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Work Accidents: A Bibliometric Analysis of International Literature and the Situation in Turkey

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Abstract
With scientific and technological developments, people's welfare levels have increased. However, occupational accidents still continue to be an important problem in workplaces around the world. The aim of this study is to examine the necessary articles about the active journals, the most publishing countries, the most used keywords and research areas in the international and Turkish literature on occupational accidents. In this study, bibliometric analysis techniques were used to realize the purpose of the research and to find answers to the research questions. Research data were obtained from the Web of Science (WoS) database in November 2023. VOSviewer and Excel software program were used in the analysis of the data. While the most publications on work accidents in the world were made in 2022, they were made in 2021-2022 in Turkey. While the most publications were made in the field of public, environmental and occupational health as a research subject in the world, the most publications were made in the field of engineering in our country. While United States of America is the most broadcasting country in the world, Turkey ranks third. It has been determined that the most widely published journal in the world is Safety Science magazine and the most frequently used keyword is occupational accident. In addition, it has been determined that most of the publications addressing Turkey were made in Istanbul University. As a result, preventing work accidents should be the first priority in order to increase the productivity of workplaces and the efficiency of employees. Therefore, increasing and supporting research on occupational accidents is of great importance for the awareness of the global community and employees.

1. Introduction

People spend most of their life in working life. Working is one of the most important determinants of a person's living conditions and health. Also, work is necessary for human beings as it is the way to gain respect, integration, socialization, recognition and bonds of friendship [1].

With scientific and technological developments, people's welfare levels have increased. However, occupational accidents still continue to be an important problem in workplaces around the World [2]. The International Labor Organization (ILO) defines an occupational accident as an unexpected and unplanned work-related event, including acts of violence that causes injury, illness or death to one or more workers [3].

Occupational accidents are one of the phenomena that have become widespread with technological developments and threaten employee health, causing financial losses to human communities [4]. Occupational accidents directly affect the construction of social reality. It poses a serious public health problem, primarily because it leaves youth and working-age adults disabled or even fatally injured [5].

Every year, countless employees suffer material and moral damage due to work accidents. Occupational accidents not only damage work activities, but also cause significant economic, social

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and environmental effects [6]. Every year, millions of occupational accidents occur in the world that cause injuries and economic losses [2]. According to the ILO, approximately 4% of the world's gross domestic product (GDP) is lost every year as a result of work accidents and occupational diseases. The exact number of deaths from occupational accidents and occupational diseases worldwide is not available because most countries do not have reliable sources to obtain these figures [5]. In addition, 588 thousand 823 employees will have work accidents in Turkey in 2022, and 1517 of them died [7]. While a total of 2 million 607 thousand 900 employees had work accidents in the USA in 2021, 5 thousand 190 people died as a result of work accidents [8]. In Canada, a total of 253 thousand 397 employees had a work accident in 2020, while 924 employees died as a result of a work accident [9]. ILO states that every year there are approximately 340 million work accidents worldwide and 2.3 million workers lose their lives. The ILO periodically updates these estimates and the updates show that accidents and health problems are increasing [10]. The financial burden of occupational accidents is greater than costly diseases such as cancer, Alzheimer's, human immunodeficiency virus (HIV) and cardiovascular diseases [4], [11].

For this reason, occupational accidents are an important burden for society [12]. Various studies have been conducted to investigate the causes of accidents, including the well-known Heinrich's domino theory. After Heinrich's work in 1931 and the presentation of the domino model, the idea that the most critical role in the occurrence of the accident was formed. According to his study, 88%, 10% and 2% of the causes of accidents, respectively, are related to unsafe behavior, unsafe conditions and unpredictable factors [13].

No study has been found in the literature on the bibliometric analysis of publications in the field of occupational accidents. This study is especially for researchers; It will shed light on the active journals in the international literature on occupational accidents, the countries with the most publications, the most used keywords and the necessary articles about the research areas. In addition, this study will contribute to researchers who want to study work accidents in Turkey by revealing the deficiencies in the literature and preserving originality in the path they will follow. In line with the purpose of the research, the research questions are as follows:

- In which years were the most publications made on occupational accidents in the world?
- Which countries publish the most publications on occupational accidents?
- What are the most studied topics or concepts according to the keywords of the publications on occupational accidents?
- In which years were the most publications about work accidents made in Turkey?
- What are the most published research areas regarding work accidents in Turkey?
- Which institutions publish the most on work accidents in Turkey?

2. Material and Method

In this study, bibliometric analysis techniques were used to realize the purpose of the research and to find answers to the research questions.

Bibliometric analysis is widely used in qualitative and quantitative research to evaluate and compare the trends and academic impact of journals [14]. Bibliometric analysis is a field of scientific study that aims to create research performance indicators of studies that represent a topic based on the quantitative analysis of academic documents [15] – [17]. Bibliometric studies analyze a particular scholarly journal and publications in a particular field to map the most prolific authors, institutions, countries, and journals by their scientific productivity and citation rates [18]. In addition, the bibliometric analysis method relies on specific articles to identify publications, citations, authors, countries and keywords. The results of these studies have shown that bibliometric analysis can reveal the status and global trend of a particular journal and further improve its quality on this basis [14].

Bibliometric analysis was performed using VOSviewer (Version 1.6.19, Center for Science and Technology Studies of Leiden University), a mapping and visualization software tool. The VOSviewer program, on the other hand, has been used for data visualization among many existing software due to its free accessibility and ease of use. VOSviewer provides researchers with the opportunity to analyze a wide variety of bibliometric networks consisting of publications, authors, journals, organizations or countries [18].

2.1. Data Collecting

Research data were obtained from the Web of Science (WoS) database in November 2023. Study data in bibliometric studies can be obtained from WoS, Scopus and Google Scholar databases. Each database has its own unique functionality. Compared to WoS, Scopus and Google Scholar, it offers a rich publication and citation history and includes only high-impact factor journals and provides efficient

access to bibliographic data [18]. For this reason, research data were obtained from the WoS database.

By using the search button in the WoS database, the literature was scanned with the keywords "work accident" or "occupational accident" or "workplace injuries" or "fatal and non-fatal work accidents" for all fields, and a total of 1751 studies constituted the universe of the research. The sample of the research was included in the studies that met the criteria for participation in the research. The criteria for inclusion in the research are as follows.

1. Published only in English
2. Emerging sources citation index (ESCI), Science Citation Index Expanded (SCI-EXPANDED) and Social Sciences Citation Index (SSCI) have been published
3. Studies conducted between 2003 and 2023 (studies conducted in the last 20 years)
4. Only research articles were included, while other types of publications (e.g. proceedings, meeting abstracts, retracted publications, and book chapters) were not included.

As a result of these inclusion criteria, 143 publications were not included because they were not published between 2003 and 2023, 116 were not published because they were not research articles, 291 studies were not included because the publication language was not English, and 170 publications were not included in the specified indexes. 1031 publications that met the inclusion criteria for the research were reached. The titles, abstracts or full texts were read and evaluated to determine whether they met the research topic. In addition, the effectiveness of bibliometric analyzes in the field of work accidents in Turkey's international literature was also evaluated. Figure 1 shows the research flow chart.

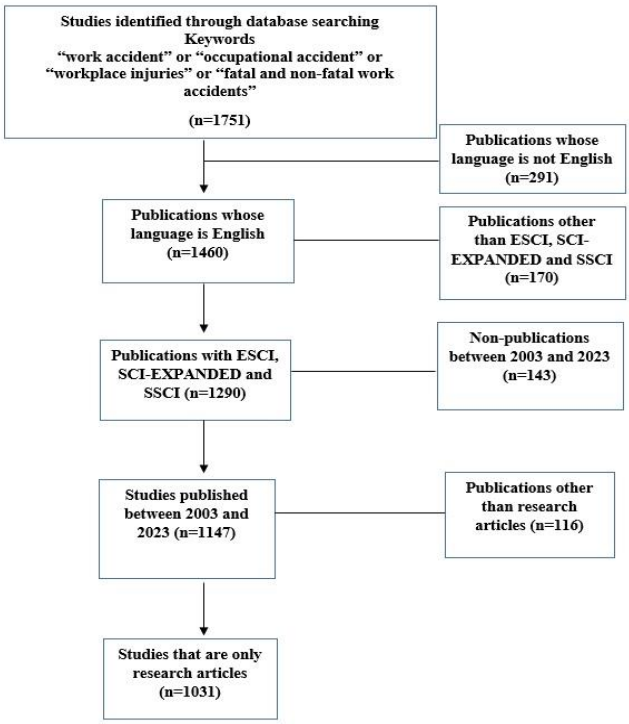

Figure 1. Flow chart of literature search and selection process

2.2.Data Analysis

Data were analyzed using descriptive content and bibliometric content analysis. Descriptive features (distribution of publications by years, type of publication, research area and journals) were analyzed using Excel program. Descriptive analysis consists of three stages. First, by entering the keywords determined on the WoS database, studies in the field of work accidents were accessed and some studies were excluded within the scope of the inclusion criteria. Then, the obtained data were classified using the Excel program and tables and figures were created.

3.Results

The findings of the research include the distribution of studies on occupational accidents in the world according to their years, journals in which they were published, research areas, publishing countries and the most used keywords in publications in this field. In addition, the years of publications on occupational accidents in Turkey, universities that publish, research areas and the most frequently used keywords in the studies are included.

When Figure 2 is examined, it is seen that the most publications on work accidents in the world were made in 2022 (101 publications), followed by 2020 (93 publications) and 2019 (87 publications). The fewest publications were made in 2004 (10 publications), followed by 2003 (16 publications), 2005 (18 publications) and 2006 (18 publications).

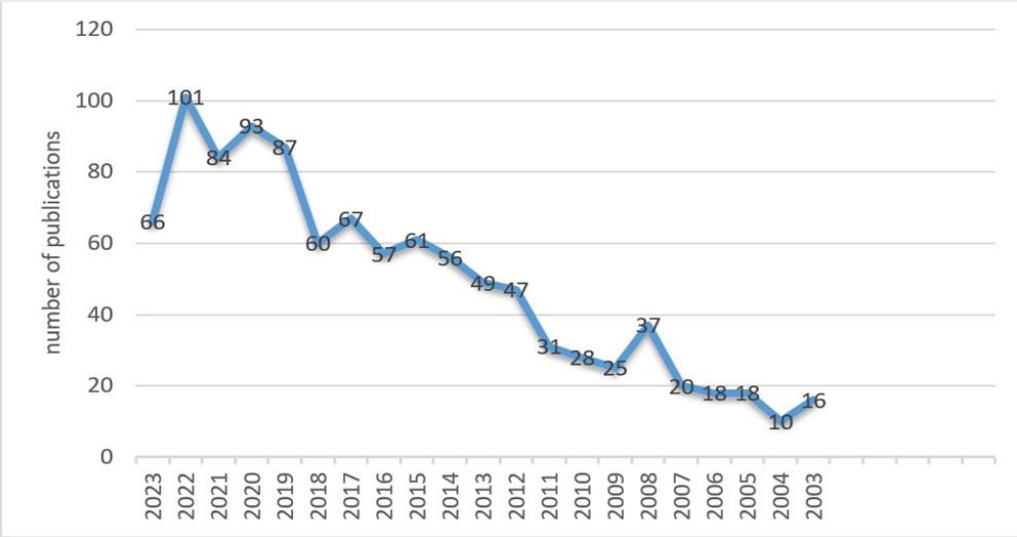

Figure 2. Flow chart of literature search and selection process [19]

Table 1 lists the 10 journals in which studies on work accidents are most frequently published in the world. It is seen that the journal with the most publications is "Safety Science" with 78 publications, followed by "American Journal Of Industrial Medicine" with 43 publications and "Journal of Safety Research" with 31 publications.

Table 1. The 10 journals in the world where studies on work accidents are most published [19]

Publication Titles	Record Count
Safety Scıence	78
Amerıcan Journal of Industrıal Medıcıne	43
Journal of Safety Research	31
Work a Journal of Preventıon Assessment Rehabılıtatıon	29
Internatıonal Journal of Occupatıonal Safety and Ergonomıcs	21
Journal of Occupatıonal And Envıronmental Medıcıne	20
Internatıonal Journal of Envıronmental Research and Publıc Health	18
Accıdent Analysıs and Preventıon	15
Internatıonal Journal of Occupatıonal And Envıronmental Health	13
Occupatıonal and Envıronmental Medıcıne	13

Figure 3 shows the 10 most frequently conducted research areas on work accidents in the world. Most publications were made in the fields of "Public Environmental Occupational Health" (404 publications), "Engineering" (251 publications) and "Operations Research Management Science" (89 publications). The

research fields with the least publications are "Nursing" (34 publications), "Psychology" (47 publications) and "Transportation" (52 publications), respectively.

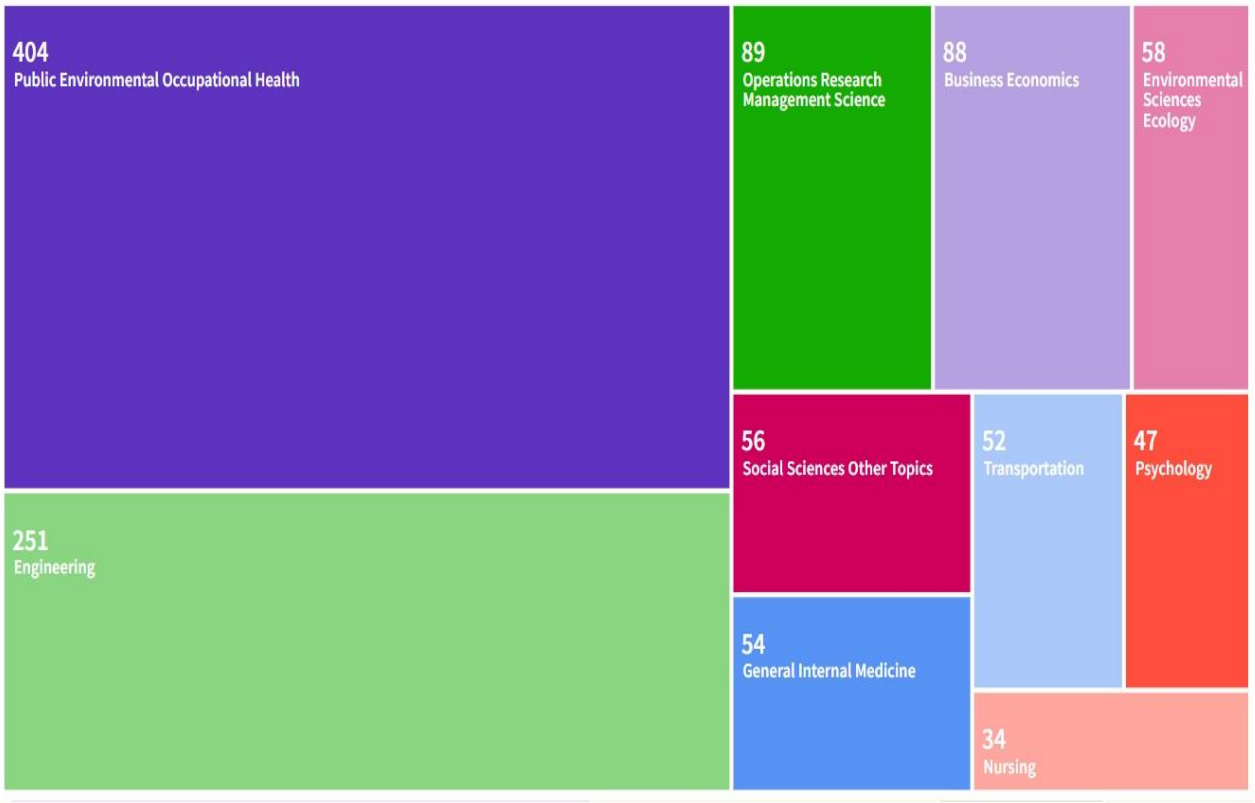

Figure 3: The 10 most published research areas on work accidents in the world [19].

Figure 4 shows the distribution of the 10 countries that publish the most on work accidents in the world. It was determined that most of the publications were made in the United States (280 publications), followed by Canada (86 publications) and Turkey (80 publications). It is seen that the countries with the least publications are France (33 publications), South Korea (34 publications) and Germany (39 publications).

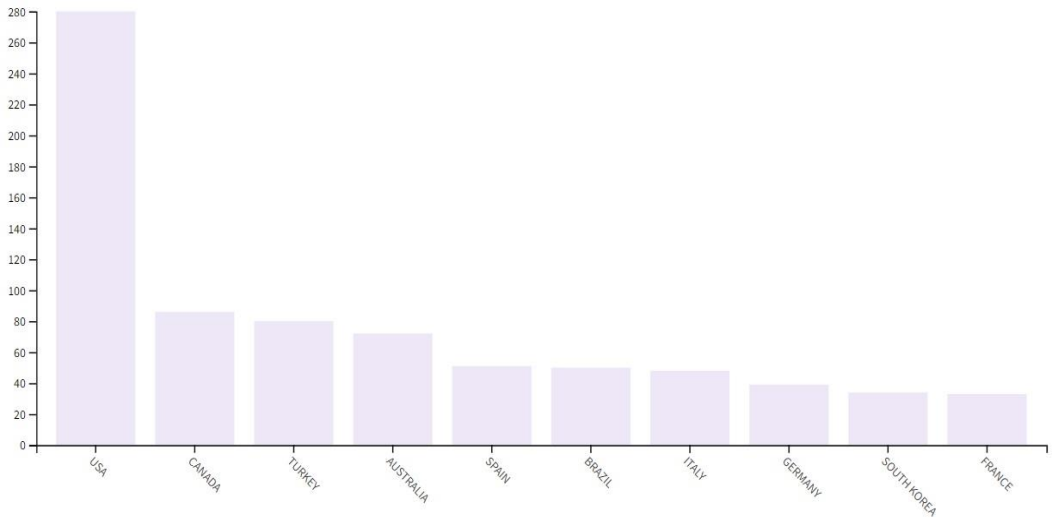

Figure 4: The 10 countries that publish the most about work accidents in the world [19].

Figure 5 shows the keywords used in studies on work accidents in the world. In the studies, the authors used 2791 different keywords. Keywords used two or more times were included in the word cloud analysis. The size of the circle shows the frequency of use of the keyword, colors show the clustering of keywords, and lines show the usage of keywords together. The most frequently used keywords were found to be Occupational Accident (140 times), Work Accidents (53 times) and Occupational Accidents (51 times).

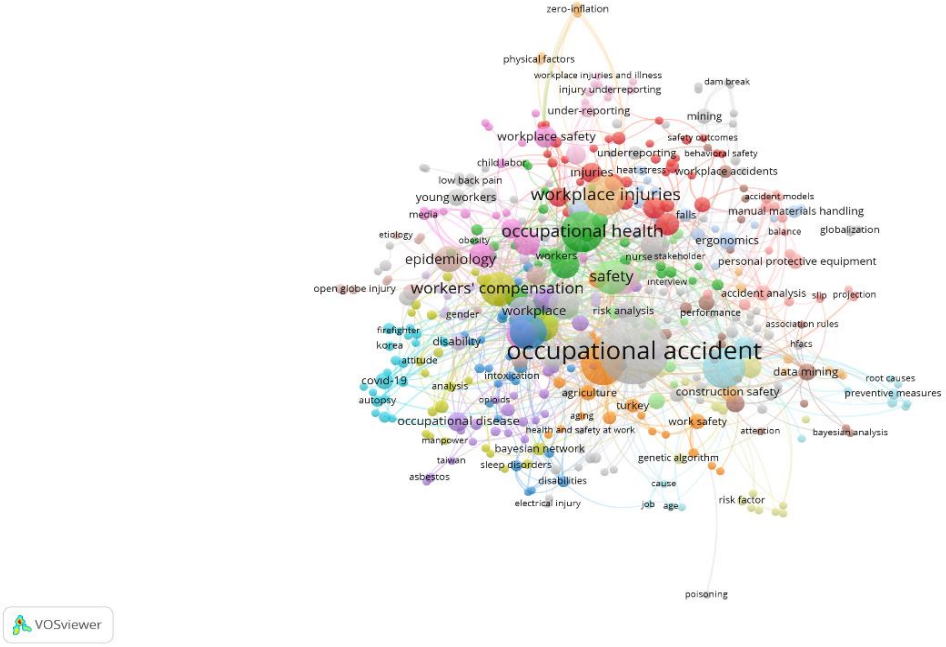

Figure 5: Keywords used in studies on work accidents in the world [19].

3.1. Publications From Türkiye

In the next part of our research, a total of 100 publications related to work accidents, addressed to Turkey, were analyzed. The distribution of the number of publications by years is shown in Figure 6. It is noteworthy that especially in 2021 and 2022, the number of publications addressing Turkey is higher than in other years. Additionally, the number of publications in 2019 and 2015 is higher than in other years. In 2023, the number of publications appears to be 0. This may be due to the fact that 2023 has not yet been completed.

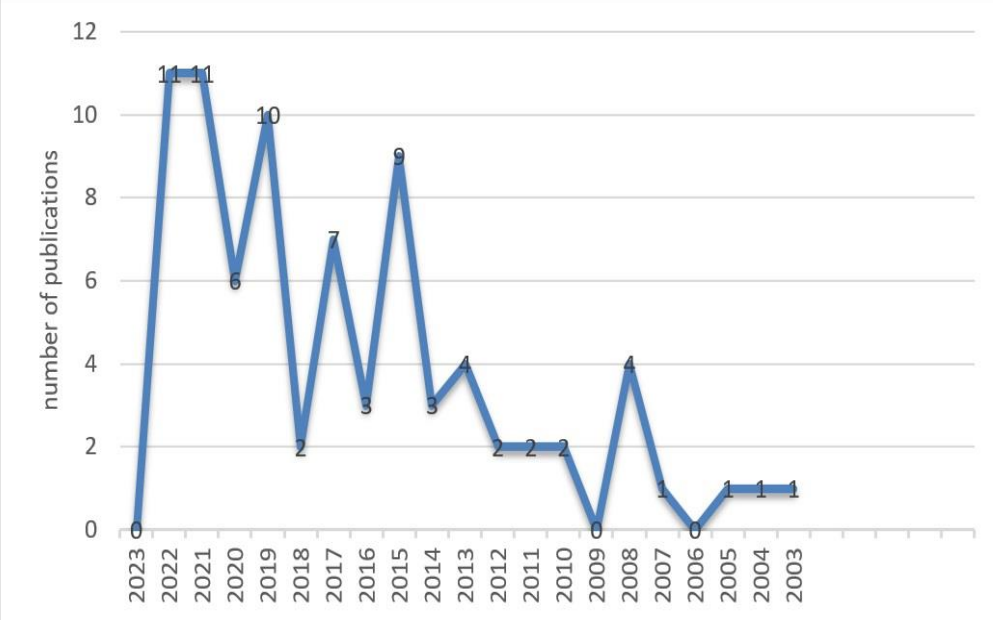

Figure 6: Distribution of studies on work accidents in Turkey by years [20].

In the table, the distribution of publications regarding work accidents from Turkey according to universities is shown for the top 10 most active universities. When the figure is examined, it can be seen that the most active contributors to the literature are Istanbul Technical University (7 publications), Yıldız Technical University (6 publications) and Istanbul University (5 publications).

Table 2: Distribution of studies on work accidents in Turkey according to universities [20].

Affiliation with Department	Record Count
Istanbul Technıcal Unıversıty	7
Yıldız Technıcal Unıversıty	6
Istanbul Unıversıty	5
Ankara Numune Traınıng Research Hospıtal	4
Dokuz Eylul Unıversıty	4
Ege Unıversıty	3
Hacettepe Unıversıty	3
Karadenız Technıcal Unıversıty	3
Kırıkkale Unıversıty	3
Mınıstry Of Justıce Turkey	3

Figure 7 shows the 10 most published research areas in the field of occupational accidents in Turkey. The most common ones are "Engineering" (20 publications), "Public Environmental Occupational Health" (17 publications) and "Emergency Medicine" (12 publications).

Figure 7. The 10 most published research areas in the field of work accidents in Turkey [20].

Figure 8 shows the keywords used in studies on work accidents in Turkey. In the studies, the authors used 260 different keywords. Keywords used two or more times were included in the word cloud analysis. The size of the circle shows the frequency of use of the keyword, colors show the clustering of keywords, and lines show the usage of keywords together. The most frequently used keywords were found to be Occupational Accident (22 times), Work Accidents (11 times) and Occupational Health and Safety (9 times).

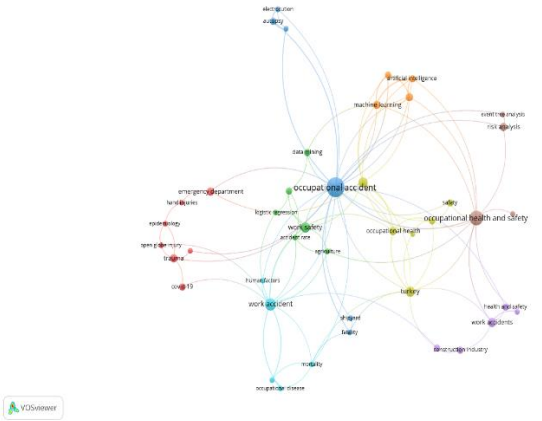

Figure 8. Keywords used in studies on work accidents in Turkey [20].

4. Conclusion and Suggestions

In this research, studies in the field of occupational accidents were examined by bibliometric analysis method. Studies in this area were accessed from the Web of Science Core Collection database. Other databases were not used. By using VOSviewer software and excel application, the publication year, research areas, the most publishing journals and word mining analyzes of the studies on occupational accidents were made.

In our research, the number of work accidents by year is given. The number of publications is a descriptive indicator that shows the productivity in the relevant field [21]. While the number of publications in this field was 16 in 2003, it is seen that it increased to 101 in 2022. Even if there is not a regular increase every year, there is an increase in the number of publications made over the last 20 years. This may be thought to be due to the fact that the importance given by countries and researchers to occupational accidents is increasing every year. In addition, legislators have to develop various policies regarding work accidents in order to increase the development levels of their countries. This situation has led to research on work accidents.

Analysis of the countries or journals that publish the most on the subject provides information about their productivity. Therefore, the one who publishes the most is considered the most productive [22]. It is seen that the journal that contributes the most to the work accident literature in the world is Safety Science. Therefore, this shows that the most productive journal contributing to the work accident literature is Safety Science. It may be important for a healthy research process for researchers who will work in this field to start their studies after reviewing the publications in the Safety Science journal. In addition, this journal is a journal with a high impact factor [23], and therefore, publication of work accident-related publications in high-impact journals will increase the motivation of researchers and positively affect the quality of future studies.

It has been determined that the countries that contribute the most to the work accident literature in the world are the United States, Canada and Turkey. It can be interpreted that these countries are the most productive countries contributing to the literature on work accidents. It can also be considered that the USA and Canada have an absolute advantage in this area due to their better economy and scientific research expenditures. In Turkey, the high number of publications on occupational accidents can be interpreted as a positive finding as it indicates that the body of knowledge on this subject will continue to increase. However, although studies on work accidents on a global scale seem sufficient, it can be interpreted that the publications have no effect on work accidents in the country.

In the international literature, it is seen that the most publications about work accidents are in the field of Public Environmental Occupational Health. Thanks to this study, it will be better for researchers who want to publish on work accidents to see which field there is a gap in and focus on that field. Turning to other research areas will provide a versatile perspective on the field of work accidents in international literature. It was determined that the most used keyword was Occupational Accident. Using the right keywords when researchers scan the literature will lead them to the right path. Additionally, the frequency of keywords shows the most researched topics [24].

When the publications addressed to Turkey were examined, it was determined that 80 publications were produced between 2003 and 2023 and the number of publications increased over the years. It can be seen that between 2003 and 2012, a maximum of 4 publications were made only in 2008. With the occupational health and safety law no. 6331 coming into force in 2012, a gradual increase in the number of publications was observed. This may be an indication that Turkey attaches more importance to work accidents after 2012.

When we look at the institutions that publish the most in this field, we see that Istanbul University is at the forefront. This situation can be thought to be due to the interest of researchers at Istanbul University in the subject or to the fact that the university supports researchers in every field. When looking at the research areas, it is seen that most publications are made in the field of Public Environmental Occupational Health. There is great interest in this field of research in Turkey, as in the world. Likewise, the gap in other research areas in Turkey can also be evaluated by researchers. It seems that the most used keyword in publications is Occupational Accident. It can be thought that the publications made from Turkey are mostly related to the Occupational Accident.

As a result, preventing work accidents should be the first priority in order to increase the productivity of workplaces and the efficiency of employees. Therefore, increasing and supporting research on occupational accidents is of great importance for the awareness of the global community and employees. Our results provided insights and valuable information regarding occupational accident research. These findings will guide researchers to guide new researchers by examining and analyzing the gaps in the literature, journals publishing on occupational accidents, and trends in research areas in a timely manner. In addition, Turkey ranks 3rd among the countries that publish on work accidents. However, although this is considered a good result in the international literature, it is not sufficient. Supporting publications about occupational accidents and creating financial resources are important in preventing occupational accidents and increasing awareness in Turkey.

Limitations

The most critical limitation of the study is that databases such as scopus and pubmed, as well as sources that are not online, were not included in the analyzes made on the studies listed in the wos care collection.

Statement of Research and Publication Ethics

Ethical approval is not required for this study.

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