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Socioeducational Observation in Electromagnetic Wave Devices and Health Risks: Bibliometrics for Synergy

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ABSTRACT: The technological transition we are currently experiencing with electronic devices and appliances such as televisions, cell phones, and other wireless connections such as headphones. They are part of our daily lives and all emit radiofrequency (RF) waves that are dispersed into the environment. Male infertility and genetic diseases are causes for concern according to studies and pose health risks. Objective: to analyze the literature related to "Electromagnetic wave devices and health risks" based on a bibliometric review. Method: A bibliometric analysis was conducted in Web of Science Journal Citation Report, using the search syntax "Electromagnetic wave devices and health risks" in all fields of the search engine. The search date was August 26, 2025. Results: 35 publications were found, mainly articles (28), literature review articles (5), and conference proceedings (2). These were categorized in Web of Science mainly in Multidisciplinary Materials Science (12), Electrical and Electronic Engineering (8), Physical Chemistry (7), Applied Physics (6), and Nanoscience Nanotechnology (2). The main publishers are Elsevier (12), IEEE (6), Springer Nature (6), Mdpi (4), Royal Soc Chemistry (2), among others. Nanoscience Nanotechnology (2). The main publishers are: Elsevier (12), IEEE (6), Springer Nature (6), Mdpi (4), Royal Soc Chemistry (2), among others. Production by year: 2025 (9), 2024 (8). and 2023, (6). 2022, (5). and 2021, (7). The countries with the highest production are China, (14). India, (5). USA, (5). Italy, (4). England (3), among others.

KEYWORDS: Socioeducational, Synergy, Public health, Determinants of health, Carbon, Nanocomposites, Fiber, Radiofrequency radiation, Genotoxicity, DNA damage, Oxidative stress, electromagnetic.

INTRODUCTION

The study is part of the project for socio-educational observatory and epistemological processes, it was carried out with the intention of expanding and analyzing institutional models, opening up a line of innovative knowledge generation and application, and showcasing new learning environments for students focused on descriptive research with this example of bibliometrics, without losing sight of quality indicators, programs, and actions, particularly those associated with teacher development, the quality of teaching and comprehensive training.

Electromagnetic waves and radiation are already very important in our daily lives. They are mainly used in telecommunications networks through radio and television with a variety of wireless devices. Due to this widespread use of electromagnetic waves in the GHz range for mobile telephony, national networks, radar systems, and other base station antennas, they represent a dangerous threat to human health. With these different electromagnetic waves in space, other devices do not function optimally, and the power of other electrical and electronic components and circuits is reduced. This drives the design of absorbent filters that protect electrical and electronic equipment on the one hand and safeguard human health on the other. (Ahmadi, 2022), (Zou, 2024), (Wang, 2022), (Heshmat, 2024), (Albert, 2024), (Lian, et al, 2021).

Excessive exposure to non-ionizing radiation can cause genetic diseases with different effects on the male reproductive system, with a primitive factor in cancer risk. Numerous studies report RFR-induced genotoxicity, although there is contradiction regarding effects in humans and animals. This review focuses on the genomic impact of radiofrequency electromagnetic fields (RF-EMF)

underlying the problem of male infertility, studies showing DNA damage to the sperm head and problems of cross-linking between DNA and proteins. (Kaur, et al, 2023), (Zhu, 2024), (Xue, 2024), (Ramirez-Vazquez, 2022), (Li, 2024), (Arendash, Cao, 2023), (Arianrhod, 2024).

Children born in the midst of this technological transition have no idea that we are navigating an ocean of wireless radiation, transforming emergency response capabilities and extending communications across the globe, where technologies are ubiquitous, completely changing the course of commerce, medicine, transportation, and our daily lives. where the biological and environmental impact is striking and where there are no standards for evaluating the countless wireless devices or technologies that were established in 1996 to prevent tissue heating and remain unchanged to date in the US and many other countries. Much evidence indicates that wireless radiation has many non-thermal effects on reproduction and the development of chronic diseases, (Davis, et al, 2023), (Zhao, 2025), (Ye, 2022), (Wang, 2023), (Arendash, 2023), (Matin, et al, 2025).

Electronic devices such as cell phones work like two-way microwave radios, sending and receiving various microwave frequencies that carry information, like many antennas operating simultaneously. Some of the experts on the subject who advise governments cannot agree on the best decisions to make. A US pediatric academy recommends restricting screen time for children under two years of age, as those who use them most frequently experience delays in speech development and bonding. Some older children experience disappointment due to "technoference." It is recommended that exposure to microwave radiation be as low as possible (Davis, et al, 2023), (Wali, 2022), (Nair, 2023), (Liu, 2021), (Chen, 2024), (Birks, 2021), (Baldini, 2025), (Arianrhod, 2024), (Matin, et al, 2025).

BACKGROUND

With the expansion of 5G wireless communication services, it became necessary to establish next-generation 5G Base Node stations everywhere and for user equipment (UE) to be widely accepted. However, the vast majority of people are fearful of the potential risks to human health from emissions. (gNB) base stations everywhere and the widespread acceptance of 5G user equipment (UE), the vast majority are fearful of the potential risks to human health from electromagnetic radiofrequency (RF) emissions from 5G devices. Different communities are working to slow down its implementation. This analysis focused on the effects of 5G exposure from a communications engineering perspective and reviewed the latest health support findings, assessing the new guidelines from the Institute of Electrical and Electronics Engineers (IEEE). It suggests evaluating the long-term impact of 5G exposure as innovative solutions to further minimize radiofrequency emissions. (Chiaraviglio, et al, 2021), (Mishra, 2021), (Lin, 2025), (Choi, 2024), (Li, et al, 2024).

With rapid technological advances, wireless communications, and the continuous use of high-frequency electromagnetic devices, radiation and interference have become increasingly dangerous, posing various risks to human health. The electronic workings of these devices condense hierarchically ordered porous carbon structures in 3D with magnetic Co (Co-OPC) using a template-assisted method and a process (pyrolysis), thermal degradation due to lack of oxygen by regulating pyrolysis temperatures, the average size of Co-OPC nanoparticles ranged from 12.4 to 44.7 nm. The unbeatable Co-OPCs exhibited greater electron transfer capacity (Xu, et al, 2025), (Demircilioglu, Erol, 2025), (Choudhary, 2025), (Lian, et al, 2021).

Electromagnetic pollution waves have become a global challenge that disrupts the normal functioning of electronic devices and appliances, posing a major problem and risks to human health. MAX materials are considered to be effective for electromagnetic (EM) absorption due to their layered structure and inherent properties. In this analysis, we summarize three Sn-based ternary MAX phases: Ti_3SnC_2, Zr_3SnC_2, and Hf_3SnC_2. Ti_3SnC_2 and Zr_3SnC_2 show minimum reflection losses (RLmin) of -35.5 dB at 1.5 mm and -40.2 dB at 1.6 mm, along with effective absorption bandwidths (EAB) of 2.56 GHz and 3.6 GHz, respectively. (Chen, et al, 2025), (Mahltig, 2023), (Chahal, 2025), (Ye, 2022), (Matin, et al, 2025), (Wang, et al, 2023).

The rapid spread of 5G technology and the proliferation of wireless devices that emit electromagnetic waves are causing radioactive pollution in urban built environments, posing risks to human health. This calls for the creation of effective systems for absorbing this wave of electromagnetic wave (EMW) materials that can reduce and address the challenges of absorbing carbon nanotubes (CNT) and magnetic materials such as iron (Fe), which is widely used for its unique characteristics and electromagnetic properties. (Liu, et al, 2025), (Canicatti, 2021), (Zhu, 2024), (Liu, 2025), (Zhao, et al, 2025).

DIMENSION OF THE CURRENT STATE OF THE TOPIC. Methodology.

To determine the current status of health risks and scientific production on electromagnetic wave devices and health risks in the context of higher education, a descriptive bibliometric literature analysis was conducted using the Web of Science (WOS) digital platform, analyzing the most recent scientific production (from the last 5 years) and health risks. Web of Science is an integrated web-based system that offers a high-quality content platform and tools for accessing, analyzing, and managing research information. It consists of the Core Collection, which includes titles from publications in the International Journal of Environmental Research and Public Health, Research on Technology and Engineering, Electromagnetism, Communications, and 5G. Along with tools for analysis and evaluation, such as the Journal Citation Report and Essential Science Indicators, Science Citation Index Expanded (SCI-EXPANDED),

Bibliometrics:

The bibliometric analysis was conducted on the digital multi-theme platform or system (wdg.biblio.udg.mx) of information resources within top-level electronic journals (Journal Citation Report from Web of Science Core Collection). "Clarivate" with the theme (Electromagnetic wave devices and health risks). To examine the information, data collection was carried out on February 1 of this year, and results after this date were not considered in this analysis. The search key was based on the English words "Electromagnetic wave devices and health risks." The search was exclusively in the title, and the report includes only publications made during the period from April 2021 to August 2025.

Bibliometric indicators of scientific activity were classified according to the tools available in WOS, such as: document types, WOS category, publishers, as well as scientific output per year, output per country or region, and languages of publications.

RESULTS

The analysis found (35) publications by document type, (28) of which were original articles and (5) review articles, (2) Procedural document. **(See Table 1).**

Table 1. Types of documents		
Document Type	***Number of publications: 35***	***100%***
Artícles	28	80
Review Article	5	14.28
Procedural document	2	5.71

***Source:** wdg.biblio.udg.mx, WOS.

It is also noted that these publications fall into the following WOS analysis categories: Multidisciplinary Materials Science (12), Electrical and Electronic Engineering (8), Physical Chemistry (7), Applied Physics (6), Nanoscience Nanotechnology (2). **(See Table 2).**

Table 2. Web of Science category		
Category	***Number of publications: 35***	***100%***
Multidisciplinary materials science	12	34.28
Electrical and electronic engineering	8	22.85
Physical chemistry	*7*	20
Applied physics	6	17.14
Nanoscience Nanotechnology	2	5.71

***Source:** wdg.biblio.udg.mx, WOS.

On the other hand, among the main content publishers were Elsevier (12), IEEE (6), Springer Nature (6), Mdpi (4), and Royal Soc Chemistry (2), among others (5). **(See Table 3).**

Table 3. Publishers		
Publishers	***Number of publications: 35***	**100%**
Elsevier	12	34.28
IEEE	6	17.14
Springer Nature	6	17.14
Mdpi	4	11.42
Royal Soc Chemistry	2	5.71
Entre otros	5	14.28

***Source:** wdg.biblio.udg.mx, WOS.

The year 2025 reflects the highest scientific output of the search with (9) results, followed by 2024 (8) results, 2023 (6) results, 2022 (5) results, and 2021 (7) results, Regarding the countries with the highest scientific output on this topic, China is the leading country with (14), followed by India (5), the USA (5), Italy (4), and England (3). Among others, (4). Likewise, the predominant language is English with (34), and China (1). **(See Table 4).**

Table 4. Year, countries of origin, and languages of publications

	Number of publications: 35	**100%**
Year of publications		
2025	9	25.71
2024	8	22.85
2023	6	17.14
2022	5	14.28
2021	7	20
Countries of origin of publications	**Number of publications**	**%**
China	14	40
India	5	14.28
USA	5	14.28
Italy	4	11.42
England	3	8.57
Entre otros	4	11.42
Language of publications	**Number of publications**	**%**
Inglés	34	97.14%
China	1	2.85

***Source:** wdg.biblio.udg.mx, WOS.

CONCLUSIONS

In view of the results of this analysis, which describes scientific production related to (electromagnetic wave devices and health risks) as well as the use of digital libraries for searching and consultation, low performance is observed with respect to the number of publications on this topic, particularly on the WOS platform, suggesting the need for in-depth studies on health risks from the use and exposure to electromagnetic wave devices, with the aim of increasing knowledge in this area.

RECOMMENDATION AND FUTURE WORK

Increase knowledge and publications in the area, particularly in an international context where a low level of scientific production was found, with only 35 publications, and Mexico does not appear among the countries with related research between 2021 and 2025.

The study presented here marks the beginning of a line of innovative knowledge generation and application focused on the study of health risks with the intention of increasing knowledge in the area, a situation that will allow for the development of institutional policies and programs that respond to the needs of the higher education academic community with regard to health promotion and care.

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