) and Australia ($n=99$). Spain had its highest number of publications ($n=113$) recorded in 2017, data not shown in Figure 2.

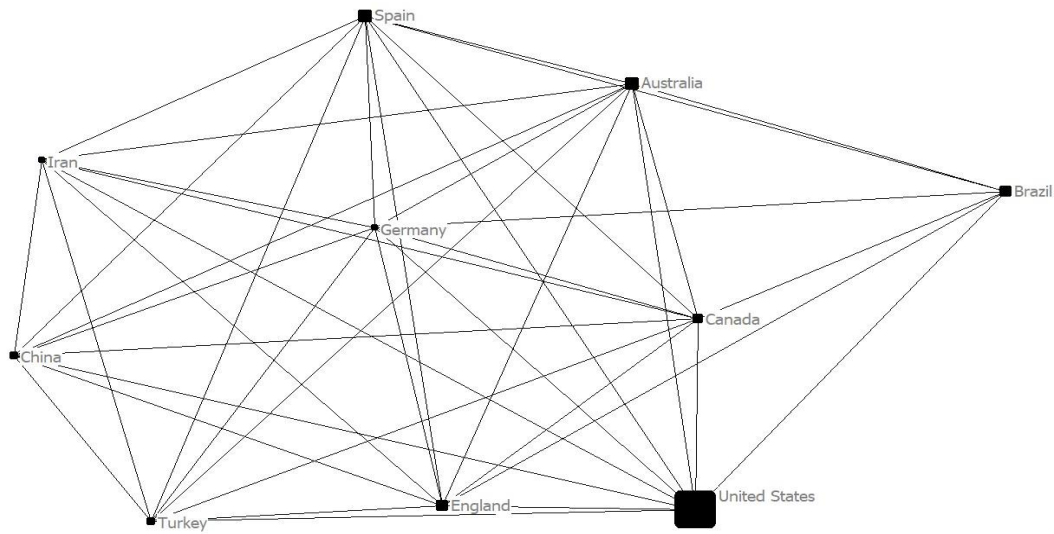
Brazil ranked fourth among the ten countries with publications on the risk behaviors of university students, contributing about 6.2% ($n = 556$) of total production. It is worth mentioning that Brazil was the only representative of South America present in the list of top 10 countries with the highest number of publications (Figure 2).

3.3 Collaboration networks of publications

Collaborations among the Top 10 countries with most publications (2009-2019)

The network analyses revealed a strong network of international collaboration (i.e. largest number of “nodes” or the size of connections, which represents a greater number of publications) between the USA in partnerships with researchers from abroad (Figure 3).

Figure 3. Networking of collaboration among the Top 10 countries that publish the most on the topic.



Source: NetDraw.

3.4 University institutions that published

Concentration of publications in Top 10 international institutions

The articles on lifestyle risk behaviors of university students between 2009 and 2019 were published by researchers in different countries and higher education institutions.

Table 2. Number of publications according to the Top 10 institutions (n=9,011).

Top 10	Publication field	Country	N
1	University of São Paulo	Brazil	118
2	University of Florida	United States	78
3	University Queensland	Australia	76
4	University of Sydney	Australia	71
5	University of Toronto	Canada	68
6	University of Granada	Spain	63
7	University of North Carolina	United States	62
8	University of Minnesota	United States	61
9	University of Newcastle	Australia	56
10	Federal University of Santa Catarina	Brazil	54

Source: Research data.

The table 2 shows the concentration of publications within a few universities in Brazil (n=206) and Australia (n=172) are highlighted in this production. Furthermore, the top American universities (n=145) were not concentrated in a single university even though overall, the USA has the largest number of world publications. In contrast, most publications on lifestyle risks in university students are concentrated in a single university--the University of São Paulo (USP). It is also noteworthy that the South and Southeast of Brazil had the highest number of publications, especially two institutions, University of São Paulo (n=118) and Federal University of Santa Catarina (n=54). These two institutions reached about a quarter of the publications of the ten most productive institutions together (Table 2).

3.5 Journals with the highest number of publications

Top 10 international journals

Among the 2,912 journals that published the 9,011 articles on risk behaviors in the university population, *Nutricion Hospitalaria* published the most articles (n=145), followed by the Journal of American College Health (n=120) and Plos One (n=98).

Table 3. Top 10 journals with highest number of published articles (n=9,011).

Top 10	Journals	N
1	Nutricion Hospitalaria	145
2	Journal of American College health	120
3	Plos One	98
4	Nurse Education Today	76
5	BMC public health	72
6	International Journal of Environmental Research and Public Health	66
7	Journal of Dental Education	53
8	BMC Medical Education	52
9	Personality and Individual Differences	47
10	Appetite	46

Source: Research data

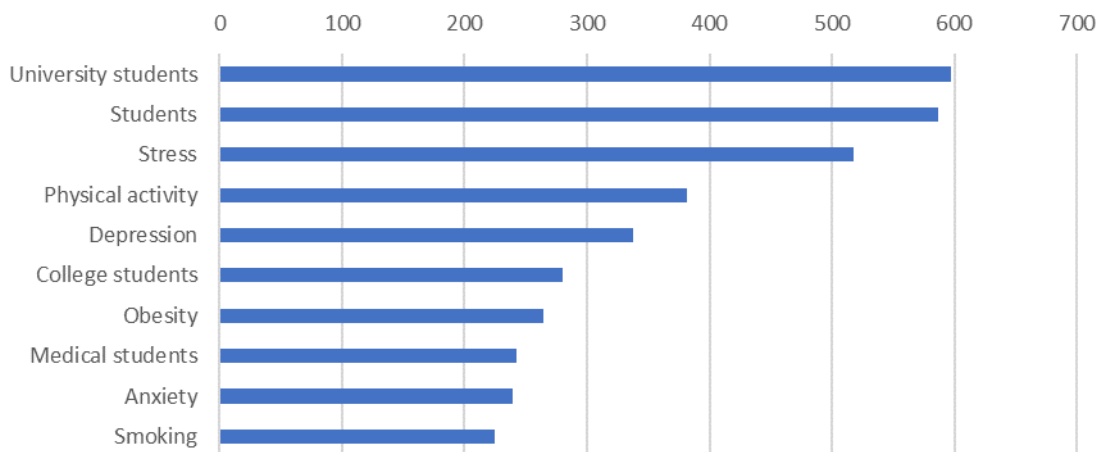
The table 3 shows that the most productive journals published a total of 366 articles in the past 11 years. Despite having a lower impact factor, *Nutricion Hospitalaria* was the journal that published more manuscripts on the subject investigated. However, the Top 10 journals publishing articles on this topic did not include any Brazilian journal.

3.6. Distribution of sets and analysis of keywords of publications

Top 10 keywords

This study identifies the most common keywords used by the authors in the analysis of the 9,011 articles. The keyword “university student” was present in more than 597 publications and the keyword “student” in 587 of the publications. The authors used some synonyms such as college student (280) and medical students (243) to refer to the study population or sample. In characterizing the study sample, the keyword “medical students” (n=243) ranked eighth and identified a specific professional discipline (Figure 4).

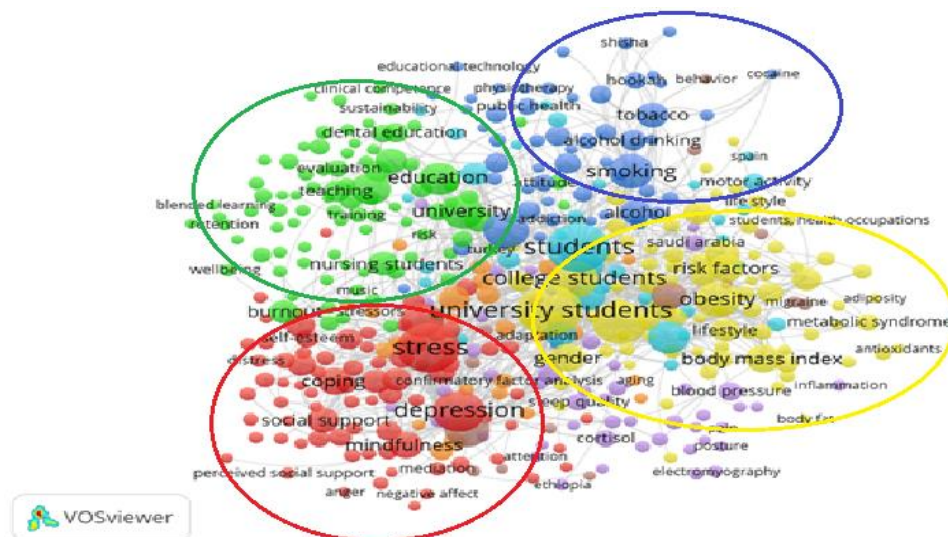
Figure 4. Top 10 most cited keywords in publications.



Source: Excel

Finally, a diverse range of keywords were used in these published articles identifying graduate courses in specific areas (e.g., medicine) and courses in various areas of higher education (e.g. university students and students). Among these, risk factors such as stress, physical activity, depression, obesity, anxiety, and smoking stood out as the focus of the studies.

Figure 5. Number of co-occurrence of keywords in publications (2009-2019).



Source: VOSviewer

Upon analyzing the distribution of keywords, using the VOSviewer software, an important network of co-occurrence of the keywords sets was visualized (Figure 5). The keywords are clustered into groups by colors that represent the following terms: 1) Red

science and technology than any other countries and is considered a world leader in several areas of knowledge (Iqbal et al., 2019; Shi et al., 2019) that include consolidated studies on lifestyle risk behaviors, such as the Framingham Heart Study and the Atherosclerosis Risk in Communities Study (Duncan, Chor, Aquino, & Bensenor, 2012).

Brazil is a developing countries which is showing significant growth in scientific publications on this topic in recent years (Maciel et al., 2018; Sidone, Haddad, & Mena-Chalco, 2016). Data from a Clarivate Analytics report entitled Research in Brazil, indicates that the country is increasing the number of research publications worldwide due to changes in research policy and funding (Cross, Thomson, & Sinclair, 2017). In addition, according to the 2018 report entitled National Strategy of Science, Technology and Innovation, the Brazilian government has been increasing investment in research development since 1990, which is a central strategy for increasing scientific, economic, and social development. Nevertheless, significant cuts in research by the current government seems likely to affect future scientific contributions in many areas.

Another finding is that despite the significant number of Brazilian articles, the majority were collaborations with other national institutions. International collaboration was identified with only five countries (i.e., Spain, England, Canada, Germany, and the USA). Cultural and geographic factors may explain the low standard of internationalization of Brazilian productions. According to Sidone *et al.* (2016), Portuguese is a relevant language barrier that hinders the dissemination of knowledge and the formation of international collaborative networks.

Networks of collaboration across institutions and countries are critical to intellectual exchange; science is increasingly collaborative in construction of knowledge (Sidone et al., 2016). In general, the more diverse the research collaborations, the greater the productivity, visibility and scientific impact (Lovakov & Agadullina, 2019). Collaborative networks generate a greater dissemination of knowledge in different geographical spaces. Looking forward, Brazilian researchers need to strengthen and expand international partnerships to ensure the contributions of Brazilian science are recognized internationally across the scientific community (Uvacsek et al., 2014).

In relation to higher education institutions, the Brazilian institution with the highest number of publications on lifestyle risk behaviors of university students was USP. According to the Coordination for Higher Education Personnel Improvement (Capes), USP has the largest number of scientific publications in Brazil, accounting for more than 20.0% of research articles. Clearly this university is a research leader in Brazilian scientific

development (Unversidade de São Paulo, 2018), which has contributed to the growth in the number of universities, research groups, researchers and distribution of investments in this region of the country (Sidone et al., 2016).

Scientific journals often publish in electronic and printed formats, in different languages, allowing broad access to and dissemination of science. This analysis found that the journals with the most publications on the subject are indexed in several databases such as Medline, Web of Science, Scopus, SciELO and CINAHL, and have English or Spanish as the primary language.

An analysis of journals from 2009 to 2019, identified *Nutricion Hospitalaria* as publishing the most articles (n=145). However, this journal (publishing since 1986) has the lowest impact factor (IF0.84) of the ten journals that published the most articles during this period. Clearly, the quality of the articles published is crucial to ensure good science and not simply the numbers of manuscripts published.

In the last decade, the search strategy shows growth in the numbers of studies using keywords related to risk behaviors in university students. These results also point out that the greatest co-occurrence of keywords was related to the field of mental health, especially the keywords stress, present in more than 518 articles and considered the third most used by the authors. Studies suggest that the main sources of stress found in the university routine are related to academic demands (e.g. number of courses, reading, testing and assignments) leaving little time for leisure, family and friends (Brito, Gordia, & Quadros, 2016; Leiva, Martínez, & Celis-Morales, 2015).

In addition to stress, disorders associated with mental health, such as depression and anxiety, appeared as keywords of 12.5% more of the 9,011 articles. Thus, these keywords point to the high frequency of studies on the mental health of university students. Strategies for prevention and control of these disorders while in academic programs, such as the implementation of mental health care services in the university fields, are needed (Rotenstein et al., 2016; Torquato et al., 2016).

Based on analysis of study samples, a majority focused on medical students. According to global estimates, there are about 2,409 medical schools in more than 180 countries, with the highest concentrations (representing 40% worldwide) in India, the United States, China, Brazil, Japan, Mexico, Pakistan and Russia (Rigby & Gururaja, 2017). Medical programs have clinical and academic requirements that can contribute to stress and exhaustion. In 2016, a meta-analysis reported that a higher prevalence of depression or

depressive symptoms (27.2%) and suicidal ideation (11.1%) than the general population (Rotenstein et al., 2016).

The research analysis of the keywords identified other common lifestyle risk behaviors of students which affect cardiovascular health (e.g., physical inactivity, obesity, and smoking). These lifestyle risk behaviors are a main cause of premature mortality from heart disease among adults and young people, especially among students (Brito et al., 2016).

Studies conducted with university students state that physical inactivity is prevalent regardless of nationality- Saudi Arabia (62.4%) (Alfhaid et al., 2017), United States (27.0%) (Lai, Ward, & Bolin, 2015) and Brazil (56.3%) (Tassia Teles Santana de Macedo et al., 2019). Physical inactivity was common in many of the studies conducted with university students (Alfhaid et al., 2017; Brito et al., 2016; Morawiec et al., 2016). In Brazilian university students excessive sitting time was predictive of abdominal obesity (Mussi, Pitanga & Pires, 2017).

The bibliometry results show that there is growing national and international interest in research on lifestyle risk behaviors of university students. Identifying risk behaviors during this stage of life is of fundamental importance to understand how the university experiences the adoption of unhealthy lifestyles (Cruz-Sánchez et al., 2016).

The present study is innovative regarding the use of bibliometric analysis, which is an innovative technological methodology for research. The results presented may motivate researchers to establish dialogues, partnerships, and cooperation networks with other research centers, as well as to direct and strengthen the development of research on this topic.

The bibliometric analysis offers evidence of the increasing volume of publications on this topic and visualizes the countries, institutions, journals, and keywords in the chronological evolution of scientific production related to the lifestyle risk behaviors of university students in recent years. The increase in numbers of scientific publications is concentrated mainly in 2018 and in the American continent. Overall, the U.S. had the largest number of publications, but a Brazilian university (i.e., USP) had the greatest number of articles published during this time.

In international collaboration networks, there was a predominance of researchers with English as their first language who work in the same geographic region. The most used keywords were related to the study population (e.g., university students), followed by risk behaviors (e.g., stress, physical inactivity, obesity, alcohol consumption and smoking). In addition to stress, there was a concentration of publications with keywords related to mental health, such as depression and anxiety.

However, the bibliometric analysis showed the necessity to stimulating new studies and scientific production about the lifestyle among university students. In addition, the results suggest an expansion of the search in other databases and the deepening of the analyzes, in new studies, with different countries that illustrate and confirm the main risk behaviors related both to the lifestyle of university students and to mental health during the training period.

This study also presents some limitations. The accuracy of the SciELO and the main collection of the Web of Science platforms were used to obtain information about the publications, including data from countries, institutions, and journals. The Web of Science data were not verified with other databases due to human resources limitations. Another limitation of the study was the choice of the analysis period (2009-2019), because only five months were analyzed in 2019. Thus, perhaps, other publications that would influence the result may not have been included in the research.

Despite these limitations, the value of this study is in illustrating the trend of publications on lifestyle risk behaviors, highlighting the countries, institutions, and journals. Also, the study confirming the main network of co-occurrence of the keyword on lifestyle risk behaviors among university students.

Acknowledgments

We would like to thank the Center for Technological Information in Materials (NIT/Materials) of the Universidade Federal de São Carlos-UFSCar for their support in data processing activities. Also, we would like to thank or financial support for this study, provided by the Coordination of Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Financial Code 001.

Declaration of interest statement

No potential conflict of interest was reported by the authors.

References

Alfhaid, F., Alzahrani, M., Almansour, M., Alghamdi, T., Ansari, T., Sami, W., ... Alhugail, F. S. (2017). Lifestyle of health sciences students at Majmaah University, Saudi Arabia. *Australasian Medical Journal*, 10(2) PG-111–116), 111–116.

<https://doi.org/http://dx.doi.org/10.21767/AMJ.2017.2785>

Avena, M. J., & Barbosa, D. A. (2017). Bibliometric indicators of the nursing journals according to the index databases. *Rev Esc Enferm USP*, 51(e03262 1), 1–9. <https://doi.org/http://dx.doi.org/10.1590/S1980-220X2017014603262>

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2002). *UCINET 6 for Windows: Software for Social Network Analysis*. (M. Harvard, Ed.). United States: Analytic Technologies.

Brito, B. J. Q., Gordia, A. P., & Quadros, T. M. B. (2016). Estilo de vida de estudantes universitários: Estudo de acompanhamento durante os dois primeiros anos do curso de graduação. *Medicina (Brazil)*, 49(4), 293–302. <https://doi.org/10.11606/issn.2176-7262.v49i4p293-302>

Cross, D., Thomson, S., & Sinclair, A. (2017). Research in Brazil: a report for CAPES by Clarivate Analytics. *Clarivate Analytics*, 73.

Cruz-Sánchez, E., Orosio-Méndez, M., Cruz-Ramírez, T., Bernardino-García, A., Vásquez-Domínguez, L., Galindo-Palma, N., & Grajales-Alonso, I. (2016). Factores de riesgo cardiovascular en estudiantes de enfermería de una universidad pública. *Enfermería Universitaria*, 13(4), 226–232. <https://doi.org/10.1016/j.reu.2016.09.004>

DeCS. (2016). Descritores em Ciências da Saúde. Retrieved from <http://decs.bvsalud.org>

Dudziak, E. A., Fausto, S., & Costa, R. O. da. (2014). *Manual de uso do VANTAGEPOINT* (1st ed.). São Paulo.

Duncan, B. B., Chor, D., Aquino, E. M. L., & Bensenor, I. M. (2012). Doenças crônicas não transmissíveis no Brasil: prioridade para enfrentamento e investigação. *Rev Saúde Pública*, 46, 126–134. <https://doi.org/https://dx.doi.org/10.1590/S0034-89102012000700017>

Giménez-Espert, M. del C., & Padro-Gascó, V. J. (2019). Bibliometric analysis of six nursing journals from the Web of Science , 2012 – 2017. *J Adv Nurs*, 75, 543–554. <https://doi.org/10.1111/jan.13868>

Iqbal, W., Qadir, J., Tyson, G., Mian, A. N., Hassan, S., & Crowcroft, J. (2019). networking research. *Scientometrics*, *119*(2), 1121–1155. <https://doi.org/10.1007/s11192-019-03086-z>

Lai, H. L., Ward, R., & Bolin, P. (2015). Cardiovascular Health of North Carolina Undergraduates. *North Carolina Medical Journal*, *76*(5), 286–292.

Leiva, A. M., Martínez, M. A., & Celis-Morales, C. (2015). Efecto de una intervención centrada en la reducción de factores de riesgo cardiovascular en estudiantes universitarios. *Revista Médica de Chile*, *143*(8), 971–978. <https://doi.org/10.4067/S0034-98872015000800002>

Li, K., Rollins, J., & Yan, E. (2018). Web of Science use in published research and review papers 1997–2017: a selective, dynamic, cross-domain, content-based analysis. *Scientometrics*, *115*(1), 1–20. <https://doi.org/10.1007/s11192-017-2622-5>

Lovakov, A., & Agadullina, E. (2019). Bibliometric analysis of publications from post - Soviet countries in psychological journals in 1992 – 2017. *Scientometrics*, *119*(2), 1157–1171. <https://doi.org/https://dx.doi.org/10.1007/s11192-019-03087-y>

Macedo, T. T. S., et al. (2019). Perfil alimentar , clínico e padrão de atividade física em ingressantes universitários de enfermagem. *Revista Cubana de Enfermería*, *1*(25), 2–21.

Macedo, T. T. S., Mussi, F. C., Sheets, D., Campos, A. C. P., Patrão, A. L., Freitas, C. L. M., & Paim, M. A. S. (2020). Lifestyle behaviors among undergraduate nursing students: A latent class analysis. *Research in Nursing and Health*, (August), 1–9. <https://doi.org/10.1002/nur.22064>

Maciel, R. S., Faria, L. I. L. de, Milanez, D. H., & Lança, T. A. (2018). Efeito Qualis e a produção científica dos Programas de Pós-Graduação da Universidade Federal de São Carlos. *Em Questão*, *24*, 88–110. <https://doi.org/http://dx.doi.org/10.19132/1808-5245240.88-110>

Morawiec, R., Janikowski, K., & Lelonek, M. (2016). Thirty-year risk of cardiovascular disease in senior medical students – based on the StudHeart study. *Polish Journal of Cardio-*

Thoracic Surgery, 2(2), 172–177. <https://doi.org/https://dx.doi.org/10.5114/kitp.2016.61059>

Mussi, F. C., Pitanga, F. J. G., & Pires, C. G. da S. (2017). Cumulative sitting time as discriminator of overweight, obesity, abdominal obesity and lipid disorders in nursing university. *Brazilian Journal of Kinanthropometry and Human Performance*, 19(1), 40. <https://doi.org/10.5007/1980-0037.2017v19n1p40>

Prodanov, S. S., & Cimadon, H. M. S. (2016). A influência da publicidade nos hábitos alimentares de crianças em idade escolar the influence of advertising in eating habits of school age children. *Revista Conhecimento Online*, 1(8), 3–12.

Ravelli, A. P. X., Fernandes, G. C. M., Barbosa, S. de F. F., Simão, E., Santos, S. M. A. dos, & Meirelles, B. H. S. (2009). Knowledge production in nursing and aging : A bibliometric study. *Texto Contexto Enferm*, 18(3), 506–512.

Rigby, P. G., & Gururaja, R. P. (2017). World medical schools : The sum also rises. *Journal of the Royal Society f Medicine Open*, 8(6), 1–6. <https://doi.org/10.1177/2054270417698631>

Rotenstein, L. S., Ramos, M. A., Torre, M., Segal, J. B., Peluso, M. J., Guille, C., ... Mata, D. A. (2016). Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation Among Medical Students: A Systematic Review and Meta-Analysis. *Jama*, 316(21), 2214–2236. <https://doi.org/10.1001/jama.2016.17324>

Saint Onge, J. M., & Krueger, P. M. (2017). Health lifestyle behaviors among U.S. adults. *SSM - Population Health*, 3(December 2016), 89–98. <https://doi.org/10.1016/j.ssmph.2016.12.009>

Santos, J. D. S., Patrício, A. C. F. de A., Alves, K. de L., Albuquerque, K. F. de, Pereira, I. L., & Félix, I. V. B. (2015). Avaliação para riscos cardiovasculares em estudantes de enfermagem. *REME Rev. Min. Enferm*, 19(4), 842–847. <https://doi.org/10.5935/1415-2762.20150065>

Shi, J., Miao, W., & Si, H. (2019). Visualization and Analysis of Mapping Knowledge Domain of Urban Vitality Research. *Sustainability*, 11(988), 1–17. <https://doi.org/10.3390/su11040988>

Sidone, O. J. G., Haddad, E. A., & Mena-Chalco, J. P. (2016). A ciência nas regiões brasileiras: evolução da produção e das redes de colaboração científica. *Transinformacao*, 28(1), 15–31. <https://doi.org/10.1590/2318-08892016002800002>

Simão, M., Hayashida, M., Santos, C. B. dos, Cesarino, E. J., & Nogueira, M. S. (2008). Hypertension among undergraduate students from lubango, angola. *Rev Latino-Am Enfermagem*, 16(4), 672–678.

Sociedade Brasileira de Cardiologia. (2013). I Diretriz Brasileira de Prevenção Cardiovascular. *Arquivos Brasileiros de Cardiologia*, 101(6 Supl. 2), 63.

Torquato, S. C., Freires, R. D. S. E., Rodrigues, A. R., Pimenta, V. T., Ramos, J., Moura, A., & Roberta, A. (2016). Sedentary lifestyle and metabolic disorders among college. *Rev Enferm UFPI*, 5(2), 16–21.

Unversidade de São Paulo. (2018). Relatório confirma liderança da USP na ciência brasileira. Retrieved from <https://jornal.usp.br/universidade/relatorio-confirma-lideranca-da-usp-na-ciencia-brasileira/>

Uvacsek, M., Kneffel, Z., Tóth, M., Johnson, A. W., Vehrs, P., Myrer, J. W., & Hager, R. (2014). Ten-year cardiovascular risk assessment in university students. *Acta Physiologica Hungarica*, 101(3), 321–328. <https://doi.org/10.1556/APhysiol.101.2014.3.7>

VantagePoint. (2016). VantagePoint: Serious software for serious professionals. 2016. Retrieved from <https://www.thevantagepoint.com/>

Zajac-Gawlak, I., Pośpiech, D., Kroemeke, A., Mossakowska, M., Gába, A., Pelclová, J., ... Kłapcińska, B. (2016). Physical activity, body composition and general health status of physically active students of the University of the Third Age (U3A). *Archives of Gerontology and Geriatrics*, 64, 66–74. <https://doi.org/https://dx.doi.org/10.1016/j.archger.2016.01.008>

Zeleznik, D., & Kokol, P. (2017). A bibliometric analysis of the Journal of Advanced Nursing , 1976 – 2015. *J Adv Nurs*, 73(10), 2407–2419.

Percentage of contribution of each author in the manuscript

Tassia Teles Santana de Macedo- 40%

Debra Sheets- 15%

Wilton Nascimento Figueredo-10%

Michaela Eickemberg-10%

Jules Ramon Brito Teixeira- 10%

Fernanda Carneiro Mussi- 15%