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Exploring the Relationship between Healthy City and Public Space Ergonomics: A Bibliometric Analysis

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Abstract
This study uses the Scopus database and VOSviewer software to do a bibliometric analysis, specifically examining the correlation between healthy cities and public space ergonomics. The study tries to understand the relationship between these fields by analyzing 2074 English-language papers from Scopus, which include the period from 2004 to 2024. Healthy city involves ensuring environmental sustainability, promoting public health, and achieving social equity. In addition, public space ergonomics examines the design of urban spaces in order to improve the experience and accessibility for users. The analysis uncovers dynamic patterns, fundamental ideas, and cooperative connections. The findings highlight the reciprocal impact of urban planning that promotes health and the ergonomic design of public spaces, emphasizing the importance of integrated strategies for creating healthier urban environments. This work contributes discussion by providing comprehensive summary, as well as leading future research in these interrelated fields.
Keywords: Ergonomics; Public Space Ergonomics; Healthy City; VOSviewer; Bibliometric Analysis.

1. Introduction

Study in the field of healthy cities continues to grow with progress. As the world becomes more globalized, there is a growing trend of people moving from rural areas to urban areas. This leads to an increase in the urban population and requires individuals to live in more densely populated cities. According to the World Health Organization (WHO), effectively health is primarily determined by the level of quality in daily life, rather than simply the absence of illness. In the opinion of the World Health Organization (WHO), health includes various factors such as accessibility, safety, availability of basic food, air quality, soil and water quality, management of solid waste, climate changes, social welfare, quality of lodging, employment, and healthy living conditions (Tsouros, 1995). The World Health Organization (WHO) began doing research on healthy cities in 1986, and this field of study continues to include a limited number of disciplines to this day. The World Health Organization defines a healthy city as a process rather than a static result. The city lacks a particular health status, but it is conscious of health and makes efforts to enhance it. Thus, irrespective of the present state of health, each city has the potential to become a healthy city olabilmektedir (Ison, 2009; Leeuw et al., 2014). A healthy city continually enhances its physical and social environment, and increases community resources that empower individuals to assist one another in fulfilling all aspects of life and reaching their full potential. Therefore, it has a direct correlation with multiple fields like environmental science, sociology, geography, urban planning, policy, and economics (De Leeuw, 2013; Hall et al., 2010).

The availability of public spaces is directly related to the ability to integrate natural and built environments. The World Health Organization has developed the Global Action Plan on Physical Activity (GAPPA) with the slogan "more active people for a healthier world" (Leeuw et al., 2014). Within this plan, the goal for the period 2018-2030 is to create urban environments that support and protect the rights of people of all ages, and to produce areas with equal access to safe places and spaces for regular physical activity (Appolloni et al., 2020). The organization of public spaces within cities to increase physical activity can indirectly have positive effects on human health. Increased physical activity can provide significant benefits in diseases such as type-2 diabetes, cerebrovascular diseases, breast cancer, depression, heart conditions, and dementia (Jarrett et al., 2012). The arrangement of public spaces within urban areas to serve the states of being healthy for individuals can be effective in reducing the negative impacts of these diseases (Alves & Arezes, 2012).

The optimal organization of urban spaces is directly related to the science of ergonomics, which focuses on human-environment interaction. Ergonomics can be specifically defined as "a scientific discipline concerned with the understanding of interactions between humans and other elements of a system. It applies theory, principles, data, and methods to optimize human well-being and overall system performance" (Attaianese & Duca, 2010; Karsh et al., 2014; Panjaitan, 2018; Wisner, 1985). Ergonomics is considered a multidisciplinary science because it focuses on the human-environment interface and seeks concrete and rational answers to such a complex relationship. The outputs of ergonomics science are applicable to public space systems. In fact, public spaces are concrete foundational elements that shape the system of a city by connecting people, places, and functions (Dul et al., 2012). Various organizations are established with the aim of improving and organizing existing public spaces, as well as making newly constructed areas appealing for daily use from both urban and user perspectives. Thanks to local-scale projects initiated by organizations like Project for Public Spaces (PPS) and Essex Design Guide (EDG), successful

enhancements to public spaces are observable today. Project for Public Spaces, founded in 1975 by Fred Kent and Kathy Madden, is rooted in William H. Whyte's pioneering research on public spaces and was initially conceived as a three-year project to demonstrate the significance of public spaces (*Project for Public Spaces*, 2024). By the time the project reached its completion in 1978, Madden and Kent came to the realization that there was still plenty to discover and enhance regarding public spaces (*Project for Public Spaces*, 2024). Steve Davies also joined them to support their efforts. Operating for approximately forty years across over fifty countries, this organization has aided in improving public spaces for more than 3,500 communities in the United States alone. Rooted in research conducted by William H. Whyte, the organization has become a primary resource for placemaking and consulting on the design and management of public spaces since its inception (*Project for Public Spaces*, 2024).

Public spaces such as parks, squares, and streets are areas where urban users can gather, socialize outside of their private spaces, and feel part of the community. The social and physical activities in these areas have positive effects on people's mental and physical health (Kostrzewska, 2017). While achieving universal appeal for public spaces may not always be feasible, it is essential for these areas to incorporate architectural elements that are universally recognized. This ensures that they can serve the greatest number of users in terms of social and physical activities (Kostrzewska, 2017).

The user-oriented nature of public spaces and their incorporation of features to meet users' physical and social needs can be associated with their ergonomics. With the constantly evolving technology today, the interaction between the city and its users is increasing day by day. Adapting the materials, scale, form, and function of urban components to serve the well-being of people is what urban ergonomics signifies (Alves & Arezes, 2012). Through the organized exchange of information among planners, designers, and users, facilitated by the science of ergonomics, valuable products are created. Urban ergonomics, driven by these collaborative efforts, ensures that users can comfortably and safely utilize urban amenities in social, physical, and psychological dimensions (Turkyilmaz & Villani, 2021).

The arrangement of public spaces in healthy urban designs to enhance the well-being of city users is closely related to urban ergonomics (Alves & Arezes, 2012). Over time, a healthy relationship is established between users and public spaces that are designed ergonomically. It can be said that people prefer these spaces that are beneficial to their minds and bodies more. This directly and indirectly enables users and the city to improve.

It is argued that science encodes ways to operate in urban planning and public health, and scientific applications are the most critical tools that pave the way towards healthier and fairer cities (Corburn, 2009). However, the city, which can be seen as a laboratory, has long supported its steps towards health with germ theories, bacteriology, and biomedical models (Corburn, 2009). Viewing the city as a laboratory is reshaping urban policies to reflect legitimacy in laboratory settings. Findings and interventions are perceived as universally applicable everywhere and to all population groups because they reflect the inappropriate (contextless) and standardized. As a result of the laboratory practice of science, the controlled environment of the ideal laboratory ultimately adapts to everywhere and every condition. Consequently, the concept and practice of healthy city interventions are implemented at the level of universal, non-specific interventions such as the chemical treatment of drinking water and childhood vaccinations applied by central bureaucracies. This situation leads to the disregard of the city's uniqueness and context-specific policies.

In his work "Toward The Healthy City," Jason Corburn offers a critical examination of how the scientific perspectives of the city not only separate planning from public health but also shape the analytical and political processes that govern urban management today (Corburn, 2009). As demonstrated in this book, health reflects the biomedical model of urban health interventions. The laboratory appearance of the city also emphasizes urban health policies aimed at improving everyone's health with non-specific interventions such as chlorination of drinking water. "Toward The Healthy City" highlights the recognition of the complex qualities and interactions of places as significant determinants of health. Combining the field appearance with the laboratory appearance is necessary for cities to achieve a healthy urban environment (Corburn, 2009).

The aim of the Healthy Cities movement initiated by the World Health Organization, which is to design "urban places that enhance health and well-being," reflects the state of public spaces in urban organizations, mirroring the city's healthy condition. Organizing public spaces with this purpose in mind can positively impact both the city and its users. Public spaces are planned or unplanned open and enclosed areas provided for urban users. These areas, which facilitate the gathering of city users, consist of spaces such as parks, gardens, squares, streets, alleys, and marketplaces. They enable social and physical interaction among individuals from different religions, statuses, and cultures. It is possible to say that these spaces form a collective consciousness and foster awareness of communal living.

The Healthy Cities Project, prepared by the World Health Organization, has been in operation for 35 years. It plays a significant role in the creation of health policies, monitoring health objectives, and their planned implementation by member countries. The project's implementation requires collaborative efforts among civil society organizations, local governments, official and unofficial institutions, media, urban residents, universities, and health professionals.

The German philosopher and sociologist Max Weber describes public spaces as areas where people of different races, social, and ethnic backgrounds come together on the same level. Weber suggests that these spaces are arenas for reconciliation and agreement, where contrasts and differences converge (Weber, 2000).

Alexander (1977) describes public spaces as living organisms and argues that they must adapt to changing social, political, and economic conditions (Alexander et al., 1977). This suggests that Alexander sees public spaces as physical areas that can provide a suitable ground for society to adapt to all changes. Ashihara (1981), who defines all areas outside built-up areas in urban settlements as public spaces, uses the concept of "roofless architecture" to express these areas (Ashihara, 1981). Carr and his colleagues (1992) evaluate public spaces as areas established in contrast to private spaces, arguing that the meanings of these areas emerge as a result. They reduce the essential characteristics that these areas must have to three fundamental qualities: being democratic, meaningful, and user-centered (Carr et al., 1992). Barnett (2001) expresses that people seek activities where they can be together with others and therefore expect inviting attitudes from public spaces where they can socialize with strangers. He emphasizes that the traditional notion of public spaces goes beyond areas allocated for leisure activities (Barnett, 2001). Madanipour (2015) argues that public spaces, as the primary component of the built environment, are places of encounter and where public life emerges (Madanipour, 2015). Collins and Stadler (2020) describe public spaces as open areas at the heart of social and political life in cities. They define parks, squares, and streets as places for socialization and encountering differences, arguing that these spaces contribute to the city's reputation and make it a livable place. Collins and Stadler assert that these areas are open to everyone, from people living on the streets to those in the upper-income bracket, emphasizing that the numerous rules governing the use and access of these spaces should be regulated to encompass everyone's access (Collins & Stadler, 2020).

The user-centered nature of public spaces and their incorporation of features to meet users' physical and social needs can be associated with their ergonomics. With the continuous advancement of technology today, the interaction between the city and its users is increasing day by day. Adapting the materials, scale, form, and function of urban components to serve the well-being of people is what urban ergonomics signifies (Alves & Arezes, 2012). Exchange of information among planners, designers, and users is organized through the science of ergonomics to produce valuable products. Urban ergonomics, facilitated by these collaborations, ensures that users can utilize urban amenities in social, physical, and psychological comfort and safety. The close association between urban ergonomics and the arrangement of public spaces in healthy city planning elevating the well-being of urban users is evident. At present, a healthy relationship is observed over time between users and public spaces designed ergonomically. It can be said that people tend to prefer these spaces that benefit their minds and bodies. This directly and indirectly contributes to the well-being of users and the city. Understanding the current state and future trends of studies related to healthy urbanism and the ergonomics of public spaces is essential to identify significant points in the literature and developments in this field. In this context, the advancements in ergonomic urban planning and the use of public spaces over the past two decades should be evaluated through bibliometric and comprehensive analysis.

This study utilizes VOSviewer to highlight the present condition and future prospects of research on healthy cities and the ergonomics of public places, giving significant perspectives for researchers. This statement highlights the significance of integrating ergonomic factors to urban design for the purpose of enhancing health. It emphasizes the conceptual framework and research area supporting this approach. The article is organized into four separate phases as seen in Figure 1. Phase 1 provides a detailed description of the study methodology, the process of gathering data, and the methodologies used for analysis. Phase 2 offers an in-depth examination of the findings gathered through VOSviewer mapping and performance analysis, using data gathered from the Scopus database. Phase 3 analyzes patterns related to nations, authors, and publishing years. Phase 4 serves to provide a concise overview of the article, highlighting important discoveries, and suggesting possible directions for further research.

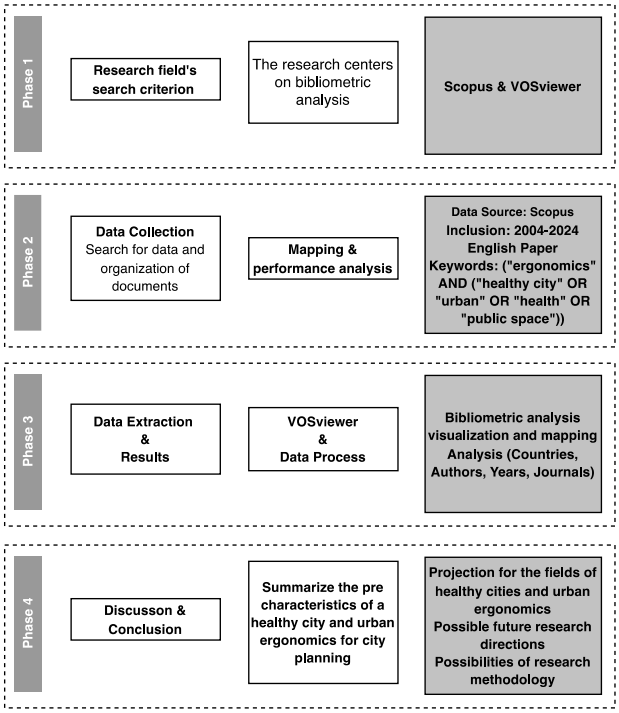

Figure 1. Structure of the Study (Developed by Author).

2. Material and Methods

Bibliometric analysis is a comprehensive analytical method that provides an overall overview of various academic literature and enables us to comprehend the features and development of scientific production in the research subject (X. Jia et al., 2014; Rodrigues et al., 2014; Van Nunen et al., 2017). This approach is implemented by doing a quantitative analysis of data related to the development of publications. It aims to provide a thorough comprehension of how scholarly output is distributed, the topics that are prevalent, and the patterns observed within a specific field of study (Zhou et al., 2015). It is also employed to analyze and evaluate patterns of collaboration among authors, journals, countries, and organizations (Li & Zhao, 2015). Understanding prominent researchers, papers, and journals help within understanding multidisciplinary relationships and developments in the research field (Gall et al., 2015). Bibliometric analysis plays an important role in strategic decision-making processes such as identifying gaps in the research field and identifying new research methods and topics (Gall et al., 2015; Ugolini et al., 2015). The findings of this method can contribute to informed decision-making processes in research funding and policy making (Van Nunen et al., 2017). With the advancement of information development and technology, many visualization tools have emerged, such as VOSviewer, BibExcel, Sci2, Gephi and CiteSpace (B. Jia et al., 2021). Compared to other tools, VOSviewer offers better analysis and comprehensive visualizations, including the measurement of central in the network (B. Jia et al., 2021). For bibliometric analysis, databases such as Google Scholar, Web of Science and Scopus were scanned within the scope of this study. However, no bibliometric, scientometric or scientific mapping studies were identified within the scope of the study keywords. Therefore, in order to draw attention to the existing literature and the importance of the topic of interest, the study used the Scopus Database to explain historical trends and expectations by addressing the concepts of “healthy city” and “public space ergonomics”. The Scopus database is considered the largest database of citations and abstracts covering a wide range of topics compared to the Web of Science database (Xie et al., 2020; Yang et al., 2023). This study used an appropriate search term that matched all the terms with the literary background of the study. However, certain limitations are out there. This study will be the initial bibliometric and scientometric analysis in the discipline, providing as a foundation for subsequent research. Furthermore, it will address the following questions in order to fill any gaps in knowledge: 1) What is the correlation and progression between the ideals of a healthy city and the ergonomics of public spaces? 2) Which countries, keywords, sources, and documents have the highest number of efficient authors? 3) What is the chronological progression of key concepts in history, and what is the future direction for scholars, politicians, and organizations in these fields? This article will not only represent information but also offer users internet access to real-time data, allowing them to obtain further knowledge, make predictions, and uncover new findings. Scopus is a comprehensive database that includes over 1.8 billion cited references, more than 87 million archive records, 17.6 million author profiles, 94.8 thousand institutional memberships, and over seven thousand publishing organizations. It covers the period from 1970 to the present (Van Nunen et al., 2017). In this study, VOSviewer was used to conduct a bibliometric analysis in the field of healthy urban planning. To understand future research trends in this field, this study also examines the characteristics of the paper (e.g., journal impact factor, author-related factors, single author, density of keywords, underlying field coverage, country of the first author) and key research areas in the field of healthy urban planning. will use it to predict hotspots and trends. In summary, this study combines two different methods to jointly analyze current and future research focuses of healthy urban planning.

The bibliometric analysis process consists of four basic stages: data collection, data pre-processing, statistical calculation and analysis application. For an effective analysis, it is essential to choose keywords that will determine the focus of the study. In this context, more than 2101 articles focusing on "healthy city" and "public space ergonomics", both current and widely cited, were scanned from the Scopus Database and combined around these keywords. The search query was refined and improved by experimenting with various combinations of selected keywords from February 16 to April 20, 2024. This was done by taking into account the articles that were available during that time period. The search query is as stated: TITLE-ABS-KEY ("ergonomics" AND ("healthy city" OR "urban" OR "city" OR "health" OR "public space")) AND PUBYEAR > 2003 AND PUBYEAR < 2025 AND (LIMIT -TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "ARTS") OR LIMIT-TO (SUBJAREA , "MULT") OR LIMIT-TO (SUBJAREA , "PSYC") OR LIMIT-TO (SUBJAREA , "ENVI")) AND (LIMIT-TO (LANGUAGE , "English")).

This analysis is based on data obtained on April 20, 2024 and covers articles indexed in Scopus Database between 2004 and 2024. The analysis was limited to articles appearing in the most prestigious academic journals. The data obtained is brought together using Ms Excel and Mendeley Reference Manager v2.112.2 program. All articles are scanned from the Scopus database. The data of 2074 articles obtained from the Scopus database were analyzed according to keywords, countries, authors, journals and years through the free-to-use VOSviewer_1.6.20 (Van Eck et al., 2010) program. The VOS (Visualization of Similarities) method is used to position subjects on a two-dimensional map so that the distance between two elements most accurately reflects the similarity or relationship of these elements with each other (Van Eck et al., 2010)**.** The VOS clustering method groups subjects into different clusters, and each cluster is separated by showing different colors (Rodrigues et al., 2014; Van Eck et al., 2010; Waltman et al., 2010; Xie et al., 2020)**.** The interpretation of the analyzes obtained through visualizations is discussed in detail in the results section. In summary, the sizes of the circles and the font sizes of the labels express the frequencies of occurrence, while the colors distinguish different clusters (Waltman et al., 2010)**.** The distance between circles reflects the relationship and similarity between elements. Since the X and Y axes do not have any specific meaning, transformation of the maps can be done freely (Van Nunen et al., 2017; Waltman et al., 2010)**.**

3. Results

As a result of the first search in the Scopus database, 3717 documents were obtained. The diversity of study types is divided into categories as Article (2182), Conference Paper (1150), Review (189), Book Chapter (77), Editorial (43), Conference Review (32), Book (16) and Note (11). Since there were 2182 article studies, only journal articles were examined within the scope of this study, and since the common language of the authors was English, results limited to English were evaluated. When Social Sciences, Environmental Science, Psychology, Arts and Humanities, Multidisciplinary was selected as the subject area, it decreased to 2074 documents. In the following days, with updates made until April 20, 2024, this number was recorded as 2101. This situation points to the structure of a trend analysis in which the data obtained may increase over time.

The research highlights the importance of healthy cities in supporting environmental sustainability, promoting public health and ensuring social equality, while addressing the design subtleties of public space ergonomics to improve urban spaces in terms of user experience and accessibility. Graphical analysis (Figure 2) shows that in the period from 2004 to 2024, the number of academic publications in relevant fields exhibited a fluctuating but generally increasing trend. The general trend is that it increases over time, with particularly pronounced peaks in 2012 and 2018. The studies reached their peak in 2021, and 241 studies in that year were recorded in the literature. A decline is observed in 2022, which may reflect a temporary lull in research or other external factors. This fluctuating pattern of publications shows how research interest in the field has changed over the years, perhaps shaped by particular events, discoveries, or policy changes. These observations may require further examination of the content and context of studies published in particular years. In particular, it underlines the mutual influence of health-promoting urban planning and ergonomic design of public spaces, emphasizing the importance of integrated strategies for creating healthier urban environments.

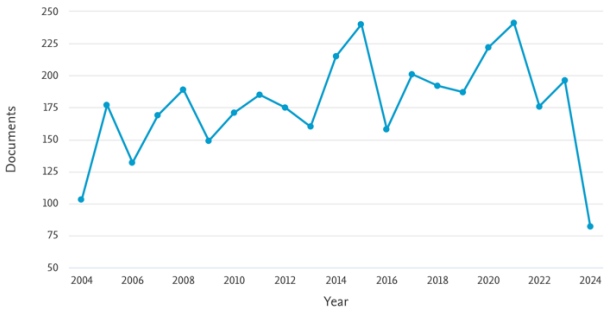

Figure 2. Number of healthy city and public space ergonomics publications by year.

The graph in Figure 3 displays the change in academic interest in these two fields over time and the publication peaks in certain periods. Increases in the number of publications in journals such as "Applied Ergonomics" and "International Journal of Environmental Research and Public Health" show that healthy city and public space design are prominent social and scientific issues in this process. The fluctuation patterns of these publications may reflect the research and policy focuses of the time, such as the impact of the COVID-19 pandemic. The research results provide a solid foundation for future research on these interdisciplinary topics, highlighting the importance of integrated strategies in these areas and the interrelationship of healthy cities and ergonomic public space design.

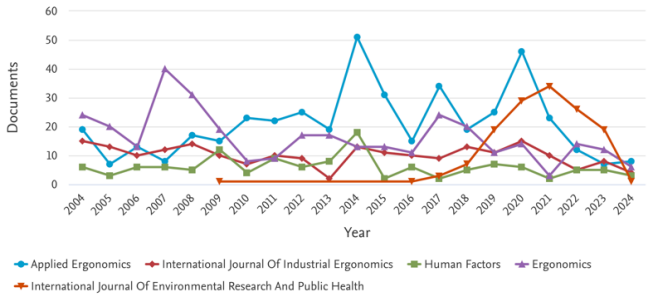

Figure 3. Number of documents per year by source “healhty city” and “public space ergonomics” research in Scopus.

In total, 3729 publications were published in 98 different journals. This high number demonstrates the wide range of research themes and the multidisciplinary character of healthy urban research. More than 10 publications were published in 21% of 98 journals. Of the 98 journals, 32% published only two publications in the field of healthy urban and public space ergonomics. Table 1 lists the number of publications made by journals in 20 years and the list of journals containing more than 10 documents. Journal Quartile* values in this field were obtained from the Scimago Journal & Country Rank (SJR) database in April 2024. Journals were ranked according to their SJR values and divided into four equal groups. Q1 (green) covers the quarter of journals with the highest values, Q2 (yellow) covers the second highest values, Q3 (orange) covers the third highest values, and Q4 (red) covers the lowest values. Although the highest number of articles in the field of study is Proceedings Of The Human Factors And Ergonomics Society, the most important journal is Applied Ergonomics journal, which has 487 publications on the subject.

Table 1. Journals with 10 or more documents.

Journal Title	Document number	Quartile*	Country
Proceedings Of The Human Factors And Ergonomics Society	582	Not Set	United States
Applied Ergonomics	487	Q1	United Kingdom
Ergonomics	375	Q2	United Kingdom
International Journal Of Industrial Ergonomics	230	Q2	Netherlands
International Journal Of Environmental Research And Public Health	169	Q2	Switzerland
Human Factors	150	Q1	United States
International Journal Of Occupational Safety And Ergonomics	108	Q2	United Kingdom
Safety Science	69	Q1	Netherlands
Human Factors And Ergonomics In Manufacturing	59	Q2	United States
Ergonomics In Design	44	Q2	United States
Plos One	35	Q1	United States
Industrial Health	28	Q2	Japan
Theoretical Issues In Ergonomics Science	21	Q3	United Kingdom
Safety And Health At Work	20	Q1	South Korea
Studies In Systems Decision And Control	20	Q4	Switzerland
Sustainability Switzerland	19	Not Found	Switzerland
Journal Of Cognitive Engineering And Decision Making	16	Q1	United States
New Solutions	15	Q2	United States
Iop Conference Series Earth And Environmental Science	14	Q2	United Kingdom
Iise Transactions On Occupational Ergonomics And Human Factors	13	Q3	United Kingdom
Annals Of Agricultural And Environmental Medicine	10	Q2	United Kingdom

In Table 1, the journal "Proceedings Of The Human Factors And Ergonomics Society" stands out as the journal that publishes the most articles with 582 documents. It is followed by "Applied Ergonomics" with 487 documents and "Ergonomics" with 375 documents. These journals appear to be quite active in their field. According to the academic quarter evaluation, journals such as "Applied Ergonomics", "Human Factors", "Plos One", "Safety Science", "Journal Of Cognitive Engineering And Decision Making" and "Safety And Health At Work" are in the Q1 category. This shows that these journals are among the most influential journals in their fields. Most journals are in the Q2 category, indicating that they are strong but not as influential as the top-ranked journals. "Theoretical Issues In Ergonomics Science" and "Iise Transactions On Occupational Ergonomics And Human Factors" are in the Q3 category, which shows that these journals appeal to a narrower readership. "Studies In Systems Decision And Control" is in the Q4 category, which shows that the impact of this journal in its field is limited. Looking at country distribution, most journals are

published in countries such as the United Kingdom and the United States. This shows that these countries have leading research centers in the field of ergonomics and human factors. Other countries such as Japan, South Korea, the Netherlands and Switzerland also attract attention. The quarterly evaluation of some journals is stated as "Not Set" or "Not Found" for, for example, "Proceedings Of The Human Factors And Ergonomics Society" and "Sustainability Switzerland". This indicates that the quartile classification of these journals has not yet been determined or is not available.

While the size of the circles in the graph in Figure 4 shows the number of publications, the thickness of the links represents the intensity of collaborations between countries, and the colors represent different collaboration networks. The main collaboration network in green tones, based in the UK, includes mostly Western and Southern European countries. Particularly noteworthy are the contributions of China, Australia and Canada to the US-based network with red tones. Another smaller cooperation network brings together the Scandinavian countries in shades of blue. In addition to geographical proximity, collaborations appear to be centered around countries with high publication volumes, which points to trends observed in other scientific research fields (Eck et al., 2009). The United States label is central to both its size and connectivity, demonstrating the dominance and high influence of the United States in the relevant academic field. If we need to analyze the structure of the network mathematically, we can use some metrics related to node sizes and edge thicknesses: According to the scoring based on the given values; United States: 100% points with a value of 1292, United Kingdom: 33.13% points with a value of 428, Canada: 19.97% points with a value of 258, Australia: 14.24% points with a value of 184, Brazil: 11.30% points with a value of 146, Italy: 126 It is valued as 9.75% points with a value of 120, Sweden: 9.29% points with a value of 120, Netherlands: 8.13% points with a value of 105, Germany: 7.97% points with a value of 103, France: 7.82% points with a value of 101. These scores reflect the relative weight of each country in the given metric (number of publications, number of citations) and are a measure of its effectiveness and impact in this field. While the United States is the clear leader in this metric, the United Kingdom and Canada are also among other significant contributors.

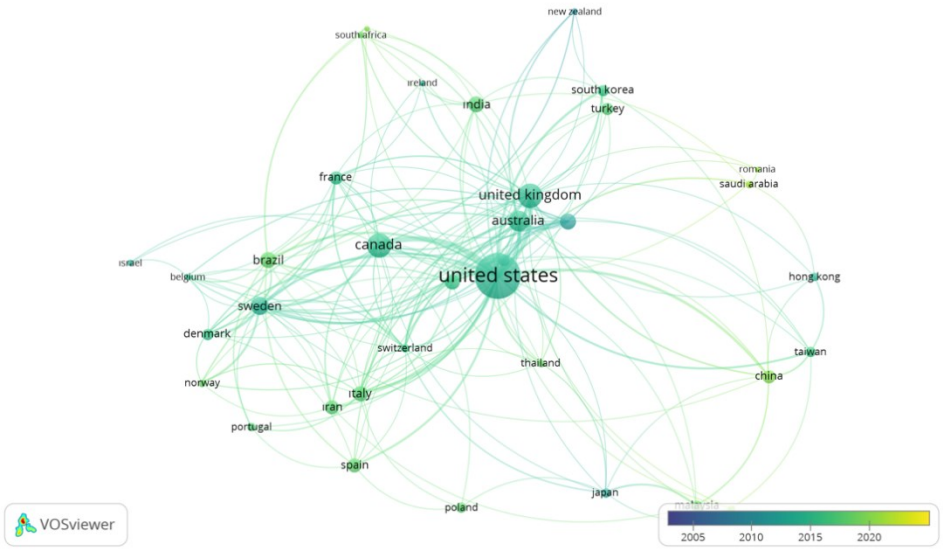

Figure 4. Cooperation network of countries in healty city and public space ergonomics.

Among a total of 6,749 authors publishing in the field of ergonomics and human factors, the scientific collaborations and network structures of 287 authors with at least three articles were examined (Figure 5). The analysis identified a total of 12 clusters to observe collaborations and interactions between these authors. A total of 11 authors were identified in Cluster 1 (red). It appeared as Cluster 2 (green) and has 10 items. "Carayon and Pascale" in this cluster have a total of 22 documents and 1967 citations, with a total link strength of 50 and are located at the strongest connection point. At Cluster 3 (blue), contains 9 items and has one of the clusters with the strongest connectivity. The highest link in the documents group is "Garg and Arun" in cluster 4 (yellow) group, with a total of 10 documents, 414 citations and a total link strength value of 33, which is the 2nd strongest link after "Carayon and Pascale".

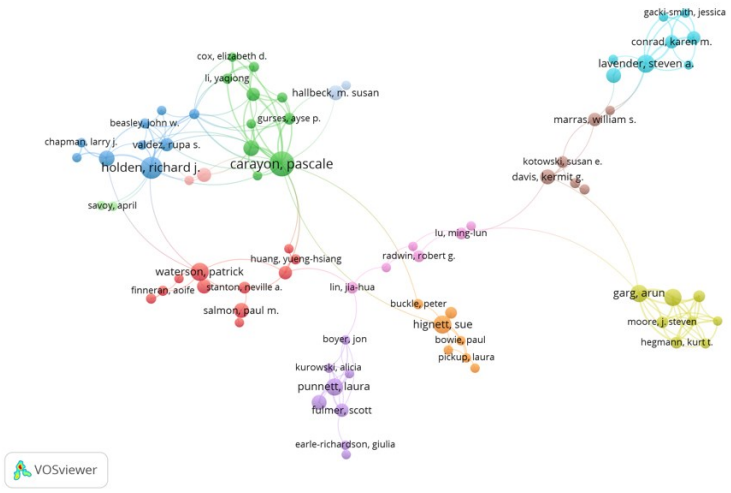

Figure 5. Authors Cooperation network in healty city and public space ergonomics.

The results of the analysis show in detail how specific researchers assumed central roles over time and how collaborations around them expanded or diminished. Additionally, a strong correlation was found between authors' publishing performance and their position in the network. In particular, it has been determined that more centralized and connected authors generally publish more and reinforce their scientific influence. Pascale Carayon, who has the highest number of publications among 287 authors, stands out with 25 articles scanned in the Scopus database. Jack P. Callaghan appears as the 2nd author who has produced the most articles in this field, with 18 articles in the database.

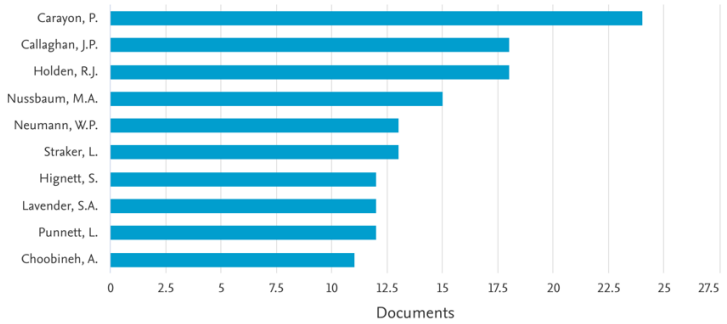

Figure 6. Authors documents.

For this analysis, the titles and abstracts of 2101 publications related to ergonomics were examined using VOSviewer software, and a total of 5168 terms were included, including terms of general meaning. Terms showing spelling differences were combined and a total of 253 keywords were analyzed and 60 items were found to be related. In the network map obtained as a result of the visualization of the analysis, the size of the circles represents the frequency of occurrence of the terms in the publication texts. The larger this size, the more frequently that term is used. The distance between terms indicates their relationship to each other, and the shorter the distance, the stronger the relationship. These relationships are calculated based on how often the terms are mentioned together. It indicates 4 color clusters in total and the different subsets to which the terms belong. In Figure 7, concepts such as risk assessment, physical ergonomics and musculoskeletal, which are frequently emphasized in the field of ergonomics, are in the red cluster, while terms such as patient safety, occupational health and participatory ergonomics are collected in the green cluster. This clustering reflects the various branches and focuses of research in the field of ergonomics.

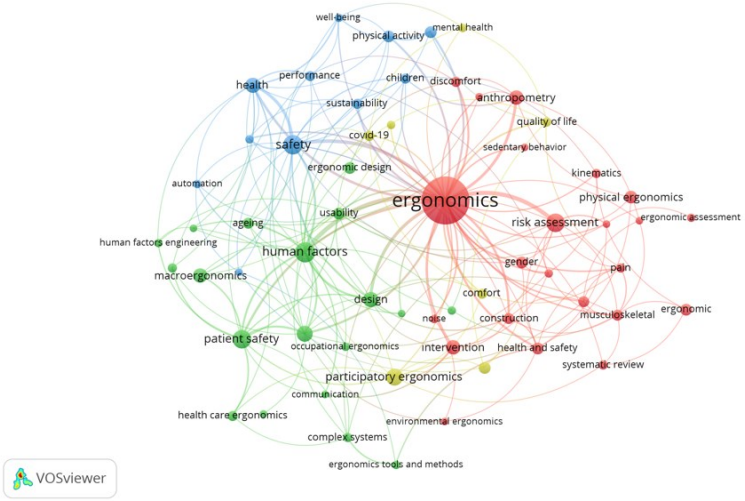

Figure 7. Keywords analysis of healty city and public space ergonomics.

In Figure 8, the term "ergonomics", located large and prominently in the center, emphasizes that it is the focus of the research field and represents the keyword with the most citations. Other major nodes, terms such as "human factors," "design," and "safety," indicate frequently encountered secondary focuses that have strong relationships with this main topic. The color gradient shows the distribution of keywords within publications by year; blue represents the oldest years, green represents the middle years, and yellow represents the most recent years. The lines on the map show the strength and frequency of associations between words; the thicker the lines, the stronger the relationship between those words (Yang et al., 2023). Within the field of "ergonomics," terms such as "health," "safety," "design," and "risk assessment" are of continued importance, reflecting the fact that ergonomics is an interdisciplinary field directly related to health and safety. The existence of a relatively new term such as “Covid-19” may indicate how the pandemic has affected ergonomics research and the increasing importance of this topic during this extraordinary period. Terms such as “aging,” “automation,” and “macroergonomics” offer insights into the field of ergonomics' interaction with aging populations, technological advances, and large-scale systems. Concepts such as “patient safety” and “health care ergonomics” indicate that ergonomics is particularly emphasized in the healthcare sector, suggesting that the applied dimension of the field is strongly represented.

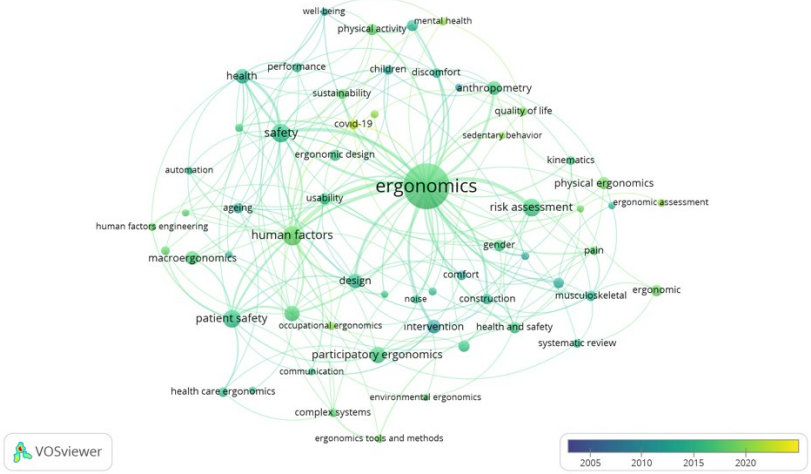

Figure 8. Keywords relation by years.

As a result, it is clear that the time and relationship map of the keywords shows how the field of ergonomics has evolved in recent years and which sub-themes have come to the fore, from healthy urban culture in general, and from the concept of basic ergonomics in particular, as well as key terms such as human factors, design and safety. Along with indications that current events such as COVID-19 may affect the direction of ergonomics research, the effects of socio-economic factors such as the aging population and technological developments on this field are also noteworthy (Smith et al., 2014). While the rise to prominence of the concepts of healthcare ergonomics and patient safety underlines the practical and applied aspect of ergonomics, the intensity of multidisciplinary collaborations and connections between concepts demonstrates the expanding nature and increasing integration of this field.

4. Discussions

This study examined a large literature pool obtained from the Scopus database, shaped around the topics of "healthy city" and "public space ergonomics". The analysis aims to measure the evolution of urban health and ergonomics research over the last twenty years and its place in academic dialogue. Preliminary findings reveal an increasing trend of research and publication in these areas. The overall increase in the number of publications between 2004 and 2024 indicates an ongoing interest among scientists investigating both the quality of urban spaces and the ergonomic effects of these spaces on user experience (Zhao et al., 2023). The fluctuating increase in the number of publications shows how these topics differ on the scientific and political agenda over various time periods. In particular, the peak seen in 2021 can be seen as a trigger that increases the importance and urgency of urban health and ergonomics issues related to the pandemic (Zhao et al., 2023). However, the decline in 2022 reflects external influences on academic outcomes or a change in research focus. The clustering of key terms found reveals an interaction between specific concepts in the field of ergonomics, such as risk assessment, physical ergonomics and musculoskeletal disorders, as well as broader, holistic concepts such as occupational health and participatory ergonomics. This is a sign that research is evolving towards a more inclusive and multidisciplinary approach, as well as a search for unity in the field (Alves & Arezes, 2012; Wisner, 1985). Moreover, the analysis of the journals' publication profile and collaboration networks shows that the journals' contribution to the subject is significantly higher than others. The fact that the journal Applied Ergonomics has had a significant impact in this field highlights the value placed on practical applications of ergonomics research and the important effects of these applications on human health.

Upon examining the geographical distribution, it was noted that the cooperative networks were predominantly concentrated in the United States and Europe. This situation demonstrates the dominance of specific geographical areas in research on urban health and ergonomics. However, it also raises concerns about the extent to which countries outside these regions contribute to this topic. The statement indicates that ergonomics research extends beyond academia and has practical implications that directly impact the health and well-being of society (Wisner, 1985). The future of ergonomics will rely on strengthening and expanding these interdisciplinary links, while also enhancing the efficiency and availability of ergonomic methods through adaptation to technical and social advancements.

Conclusively, this bibliometric analysis demonstrates the existence of interdisciplinary advancements in the research of healthy cities and public space ergonomics. Moreover, it reveals that these advancements are influenced by external variables and regulations that undergo changes over time. Nevertheless, he says that research ought to possess a more equitable distribution throughout different regions and prioritize topics such as the interplay between technology and human aspects. The long-term viability of advancements in these domains will hinge upon the manner in which forthcoming researchers tackle these deficiencies and embrace comprehensive approaches to enhance the caliber of urban existence. Hence, considering bibliometric analyses, it is crucial to promote further extensive and thorough research in the domains of urban health and ergonomics.

5. Conclusions

This study provides a comprehensive evaluation of academic research conducted on healthy cities and public space ergonomics from 2004 to 2024. By conducting an in-depth analysis of extensive data obtained from the Scopus database, the study examines publication trends, journal contributions, author productivity, geographical distribution, and academic collaborations using VOSviewer software. It is revealed that research on healthy cities and public space ergonomics has seen increasing interest over time, although there have been significant fluctuations in this interest during certain periods. These fluctuations indicate that the research field has a dynamic structure, particularly influenced by global events and political periods ((Miedema et al., 2019).

The analysis of journal publications and collaboration networks highlights the influence of specific academic journals and geographical regions in this field; however, it also indicates the need for broader geographical participation and interdisciplinary collaboration. Furthermore, despite progress in the ergonomic design of healthy cities and public spaces, there is a need for deeper research and a more inclusive approach in these areas.

Finally, this bibliometric study serves as an important resource for the future of research in the fields of healthy cities and public space ergonomics. Understanding both historical trends and interdisciplinary relationships through this study can provide a foundation for developing policies and practices aimed at improving urban living quality and human health. The results of this study aim to contribute to the expansion of the current knowledge base and foster wider collaboration and dialogue among researchers.

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Conflict of Interests

The Author(s) declare(s) that there is no conflict of interest.

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