
Risk Perception and Occupational Health and Safety: Evaluation in National and Global Context

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Abstract

Risks can be prevalent problems both within national borders and beyond. Examples of recent global infectious diseases such as natural disasters, man-made disasters (such as exposure to radiation), Covid, H1N1, and Ebola viruses can serve as examples of this. Interpretations and subjective judgments about risk are called risk perceptions and are important determinants of health and risk-related decisions (such as policy decisions about nuclear power plants, genetically modified foods, processed meats). We conducted research on studies on perception around the world, trends and what can be studied in the future. In this study, we identified 137 relevant publications from the SCOPUS database between 1987 and 2023. All the data obtained were analyzed using the Bibliometrix computer program based on R-studio. Analyses included the analysis of co-occurrences of networks, thematic maps, and trending topics. According to the findings of the present study, all reports were published in 101 sources since 1987. These documents have an annual growth rate of 5.55, increasing significantly after 2009. The countries with the highest number of publications are Australia, followed by Canada, Italy, Portugal, and the United States. Due to the nature of the topic, the occurrence of joint publications among countries is quite low. Individuals' awareness of occupational health and safety issues increases their awareness of workplace risks and, therefore, the likelihood of preventing workplace accidents and occupational illnesses.

Keywords: Perception, occupational health and safety, risk, hazard

Introduction

Risk perception refers to individuals' personal judgments about the likelihood of negative events occurring. In particular, in the context of health and risk communication, risk perception is important in determining which hazards are significant to individuals and how they can cope with these hazards. Risk perception has two main dimensions: the cognitive dimension, which is expressed in terms of individuals' level of knowledge and understanding about risks; and the affective dimension, which is concerned with how individuals feel about risks (Güler, 2014). Various theoretical models have been developed to explain how individuals perceive risks, process risk information, and make decisions about them. These include the psychometric paradigm, the risk amplification model, the mental noise model, the negativity dominance model, the trust determination model, and the social amplification of risk framework (Ar, 2014).

In the workplace, non-experts typically assess risk based on subjective perceptions, intuitive judgments, and information from the media, while experts rely more on research and statistical evidence. In contrast, it is assumed that non-experts generally assess risks using heuristic methods and other informal thought processes. For

example, when people are more aware of specific risks, they tend to believe that these risks occur more frequently than they actually do. This tendency is known as the availability heuristic (Kahneman et al., 1982).

Risk perceptions are important indicators of individuals' health behaviors and other risk prevention behaviors recommended by experts. Behavior changes models such as the Health Belief Model, the Protection Motivation Theory, the Extended Parallel Process Model, and the Risk Perception Attitude framework incorporate the concept of risk perception (Paek & Hove, 2017).

Public awareness and perceptions can be influenced by how the media portrays risks. There are numerous studies demonstrating that media factors influence public risk perceptions (Slovic, 2016). Various media factors, including the amount of media coverage, the frames used, the perceived value and tone of media coverage, media sources and their perceived reliability, the formats in which risks are presented, and the types of media channels, are associated to varying degrees with risk perceptions.

Risk perceptions are important in adopting healthy behaviors, restricting unhealthy behaviors, and accepting or rejecting certain levels of risks. Risk perceptions determine how individuals will proceed in their health and risk-related decisions. Therefore, research on risk perceptions plays a significant role in the planning and implementation of health-related policies (Alexopoulos et al., 2009).

A common assumption in risk perception research is that individuals decide how to perceive a risk based on their level of knowledge and certainty about the risk. This assumption is based on the rational decision-making model, in which individuals evaluate the probabilities of outcomes after calculating potential costs and benefits. This assessment of risk is often attributed to experts who rely on scientific knowledge and objective assessments.

When we think of some examples in the context of occupational health and safety, employees who have a coworker or family member suffering from a deadly disease such as occupational cancer are more likely to perceive this disease as a higher risk. Similarly, individuals dealing with a contagious disease containing biological risks in the workplace and receiving intensive media coverage may perceive it as more widespread and riskier compared to others. Therefore, it is understood that risk perception is shaped by various influences such as individual experiences, communication sources, and other factors. Considering these factors in risk perception research will help us gain a better understanding of the path's individuals follow in the process of assessing and managing risks.

Studies investigating the level of risk perception among workers in accordance with occupational health and safety principles are important sources that guide future research. These studies identify gaps in the literature and provide inspiration for researchers. Additionally, they provide access to the most up-to-date information, especially regarding the latest technologies. Recently, bibliometric-supported analyses have become popular in order to reduce the size of reports, increase visual appeal, and enhance comprehensibility (Rejeb et al., 2022; Malanski et al., 2019). Various tools are available for bibliometric analysis. However, each tool has its advantages and disadvantages, so the use of multiple tools is recommended for better results (Choudhri et al., 2015; Karanatsiou et al., 2017; Markscheffel and Schröter, 2021).

Among the most commonly used software packages for bibliometric and visualized analysis are CiteSpace, VOSviewer, and R-bibliometrix. These programs can be used to extract and obtain the desired essential information from the examined

publications. This information may include elements such as countries/regions, institutions, authors, journals, keywords, and co-citations. These programs can identify authors, institutions, and countries/regions that contribute the most to collaboration networks and select relevant publications. Bibliometric analysis is a method based on statistical and visualization tools that aim to reveal information structures and development trends related to a subject (Devos and Menard, 2019).

This method allows for the objective determination of research trends and new topics, the evaluation of the performance of authors and organizations, and the mapping of international collaborations and geographical distribution networks. For this purpose, printed data is used. Various databases are available to obtain raw data. PubMed, which is one of the most popular and frequently used search engines for medical literature, was developed by the National Library of Medicine and released as an accessible interface for the MEDLINE database in 1997. However, the main disadvantages of PubMed include problems such as covering biomedical and life sciences journal literature and lacking dynamic citation analysis (Choudhri et al., 2015).

The main objective of the study is to examine the perception levels of employees in the business world regarding the problems and risks they face. In line with this goal, previous research was compiled and efforts were made to obtain information on changes in spatial distribution, popular terms and topics. In addition, differences in perception levels between countries and regions and the factors influencing them were examined.

Do perception levels differ between countries? What could be the reasons for these differences? Do factors such as cultural, social and economic structures of countries, occupational health and safety policies, education system, and awareness-raising activities have an impact on perception levels?

What are the popular terms and topics related to occupational health and safety? Do these emerge as rising or declining topics depending on trends? Analyses conducted using the Bibliometrix program will help identify the most commonly used terms and topics.

Is there a relationship between perception levels and the number of studies related to occupational health and safety and the development and effectiveness of countries? Are the analyses conducted sufficient to determine the relationship between the development level of different countries and the number of studies conducted?

This study examines the perception levels of the problems and risks faced by employees in the business world and discusses the differences between countries in this regard. It also notes that popular terms and topics change according to trends and that the number of studies conducted in this area is related to the level of development of countries.

Material Method

Data source and search strategy

In the research to be evaluated, based on a numerical search using the SCOPUS database, it was found that it contained approximately 49,355 documents in the field of occupational health and safety. However, the search was specifically limited to the category of "perception" with the keywords "occupational health and safety" and "work" and "risk" for research on topics such as occupational accidents and work-related diseases. As a result, 137 documents were recorded after May 26, 2023. They were downloaded in BibTex format and analyzed using the Bibliometrix program based

on R studio. The obtained results were visualized using the VOSviewer program. VOSviewer is a software tool used for creating and visualizing bibliometric networks. These networks can include journals, researchers, or individual publications and can be constructed based on citation, bibliographic coupling, co-citation, or co-authorship relationships. This software also provides a text mining function to create and visualize the formation networks of important terms obtained from scientific literature (vosviewer.com). The 137 dataset was analyzed using VOSviewer software through keyword mining, citation analysis, and bibliographic coupling analysis.

Results and Discussion

The descriptive characteristics of 137 documents from various sources, including journals, books, book chapters, and conference papers, are presented collectively in Table 1, indicating a time range from 1987 to 2023. These documents are distributed across 137 different sources. The annual growth rate of these documents is estimated to be 5.55%. The first article was published in 1987, and the average age of the documents is 7.66 years. Such a low age suggests that reports related to perception and occupational health and safety are relatively new. The time trend of the documents (Figure 1) clearly shows that the majority of the documents have been reported after the 2010s and reached a peak in the last decade. Looking at the citations per document, we observed an average of 13.47. Out of the 137 documents, 99 were published as original research, and the remaining documents consist of chapters, books, and conference papers. In general, these documents account for 525 collaborative papers (Table 1).

Table 1. Documents produced between 1987-2023

| Description | Results |
|---------------------------------|-----------|
| Timespan | 1987:2023 |
| Sources (Journals, Books, etc) | 101 |
| Documents | 137 |
| Annual Growth Rate % | 5.55 |
| Document Average Age | 7.66 |
| Average citations per doc | 13.47 |
| References | 5361 |
| Keywords Plus (ID) | 1083 |
| Author's Keywords (DE) | 464 |
| Authors | 525 |
| Authors of single-authored docs | 18 |
| Single-authored docs | 20 |
| Co-Authors per Doc | 4.15 |
| International co-authorships % | 13.87 |
| Article | 99 |
| Book Chapter | 3 |
| Conference Paper | 24 |
| Conference Review | 3 |
| Review | 8 |

In the following sections of the current study, these documents are subjected to a series of analyses, including sources and impacts, country productivity, co-occurrence of keywords, thematic maps, word clouds, conceptual structure maps, and topic dendrogram. The study is designed as a comprehensive approach to identify the main theme of the analyzed documents in the field of perception and occupational safety.

Annual scientific production of documents

The analysis of annual production of documents in the relevant field has revealed trends over time. According to this analysis, the first sources in the literature date back to the 1980s. However, a significant increase in the number of documents has been observed since 2013, accompanied by a momentum. This increase can be attributed to various factors. (Figure 1.)

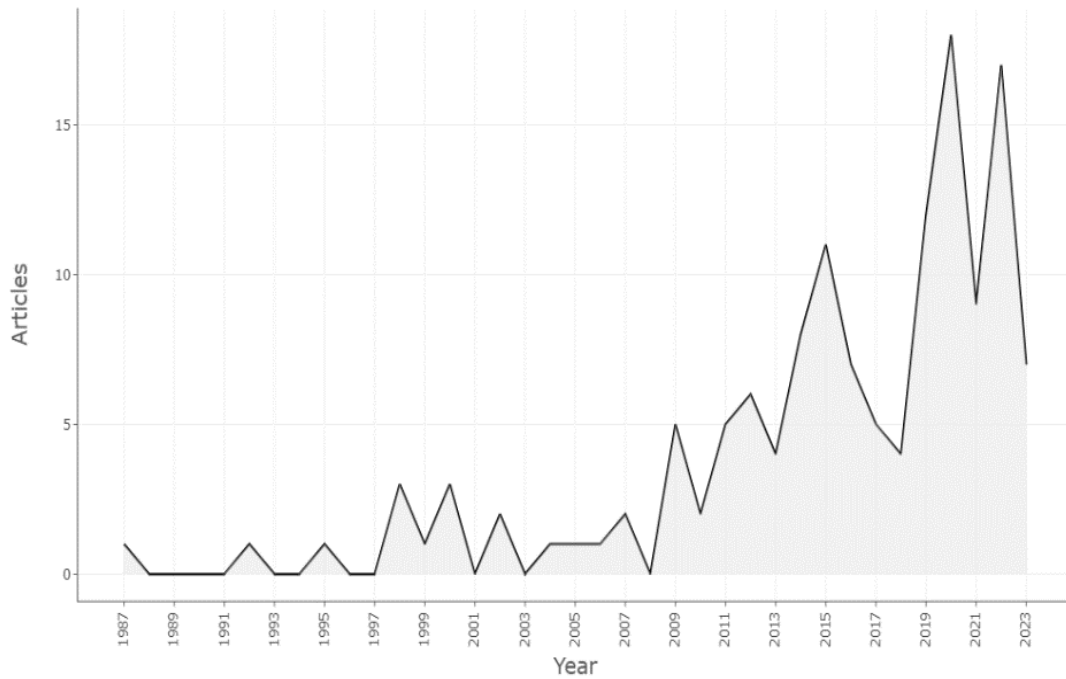


Figure 1. Annual scientific productivity.

Most published resources

As mentioned in the previous section (Table 1), the relevant publications are found in 137 different sources. These journals have been categorized into different categories based on their importance using Bradford's Law. This classification is related to their relevance level. As seen in Figure 2, the top three journals are Safety Science (N=13), International Journal of Environmental Research (N=7), and Advances in Intelligent Systems and Computing (N=4).

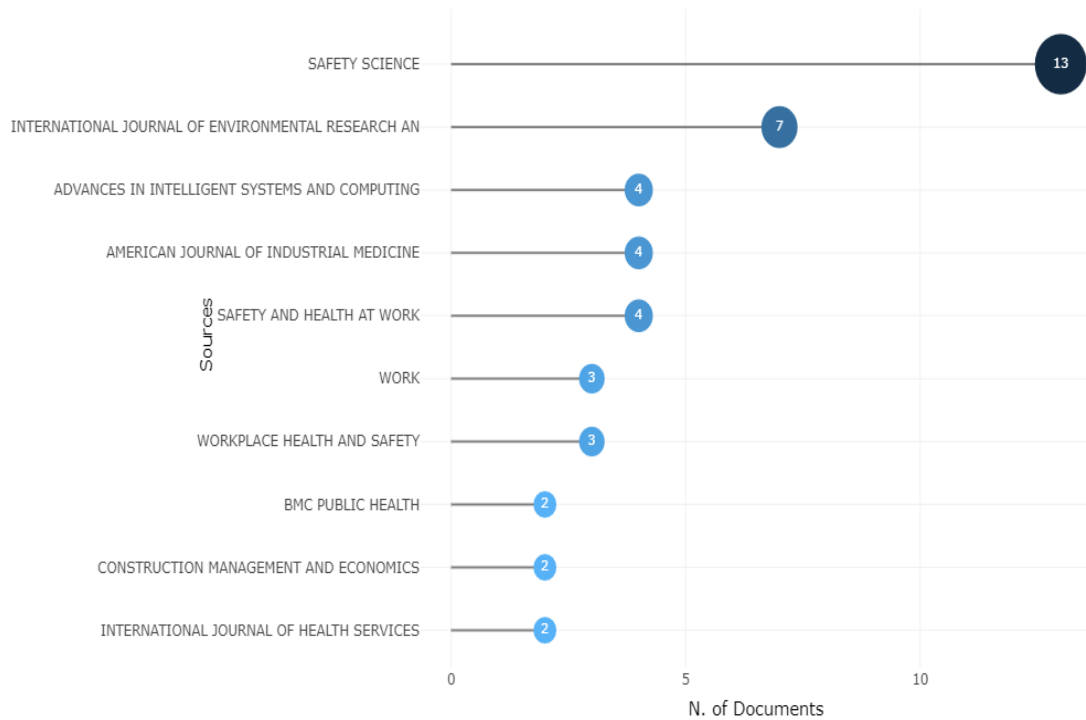


Figure 2. Most published sources

Country scientific production and connections

When looking at the number of publications, Australia ranks first, followed by Canada, Italy, Portugal, and the United States. However, in terms of receiving the most citations, the ranking is as follows: Australia (N=316), followed by Canada (N=283), the United States (N=245), Italy (N=213), Spain (N=93), New Zealand (N=74), and Denmark (N=50) (Figure 4). The reason why Australia produces a high number of publications on occupational health and safety is due to the high number of work accidents and occupational diseases in the country. According to ILOSTAT-Australia data, the number of non-fatal work accidents per 100,000 workers is 899, while the number of fatal work accidents per 100,000 workers is 1.6 (ilostat.ilo.org). Although Canada has made progress in occupational health and safety through recent legislative regulations and penalties, according to the International Labour Organization data, the number of work accidents in 2022 was 1408 per 100,000 workers, with around 5 resulting in death. In the United States, an ILO member country, the rate of fatal accidents per 100,000 workers is reported to be around 57.7 in the agriculture, forestry, and fishing sector, 13.33 in the mining sector, 16.15 in the construction sector, and 17.76 in the transportation sector. In Italy, these values are 11.27 in the agriculture, forestry, and fishing sector, 22.41 in the mining sector, 9.06 in the construction sector, and 6.39 in the transportation sector. In Portugal, the values are reported to be 9.34 in the agriculture, forestry, and fishing sector, 36.89 in the mining sector, 17.30 in the construction sector, and 11.61 in the transportation sector (Öztürk, 2022).

Country Scientific Production

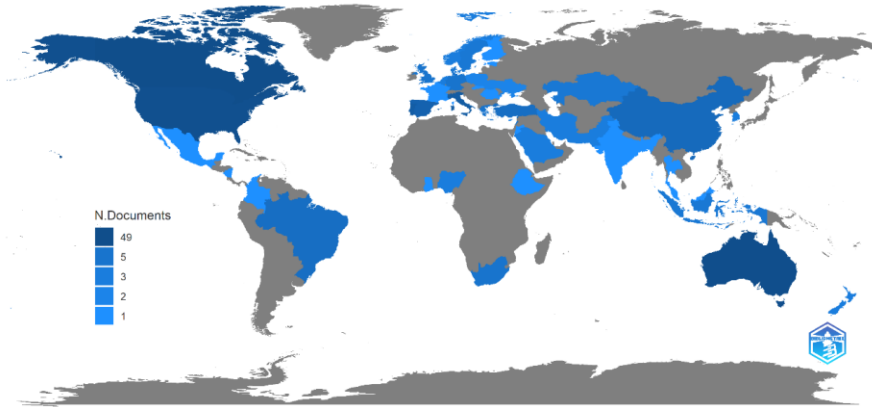


Figure 3. Scientific productivity of countries.

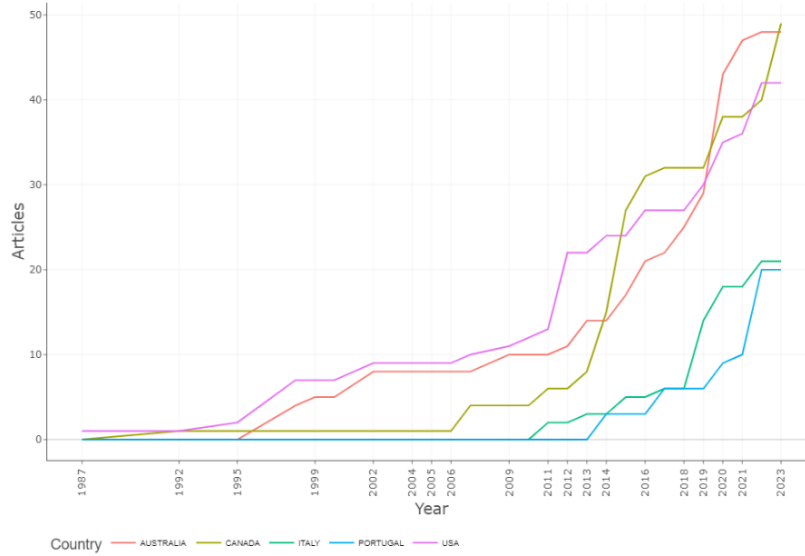


Figure 4. Scientific productivity of countries by years.

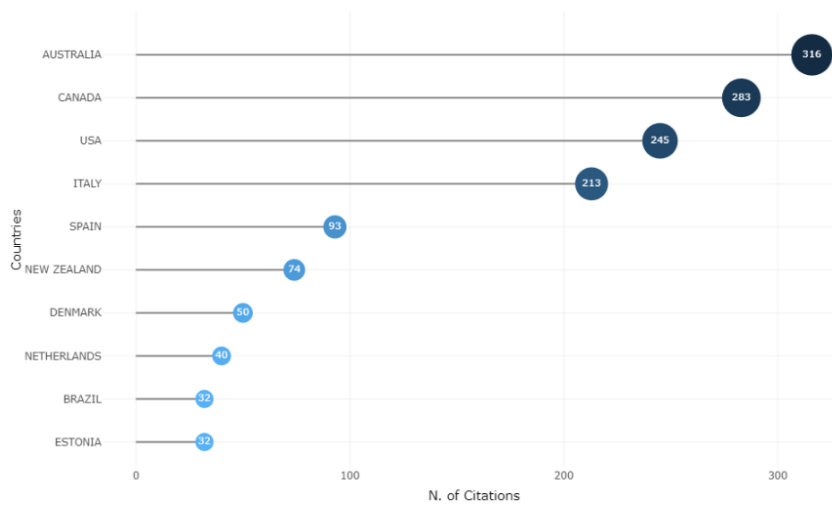


Figure 5. Number of citations received by countries.

Corresponding author (intra-country (scp) and cross-country (mcp) collaboration)

Figure 6 demonstrates the potential for individual or collaborative cooperation among countries conducting research on the respective topic. To this end, we evaluated intra-country (SCP) and inter-country (MCP) cooperation for the period 1987-2023. Figure 6 shows the top nineteen countries in this regard. Despite ranking first in terms of document count, Australia had a relatively low cooperation rate, the same as Canada, the United States, and Italy. For our country (Turkey), the MCP rate was found to be 0.0. While certain topics may be of interest to the local population, they may not fall within the scope of our regions or countries, thus the MCP rate may not reflect cooperation in specific topics. Collaboration may not be possible for every topic. Therefore, the low MCP rate can be attributed to local specificity and uniqueness.

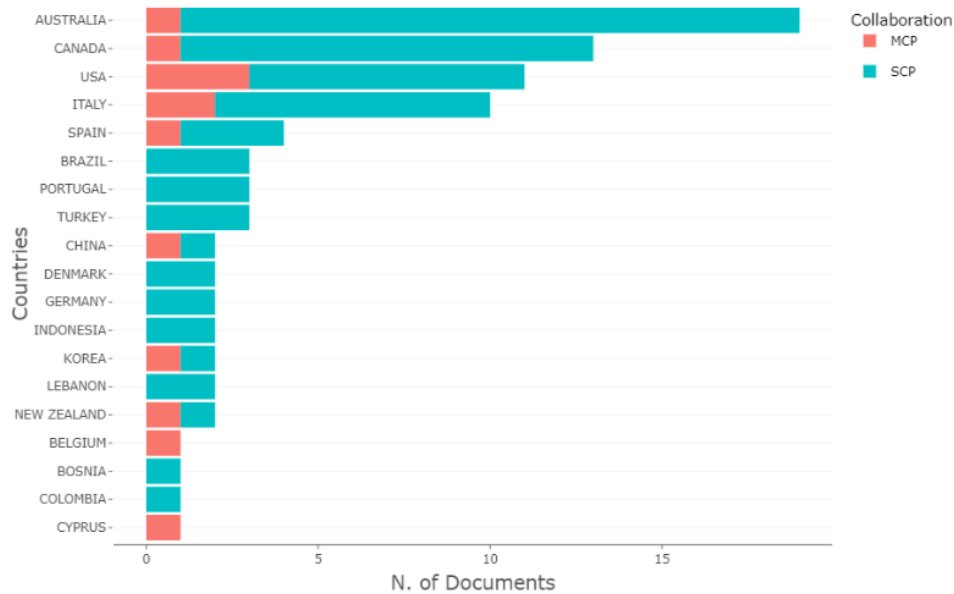


Figure 6. Cooperation status between countries

Word cloud analysis of received documents

We created three Word Clouds using Author Keywords, Keywords Plus, and Titles to further expand our insights into the content of the documents considered for analysis (Figure 7-9). As Zhang et al. (2016) report, traditional author keywords are provided by the authors of the relevant papers, while Keywords Plus are extracted from the titles of the referenced papers by Thomson Reuters. Additionally, Titles are critical indicators in reaching relevant audiences. The Word Clouds for each analysis consisted of the top 50 most frequently used words (Kulak et al., 2019; Kulak & Kılıç, 2020). Please refer to Figure 7 for Perception, Occupational Health and Safety, Risk Perception, Safety Culture, Risk Analysis, Safety Climate, etc. As evident from Figure 7, the main keywords of the study (occupational health and safety and perception) have been followed by the main keywords of the respective analysis.



Figure 7. Author keyword Cloud.

The keywords included workplace, people, women, men, risk assessment, adult, health risk (Figure 9). In the title word cloud, the most pronounced words are safety, health, work, risk, employees, perception, management, workplace, etc. (Figure 10). As seen in the country analysis (Figures 4-7), Australia has the highest number of publications. Due to its frequent usage as a keyword, Australia appears in the word cloud analysis. In occupational health and safety studies conducted in workplaces, both women and men are reported with similar frequency. Additionally, a distinction has been made between children, adolescents, and adults. These results indicate that the concept of occupational health and safety can affect all members of society.



Figure 8. Keyword plus cloud



Figure 9. Headings word cloud

Trending topics

The topics of scientific studies can vary significantly depending on time and location. As seen in Figure 10, occupational health and safety and human-related research have been prominent, generally focusing on investigating the perceptions of adult men and women. Additionally, risk assessment, industrial hygiene, and job-related risks are highlighted subjects.

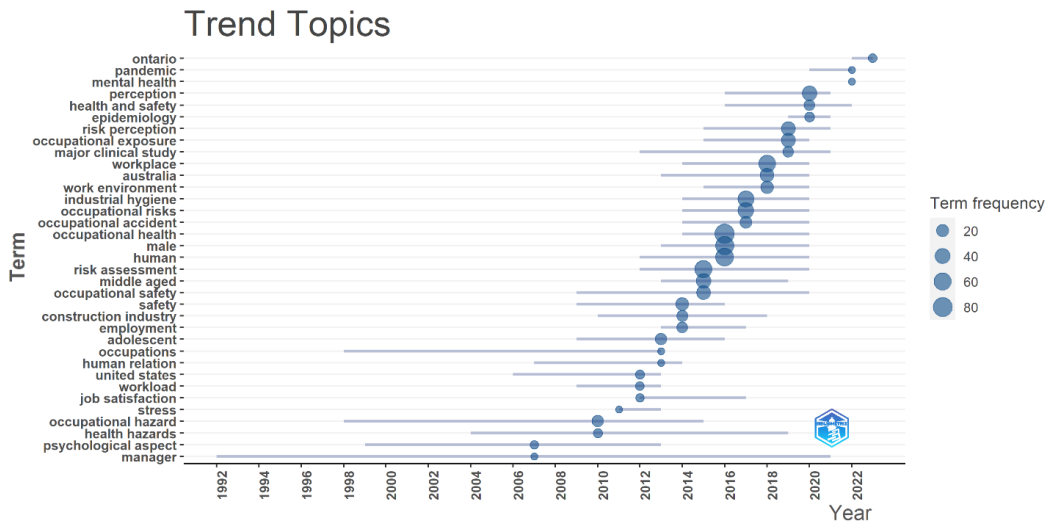


Figure 10. Trending topics

Co-occurring network

Understanding the relationship between the terms used in reports is an important analysis in the interpretation. For example, a high level of co-occurrence of words reflects a high level of relationship between them. Here, we created co-occurrence networks of authors' keywords and Keyword Plus (Figure 7-9). Accordingly, Figure 7 shows very tight clusters. The blue cluster, stemming from words related to business

risk and industrial hygiene, while the red cluster includes words related to occupational safety, human, and adult (male, female). Both clusters highlight the attention given to perception. The other main cluster (green) is centered around words like risk assessment, work environment, and occupational safety (Figure 11).

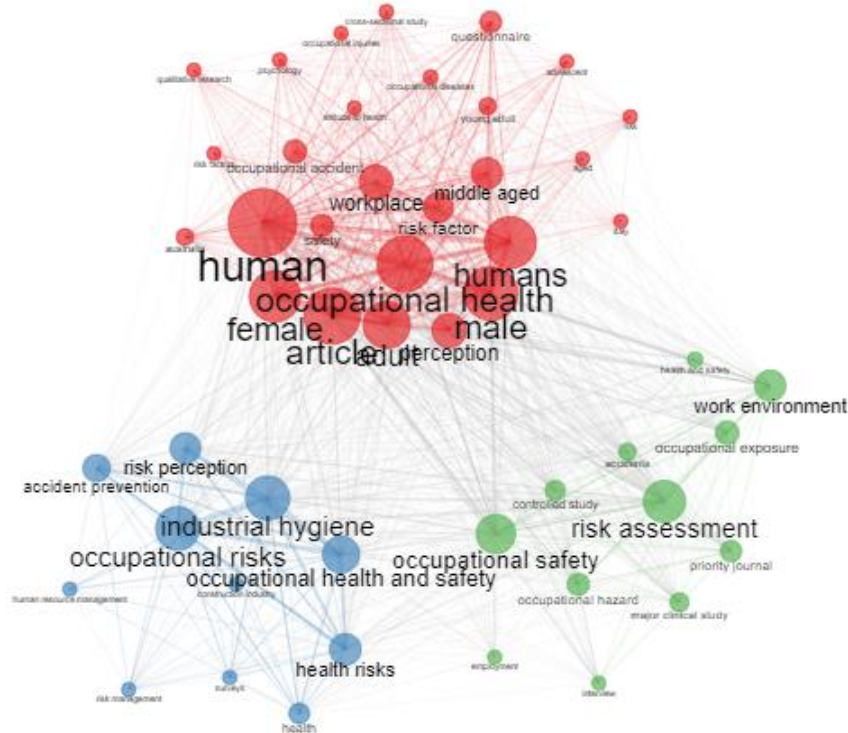


Figure 11. Network of co-occurring issues.

Thematic map

Thematic mapping, which has become popular in recent years, is important in determining the main and general topics in a field. Thematic maps consist of four quadrants. Motor theme (quadrant 1) consists of the most relevant and evolving terms related to the analyzed topic. Niche theme (quadrant 2) consists of terms that are not directly related to the topic. Emerging or declining theme (quadrant 3) includes terms that have limited or marginal relevance to the topic. The final quadrant (core theme) consists of general terms rather than specific terms related to the analyzed topic. Therefore, the same terms can be encountered in other fields as well. In the presence of networks, we also created thematic maps for author keywords (Figure 12). Figure 12 shows the thematic map of author keywords. The first quadrant (motor themes) consists of four main clusters. One cluster is about construction workers, the second cluster is about risk perception, occupational injuries, and occupational safety, the third cluster is about occupational health, perception, and security, and the fourth cluster is about occupational health and safety, Covid 19, and education. Since ensuring occupational health and safety is based on high perception, the motor theme completely encompasses these topics.

The second quadrant (niche theme) includes topics such as musculoskeletal injuries, workplace injuries, gender quantitative research, and workplace bullying. The third quadrant shows a tendency towards centrality and intensity in topics such as job

satisfaction, safety and health injuries, and work-related stress and risk sources. These suggest that these relevant topics can be moved to the motor theme and core themes. The word cloud topic (Figure 7, 8, 9), trend topics (Figure 10), and network topic (Figure 11) depict the key keywords or keywords plus "human, workplace, risk assessment" analysis, portraying hotspots or core content of occupational health and safety. This approach encompasses the fundamental topics of occupational health and safety. The final quadrant (Core Theme) identifies general topics that cross over/shared between different research fields, namely occupational health and safety, safety climate, and risk management. Interestingly, risk assessment, construction industry, and occupational hazards are at the center of this quadrant.

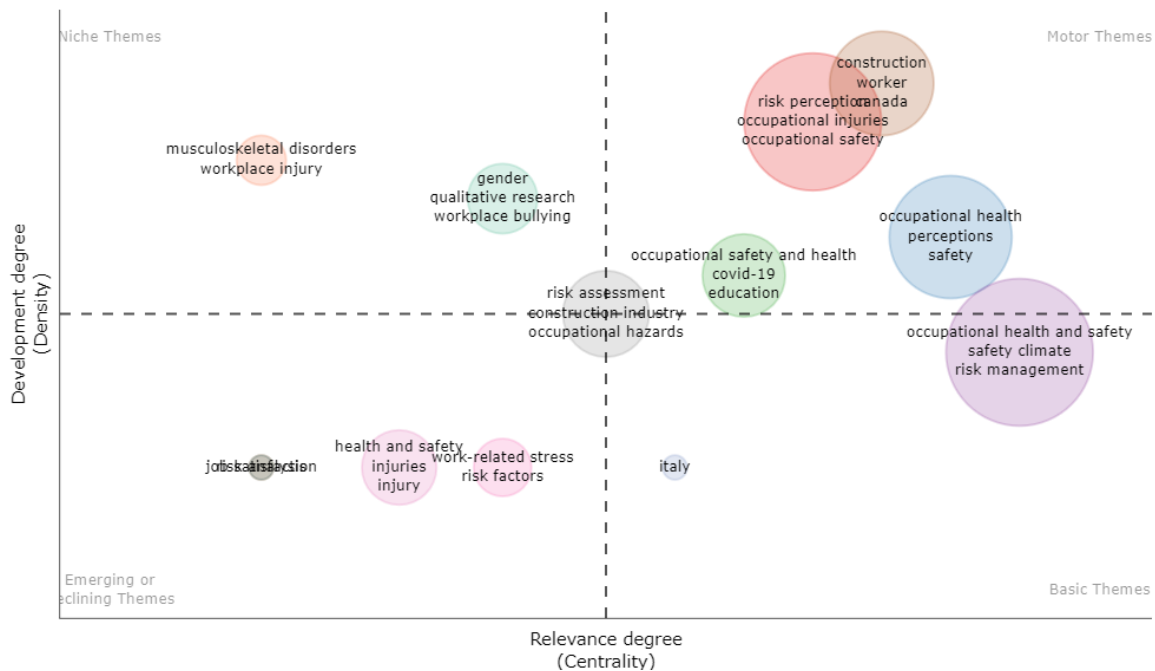


Figure 12. Thematic map

Conclusion

It is critical for researchers to determine how and to what extent emotions such as anger, fear, and anxiety affect risk perception and subsequent behavior. Although various risk characteristics have been identified under the headings of unknown and feared risks, very little research has examined which ones have stronger or weaker effects on risk perceptions and subsequent behaviors.

Research on risk perception and occupational health and safety was conducted using the Scopus database to obtain results such as authorship, citations, and keywords. Data from this study indicate that research on perception is mainly conducted in specific countries, and there is a limited number of international studies available. Perception is a reflection of the people living in each country and is generally a reflection of educational and behavioral outcomes; therefore, there is limited opportunity for collaboration.

However, risk perception is a complex phenomenon resulting from the interaction of cultural, social and educational factors. Therefore, there are difficulties in conducting collaborative research between different countries. International cooperation and

knowledge sharing are necessary to understand risk perceptions in different geographic regions and to develop occupational health and safety strategies.

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