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ORIGINAL

Psychological well-being in medical education: an analysis of its evolution and scientific communication

El bienestar psicológico en la educación médica: un análisis de su evolución y comunicación científica

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ABSTRACT

Introduction: psychological well-being in medical education is a growing line of research, essential for mitigating stress, anxiety, and burnout among medical students.
Objective: to map the intellectual structure and evolution of this area of study through a bibliometric analysis.
Method: a bibliometric analysis of 3 127 documents indexed in Scopus (2018-2024) was conducted, processed with VOSviewer to examine production metrics, collaboration, and keyword co-occurrence.
Results: scientific production experienced exponential growth, accelerated by the COVID-19 pandemic. A marked concentration of scientific leadership was identified in English-speaking countries (United States and United Kingdom), while the Hispanic American contribution was peripheral. Conceptually, the field evolved from a predominant focus on psychopathologies (anxiety, burnout) towards emerging clusters on curricular interventions and protective educational environments. Artificial intelligence is emerging as a topic with controversial impact.
Conclusions: the field is consolidated but asymmetrical. Strategic investment in Hispanic America is required to strengthen research capacities, improve visibility, and ethically integrate emerging technologies, shifting from description to prediction and prevention of psychological distress in medical training.

Keywords: Psychological Well-Being; Medical Education; Bibliometrics; Hispanic America; Artificial Intelligence.

RESUMEN

Introducción: el bienestar psicológico en la educación médica constituye una línea de investigación en crecimiento, esencial para mitigar el estrés, la ansiedad y el agotamiento entre los estudiantes de medicina.
Objetivo: cartografiar la estructura intelectual y evolución de esta área de estudio mediante un análisis bibliométrico.
Método: se realizó un análisis bibliométrico de 3 127 documentos indexados en Scopus (2018-2024), procesados con VOSviewer para examinar métricas de producción, colaboración y co-ocurrencia de palabras clave.

Resultados: la producción científica experimentó un crecimiento exponencial, acelerado por la pandemia de COVID-19. Se identificó una marcada concentración del liderazgo científico en países angloparlantes (Estados Unidos y Reino Unido), mientras que la contribución hispanoamericana resultó periférica. Conceptualmente, el campo evolucionó desde un enfoque predominante en psicopatologías (ansiedad, burnout) hacia clústeres emergentes sobre intervenciones curriculares y entornos educativos protectores. La inteligencia artificial se vislumbra como un tema emergente de impacto controversial.
Conclusiones: el campo está consolidado, pero es asimétrico. Se requiere una inversión estratégica en Hispanoamérica para fortalecer capacidades investigativas, mejorar la visibilidad e integrar éticamente tecnologías emergentes, transitando de la descripción a la predicción y prevención del malestar psicológico en la formación médica.

Palabras clave: Bienestar Psicológico; Educación Médica; Bibliometría; Hispanoamérica; Inteligencia Artificial.

INTRODUCTION

According to Saqid et al.[1] academic stress is the most significant source of stress among medical students. In this regard, Han et al.[2] emphasize that these students face significant challenges in terms of depression, anxiety, insomnia, and perceived stress, which negatively impact their academic performance.

Precisely in this scenario, the study of psychological well-being as a protective factor for mental health, specifically in medical students, constitutes a rapidly growing line of research. In fact, Hawsawi et al.[3] assert the relevance of this line of study, as positive factors of psychological well-being such as work-life balance, academic achievement, meaningful relationships, and time spent with close friends or family positively influence the academic performance of medical students.

As a growing research trend, the phenomenon of psychological well-being in medical education is being addressed in the scientific community from psychological, sociological, educational, and, of course, medical perspectives.[4] However, according to Guldner[5], all these approaches converge on the need for medical education to create and support well-being by addressing depression, anxiety, burnout, and dissatisfaction among faculty and students.

In addition, Mazzoleni et al.[6] report that there is a general research gap regarding medical students' attitudes toward well-being and health, which could be used to develop specific practices that improve physicians' quality of life and reduce overall burnout. Because of this, this research is justified by the need to condense the body of research on psychological well-being in medical education as a starting point for charting research trends that will serve researchers, educators, and educational policymakers. Therefore, the objective of this study is to map the intellectual structure and evolution of psychological well-being in the field of medical education.

METHOD

Methodological design

This research assumes a theoretical literature review design based on a bibliometric approach. To this end, the authors adhere to the methodological guidelines stated by Donthu et al.[7] , who state that bibliometric methods can increase rigor and mitigate researcher bias when reviewing scientific literature. This approach was chosen due to reported evidence that bibliometric analysis is a comprehensive technique for examining scientific data, identifying patterns, trends, and impact, and can be a suitable alternative to literature reviews.[8,9,10,11]

Sources of information and search strategy

Based on the suggestions of Wanyama et al.[12], and taking into account that the choice of bibliographic databases can substantially affect the results of reviews, the Scopus database was chosen as the search engine for this study. In fact, research suggests that this is the leading scientific information database, as it offers remarkable coverage of high-impact peer-reviewed scientific literature.[13,14,15]
The search formula used combined key terms related to the topic, as presented below:

- *(TITLE-ABS-KEY (medical AND education) AND TITLE-ABS-KEY (psychological AND well AND being)) AND PUBYEAR > 2017 AND PUBYEAR < 2025*

In addition, a time restriction was implemented that focused on studies from 2018 to 2024. This combination yielded a total of 3,127 studies, which were screened to ensure their relevance to the study.

Bibliometric analysis procedure

For the bibliometric data analysis, the final solution of 3,127 studies was exported to a comma-separated

values (.csv) file for processing. The bibliometric analysis software VOSviewer was used as the analysis tool. According to Husaeni & Nandiyanto[16], this tool is effective for bibliometric data analysis as it allows sophisticated cluster analysis of scientific publications using citation relationships, enabling bibliometricians to perform advanced analyses without the need for advanced computer skills.

Production metrics (number of publications per year, institution, and area of knowledge), collaboration metrics (co-authorship networks between countries), and thematic network metrics (co-occurrence of keywords) were analyzed. According to McAllister et al.[17], the main advantage of VOSviewer is that it helps visualize research collaborations and trends in the literature, helping professionals understand research and publications.

RESULTS

Production metrics and temporal evolution

Annual publication dynamics

Annual document production began the period with moderate growth (figure 1). Publications increased from 279 in 2018 to 312 in 2019, equivalent to an increase of 11,83 %. However, this trajectory changed dramatically in 2020. The number of documents rose to 461, representing a considerable jump of 47,76 % over the previous year. This initial expansion culminated in a first peak of 516 documents during 2021, with a sustained growth rate of 11,93 %.

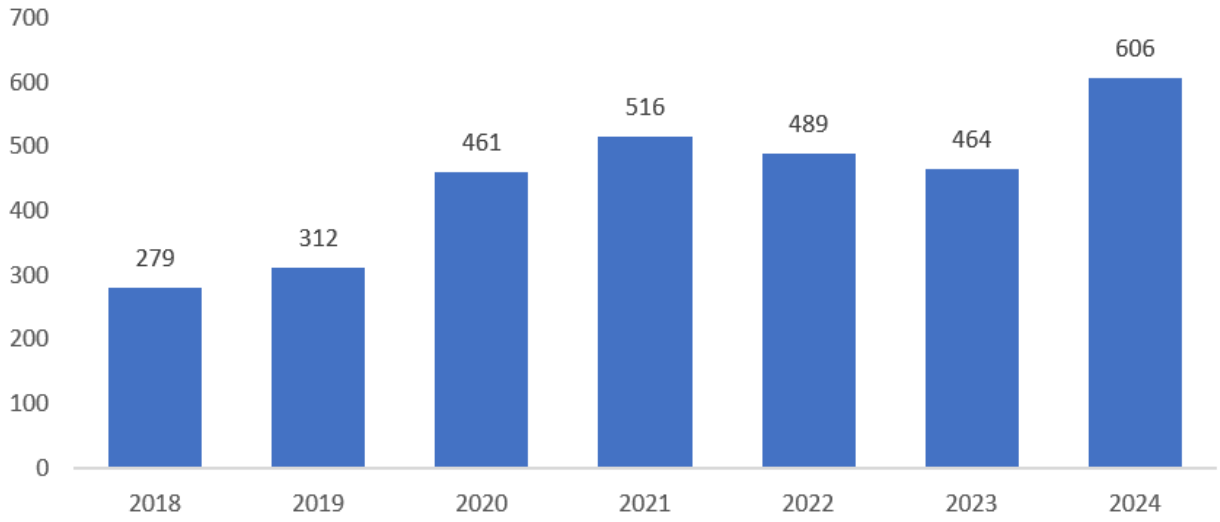

Figure 1. Annual evolution of publications

This rapid and massive increase between 2020 and 2021 seems to respond directly to the global health emergency. The pandemic caused a profound disruption in educational processes and significantly affected the mental health of students and medical professionals. As a result, the research community was prompted to assess and document the psychological impact on this sector.

Subsequently, production experienced a stabilization phase. The years 2022 (489 documents) and 2023 (464 documents) showed percentage decreases of -5,23 % and -5,11 %, respectively. Despite this slight decline, the volume of publications remained well above pre-pandemic levels. This behavior confirmed the definitive consolidation of the area of study.

Finally, the period closed with a new all-time high in 2024, reaching 606 publications. This figure represented a robust increase of 30,60 %. The upturn demonstrates that interest in psychological well-being transcended reactive research to become institutionalized in the medical education agenda. The trend thus confirms that this line of research has established itself as a priority, showing a clear trajectory of exponential growth in recent years.

Geographic contribution and country leadership

Analysis of the geographical distribution of publications indicates a notable concentration of scientific production in a small group of English-speaking countries, as shown in figures 2 and 3. Seventy-six point three percent of the documents originated in just four countries. This concentration reflects a notable asymmetry in scientific authorship at the global level. From fifth place onwards, the volume of publications decreased dramatically, showing a progressive dispersion of knowledge.

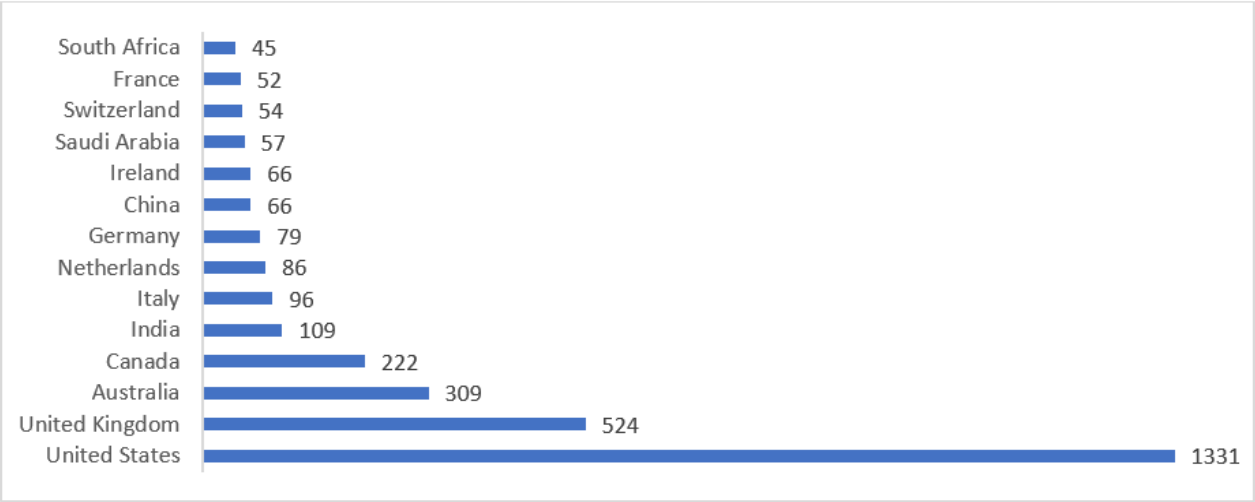

Figure 2. Scientific production by country

Figure 3. Geographical trends

A crucial aspect was the 'Undefined' category, which comprised 154 documents, equivalent to 4,92 % of the total. This circumstance (attributable to a lack of affiliation data or limitations in classification) slightly restricts the accuracy of the geographical analysis. Nevertheless, the presence of non-English-speaking countries and developing regions suggests an incipient thematic expansion. Such diversification implies that research interest is beginning to transcend traditionally dominant contexts.

Interdisciplinary relationship by areas of knowledge

Analysis of the distribution of research by area of knowledge (figure 4) indicates an overwhelming predominance of the field of medicine, which, with 2,515 publications, accounts for approximately 70 % of the total scientific output analyzed. However, despite this marked hegemony, it is crucial to highlight the significant contribution of the Social Sciences, which, with 456 publications, ranks as the second most productive area of knowledge. Likewise, the areas of Nursing (232) and Health Professions (134) complement this perspective, suggesting an interdisciplinary approach within the clinical field.

On the other hand, it is striking that Psychology ranks fifth, tied with Health Professions with 134 publications. Although its contribution is indispensable, its volume of production is significantly lower than that of Medicine. Additionally, the presence of areas such as Neuroscience (84) and Biochemistry, Genetics, and Molecular Biology

(106) introduces a biomolecular dimension to the debate, exploring the physiological and genetic bases of stress and resilience.

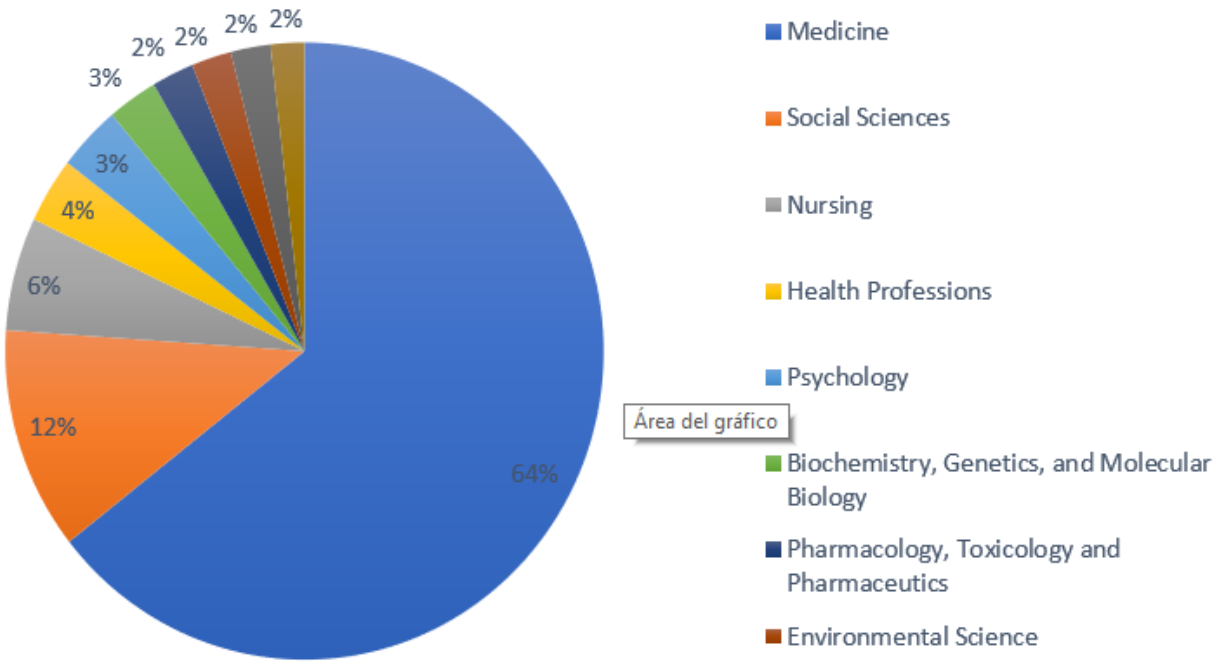

Figure 4. Distribution of publications by area of knowledge

Patterns of international collaboration (co-authorship networks)

Analysis of collaboration metrics revealed a co-authorship network with a markedly hierarchical pattern (table 1). This structure also exhibits a strong tendency toward transnational collaboration, which was mainly concentrated among the leading nations in scientific production. To assess the intensity of these interactions, the total link strength (TLS) and the number of collaborative connections established by each country were examined.

Table 1. Co-authorship network

Country	Documents	Total Link Strength (TLS)	Collaborative Links
United States	986	442	53
United Kingdom	395	433	53
Australia	209	237	46
Canada	162	232	45
Italy	73	222	42

The data showed that the two countries with the highest document production also dominated the collaboration metrics. The United States and the United Kingdom positioned themselves as the main hubs of the network. Both had the highest TLS (442 and 433, respectively) and established the largest number of links, connecting with 53 other countries each. This finding implies that they were not only the most prolific producers, but also acted as nerve centers that coordinated global research in this field.

Behind this binary leadership, Australia and Canada also stood out as significant collaboration nodes, with TLS of 237 and 232, respectively. The high position these nations occupy, both in production and links, suggests the existence of robust intracultural collaboration. This pattern often reflects what is known as the connection between Anglo-Saxon countries.

International collaboration was a distinctive feature of the field of study (figure 5). A more detailed analysis of co-authorship among the main contributors (based on TLS) revealed the intensity of their relationships, as shown in figure 6.

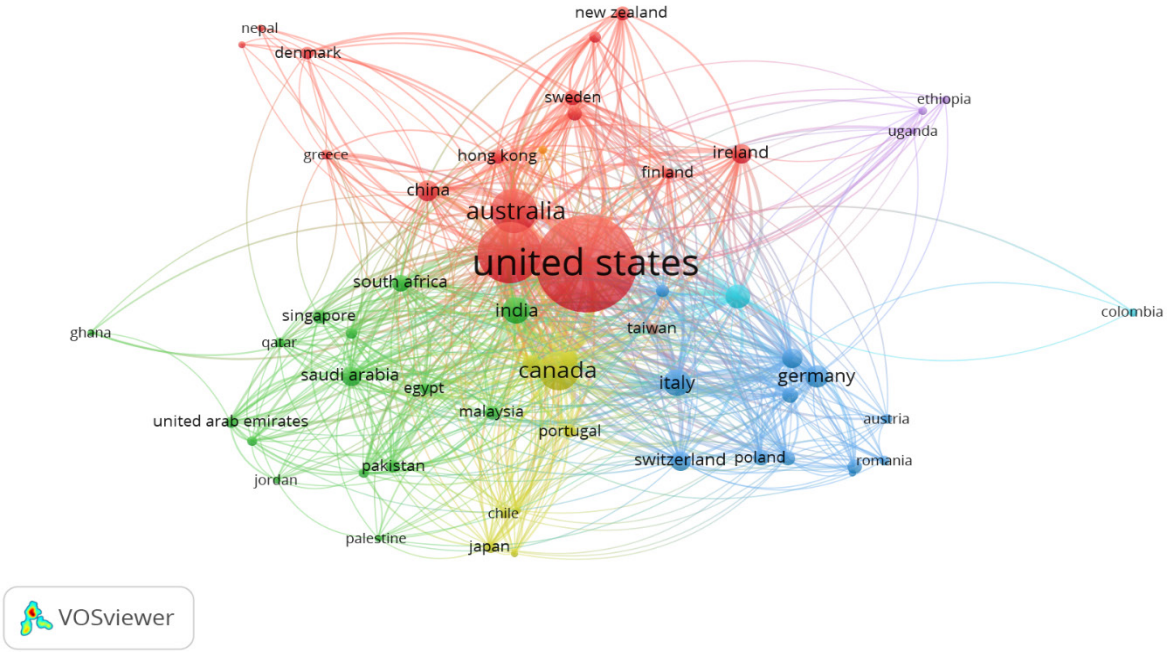

Figure 5. International collaboration networks

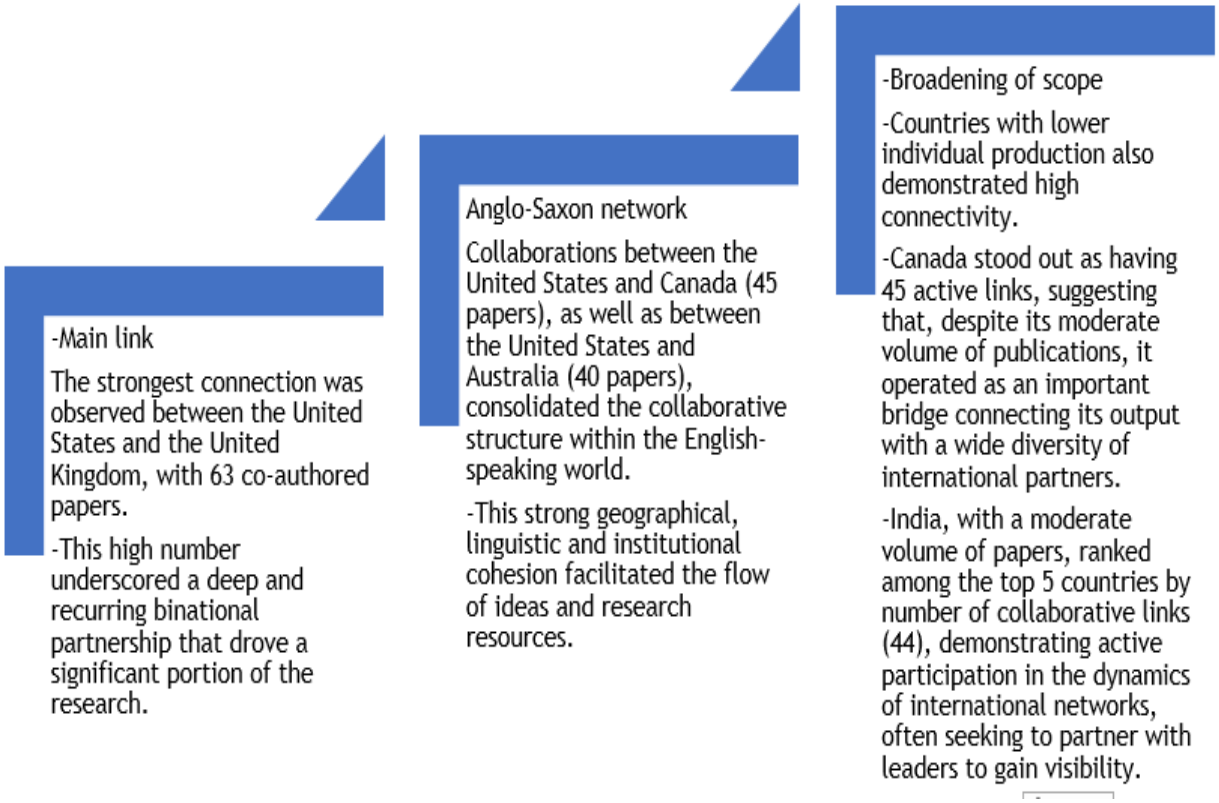

Figure 6. Analysis of co-authorship relationships among the top contributing countries

Keyword co-occurrence analysis

Distribution and composition of conceptual clusters

The co-occurrence analysis of keywords confirmed that the study of well-being is, in itself, a multidimensional phenomenon (figure 7). However, as shown in figure 7, it is inextricably linked to professional mental health, especially in academic training environments.

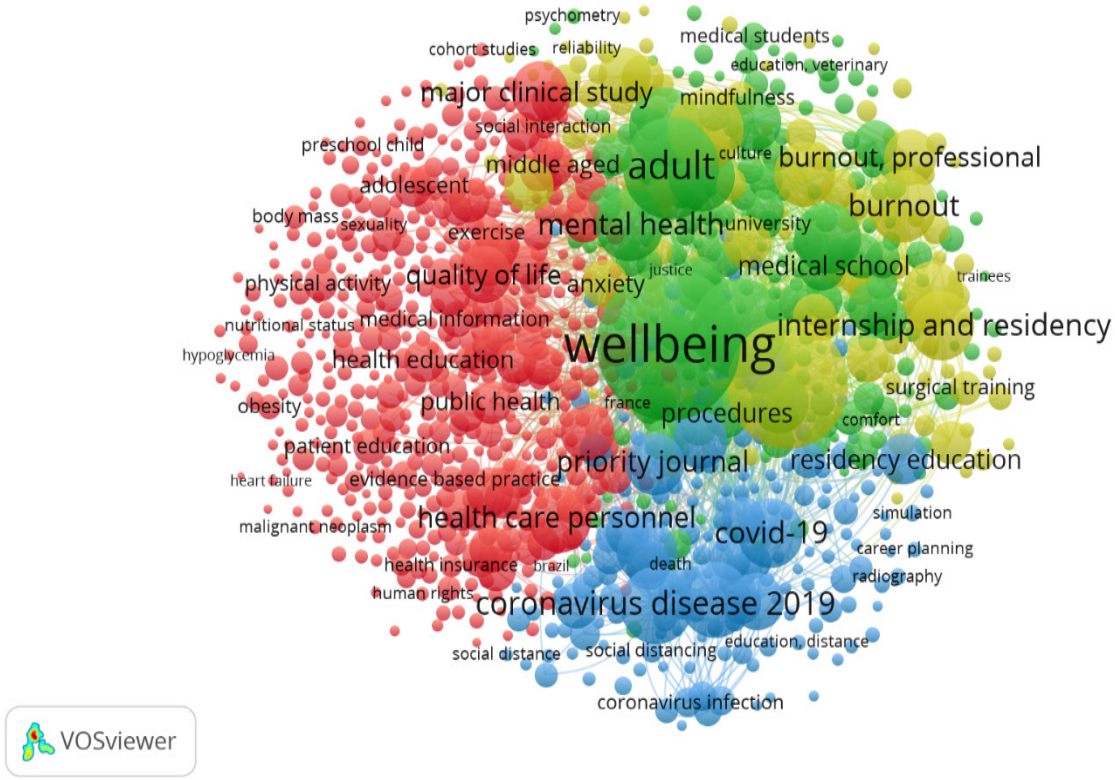

Figure 7. Keyword co-occurrence network

Central thematic cluster on the impact of the crisis on mental health

The predominant cluster focused on the response to the global health crisis. This crisis, according to Abbas[18], leads to poorer health outcomes, with women and children bearing the brunt of the damage. The observed centrality of this thematic cluster suggests that research on well-being in medical students focuses on the diagnosis and measurement of psychological consequences, especially in health crises.

In this regard, the cluster analysis mainly showed the conceptualization of well-being from a conception of pathology and stressors. In fact, it can be seen that the most interconnected keywords are anxiety and depression, understood by Dabbagh et al.[19] for psychopathological purposes as manifestations of mental stress in medical training.

Data reported by Melaku et al.[20] indicate that the prevalence of depression, anxiety, and stress among medical students is alarmingly high, highlighting the need for stress reduction interventions and the establishment of a student counseling center. The literature indicates that chronic stress can cause anxiety and depression, affecting a person's psychological well-being and potentially leading to serious health problems such as insomnia, weakened immune system, high blood pressure, anxiety, and muscle pain.[21,22,23]

Evaluation cluster and work stress on the burden of professionalism

The second most intense cluster focuses on the occupational and professional synergy of economic distress. Erschens et al.[24] reported that in 2019, the prevalence rates of professional burnout among medical students ranged from 7,0 % to 75,2 %, with factors such as country, instrument, and cut-off criteria influencing the severity of symptoms. By 2024, Di Vincenzo et al.[25] estimate that the prevalence of burnout syndrome among medical students will range from 5,6 % to 88 %, with negative life events and low motivation being key predictors.

To a large extent, chronic professional exhaustion (i.e., burnout) is relatively common among physicians and medical students, negatively affecting mental health, professional effectiveness, and patient outcomes.[26,27,28] According to Shrestha et al.[29] , exhaustion is present in 65,9 % of medical students, highlighting the need for effective strategies to improve the mental well-being of future physicians.

Burnout in medical students is a serious problem caused by high academic workloads, the demand to be perfect doctors, and stressful working conditions. This leads to a deterioration in physical and mental health, a decline in academic performance, and fewer job opportunities.[30]

Cluster of educational strategies and curriculum development

Related to the previous cluster, the third cluster focused on the problem from the perspective of intervention

and educational design to promote well-being in medical education. In this regard, Smeraglio et al.[31] suggest that integrating well-being into a health systems science curriculum improves students' knowledge, attitudes, and well-being while reducing burnout.

In relation to this, this cluster aims to analyze how modifications to study programs, learning environments, and tutoring constitute protective factors for the enhancement of well-being. In line with this, Ahart et al.[32] advise that successful well-being curricula in postgraduate medical education include physical and mental health interventions, professionalization components, and support from program leadership. In addition, a guiding model for well-being programs in undergraduate medical education emphasizes the importance of the learning environment, learning efficiency, and personal resilience, with strategies that include formalization, dedicated leadership, resource centers, and evaluation.[33]

Public health and demographic factors cluster

Finally, a fourth cluster is observed, articulated in the relationship between public health and epidemiological metrics. In fact, it is documented that academic stress, lack of social support networks, and socioeconomic background significantly impact mental health among medical students.[34]

Furthermore, medical students with disabilities experience higher levels of severe distress, burnout, and depression compared to their peers without disabilities, highlighting the need for personalized support strategies and structural interventions, according to Seaborne et al.[35]. Furthermore, Suárez et al.[36] argue that non-heterosexual medical students experience poorer mental health outcomes and are more vulnerable to psychiatric symptoms, with family dysfunction and less social support contributing to these risks.

Emerging themes and conceptual evolution

The results of the analysis of the strengths between the links that make up the keyword co-occurrence network represent, for research purposes, turning points in the study, as shown in figure 8 and 9. As figure 9 indicates, research on psychological well-being in medical education evolved significantly during the period analyzed.

Figure 8. Network of strengths between links

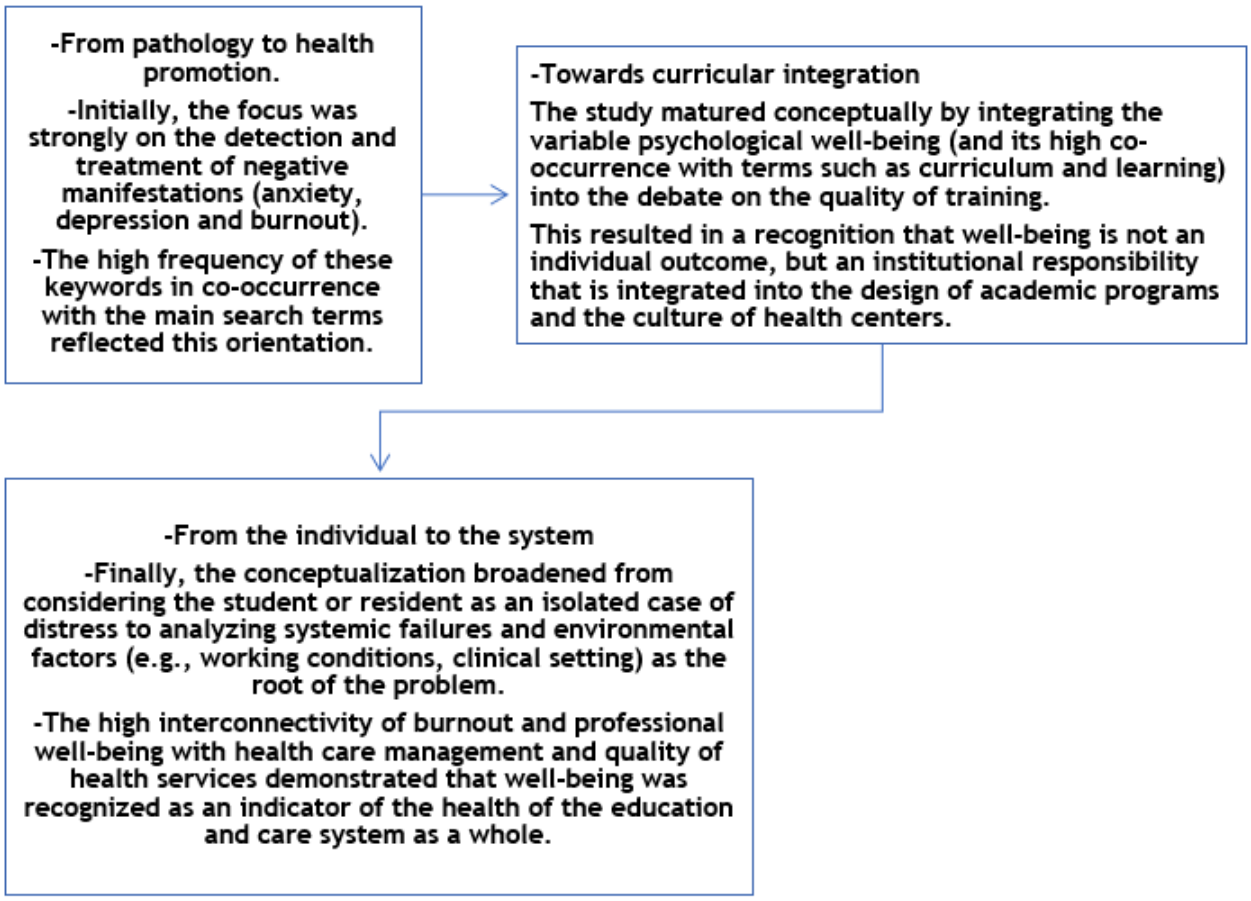

Figure 9. Conceptual evolution of themes

DISCUSSION

This research corroborated that scientific production on psychological well-being in medical education is articulated as a consolidated body of studies with notable growth. This is reflected in the temporal evolution of publications and, especially, the inflection that occurred during COVID-19 stands out. This pandemic significantly increased anxiety and stress levels in medical students, with poor sleep quality, increased depression, anxiety, and baseline stress, and COVID-19-related stressors being significant predictors.[37,38,39,40]

However, this evident increase in thematic productivity occurs within a palpable asymmetry. Evidence of this is that the highest concentration of authors and collaborative networks is centered in English-speaking countries (mainly the United States and the United Kingdom). In the Hispanic American context, scientific production was peripheral and significantly lower. This is corroborated by Ali et al.[41], who found in an analysis of approximately 10,000 documents on well-being between 1982 and 2020 that the United Kingdom is the country with the greatest global influence in research, followed by the United States, Canada, and Australia.

In Latin America, Valladares-Garrido et al.[42] reported that 62,2 % of medical students have poor sleep quality, with factors such as female gender, moderate risk of smoking, and depressive and anxiety symptoms associated with this poor quality. Therefore, this points to a need for personalized interventions to address the exhaustion and mental health challenges faced by medical students in the region.[43] This result was evidenced in this research, as a thematic cluster of analysis was identified that focused on highlighting the importance of intervention and the construction of protective learning environments.

Additionally, the conceptual analysis carried out in this study confirms that scientific production focuses on the diagnosis of pathologies that affect well-being (depression, anxiety, burnout). This conceptually links well-being to a conception based on psychopathology. In fact, Jahrami et al.[44] indicate that one-third of medical students experience a variety of problematic psychological and behavioral symptoms, with sleep problems being the most prevalent, followed by stress, exhaustion, anxiety, depression, internet addiction, substance use, eating disorders, and suicidal thoughts/gestures/acts.

A future analysis of the conceptual field suggests that it is undergoing a methodological redefinition. In the authors' opinion, this is driven by the lessons learned from the pandemic and the acceleration of technologies such as artificial intelligence (AI).[45,46,47] The latter indicator, particularly focused on promoting well-being, shows controversial evidence.

For Xie et al.[48] , AI-driven conversational agents can alleviate psychological distress, but promoting wellness literacy in young adults is crucial for addressing real-world challenges and promoting overall well-being. However, Li et al.[49] argue that these conversational agents significantly reduce symptoms of depression and distress but do not show a significant improvement in overall psychological well-being. Furthermore, Güven et al.[50] and Bracho-Fuenmayor [51,52] demonstrate that medical students have moderate AI readiness but high anxiety, with an inverse relationship between these variables. Therefore, future research in this scenario must go beyond the description of the problem observed so far. It should, in the best case, predict and mitigate them through data-driven strategies.

CONCLUSIONS

This study points to an expanding, albeit geopolitically asymmetrical, field where scientific production is concentrated in English-speaking countries that function as central nodes of collaboration, marginalizing Spanish-American contributions. Historically dominated by a psychopathological approach focused on stress and burnout, the field is undergoing a transition toward proactive and preventive models. At the current crossroads, accelerated by the pandemic and the emergence of Artificial Intelligence, the crucial challenge (especially for Spanish America) lies in articulating a strategy that combines the acquisition of digital skills with the ethical integration of these technologies, thus enabling the evolution from descriptive research to a predictive and interventionist paradigm that guarantees both regional scientific equity and the well-being of future generations of professionals.

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