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# INVESTIGATION OF OCCUPATIONAL HEALTH AND SAFETY PERCEPTIONS OF PRIVATE SECTOR EMPLOYEES AND AWARENESS OF PARTICULARLY RADIATION EXPOSURE ISSUE

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**Keywords**

Kruskal-Wallis test,
Mann-Whitney U test,
Occupational health and safety,
Radiation,
Radiation awareness.

**Abstract**

The frequency of radiation exposure and occupational health and safety awareness of private sector employees working in plastic injection, electrical contracting, construction, and textile sectors were studied according to their gender, age, sector, and education level. The data were examined using the SPSS 25 program with validity, reliability, frequency distribution, arithmetic mean, standard deviation, factor, independent sample t-test, Chi-square, Mann-Whitney U and Kruskal Wallis tests. The perception of knowing the impact on life, one of the sub-dimensions of the Occupational Health and Safety Perception Scale, was found to be higher in female employees but knowing the risks was higher in male employees. The level of perception of knowing the rules in plastic injection sector employees was higher but knowing the risks in metal works sector employees was higher than the others. The age of the employees didn't affect the sub-dimensions of the Occupational Health and Safety Perception Scale but the level of perception of knowing the rules was found to be high among high school graduates. Outcomes say that the employees must be forced to participate in Occupational Health and Safety meetings so that both their own health and safety at work and that of other employees around them will benefit.

# ÖZEL SEKTÖR ÇALIŞANLARINDA İŞ SAĞLIĞI VE GÜVENLİĞİ ALGILARI İLE ÖZELLİKLE RADYASYONA MARUZ KALMA KONUSUNDAKİ BİLİNÇ DURUMLARININ İNCELENMESİ

**Anahtar Kelimeler**

Kruskal-Wallis testi,
Mann-Whitney U testi,
İş sağlığı ve güvenliği,
Radyasyon,
Radyasyon bilinci.

**Öz**

Bu araştırmada plastik enjeksiyon, elektrik taahhüt, inşaat, tekstil gibi farklı sektörlerde çalışan özel sektör çalışanlarının radyasyona maruz kalma sıklıkları ile iş sağlığı ve güvenliği konusundaki bilinçleri katılımcıların cinsiyet, yaş, sektör, eğitim durumlarına göre incelemek amaçlanmıştır. Veriler SPSS 25 paket programı kullanılarak geçerlilik, güvenilirlik, frekans dağılımı, aritmetik ortalama, standart sapma, faktör, bağımsız örneklem t testi, Ki-kare, Mann-Whitney U ve Kruskal Wallis testleri ile incelenmiştir. Çıkan sonuçlardan İş Sağlığı ve Güvenliği Algı Ölçeği alt boyutlarından Hayata Etkisini Bilme Algısı düzeyinin kadın çalışanlarda Riskleri Bilme Algı düzeylerinin erkek çalışanlarda daha yüksek olduğu görülmüştür. Plastik enjeksiyon sektörü çalışanlarının Kuralları Bilme Algısı düzeyinin diğer sektör çalışanlarından daha yüksek olduğu gözlemlenirken metal işleri sektörü çalışanlarının Riskleri Bilme Algı düzeylerinin diğer sektörlerdeki çalışanlardan daha yüksek olduğu görülmüştür. İş Sağlığı ve Güvenliği Algı Ölçeği alt boyutları için çalışanların yaşlarına bağlı olarak anlamlı bir fark ortaya çıkmazken lise mezunu çalışanlarda İş Sağlığı ve Güvenliği Algı Ölçeği alt boyutlarından Kuralları Bilme Algı düzeyi yüksek çıkmıştır. Bu sonuçlar İş Sağlığı ve Güvenliği bilgilendirme toplantılarına katılımlarının zorunlu hale getirilerek çalışanların bilinçlendirilmesinin sağlanmasının gerektiğini bu şekilde hem kendileri hem etrafındaki diğer çalışanların işteki sağlık ve güvenliklerine olumlu etkileneceğini göstermektedir.

**Alıntı / Cite**

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# INVESTIGATION OF OCCUPATIONAL HEALTH AND SAFETY PERCEPTIONS OF PRIVATE SECTOR EMPLOYEES AND AWARENESS OF PARTICULARLY RADIATION EXPOSURE ISSUE

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**Highlights (At least 3 and maxium 4 sentences)**

- The radiation exposure frequency of workers due to job changes and their awareness were investigated.
- A pioneering research was done in the scope of the Occupational Health and Safety Perception Scale.
- The perception of knowing risks level of metal workers is found higher than the workers in other sectors.
- The Perception of Knowing the Rules for employees of the plastic injection industry was found higher.

**Purpose and Scope**

It is aimed to examine the radiation exposure frequencies and occupational health and safety awareness of employees working in different sectors such as plastic injection, electrical contracting, construction, and textile, according to their gender, age, sector, and educational level.

**Design/methodology/approach**

The data were examined with validity, reliability, frequency distribution, arithmetic mean, standard deviation, factor, independent sample t-test, Chi-square, Mann-Whitney U, and Kruskal Wallis tests using the SPSS 25 package program.

**Findings**

The level of perception of Knowing the Impact on Life one of the sub-dimensions of the Occupational Health and Safety Perception Scale, was higher in female employees, while the level of Perception of Knowing the Risks of male employees was found to be higher. The Perception of Knowing the Rules level of employees in the plastic injection industry was higher than that of employees in other sectors when the Perception of Knowing the Risks levels of metalwork employees was found to be higher. There was no significant difference between the scores in the sub-dimensions of the Occupational Health and Safety Perception Scale, depending on their age, but the level of Knowing the Rules was found to be high in high school graduate employees.

**Originality**

This article is one of the pioneering studies in the literature that attempts to determine the frequency of radiation exposure of workers working in various business sectors in Türkiye, depending on the analyses generally requested due to job changes, and examines the approaches of the same workers to the sub-dimensions of occupational health and safety in terms of different parameters such as gender, age, educational status, etc.

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## 1.Introduction

People as social beings have to work in order to survive and have a standard of living that befits human dignity. In parallel with industrialization, reasons such as people's working environments, working hours, and the increase in mechanization and competition have caused changes in production methods, and as a result, many health and safety threats have emerged. Since the industrialization processes and rates of countries may differ from each other, the degree of impact of each country on occupational health and safety may vary depending on its own characteristics (Akarsu et al., 2013). The health and safety of workers, who are the most important subjects in all production processes that continue until today, are one of the most fundamental issues of working life. While the concept of "health" is sometimes defined as "not being sick or disabled" and sometimes "not having pain" by Özabacı (1990), the World Health Organization (WHO) used a more comprehensive definition as "not only the absence of disease and disability, but also a state of complete physical, spiritual and social well-being." (Durgut, 1999). Another important concept which is “Occupational safety" can be expressed as minimizing work accidents and occupational diseases by creating healthy and safe working conditions in the work environment; thereby increasing productivity by preventing material and moral losses (Ceylan, 2011). Many studies have been carried out and regulations have been issued in Türkiye on occupational health and safety, which is a very important component of working life and labor law today, and these are given in Table 1 as date and Official Newspaper Number (ONN).

**Table 1.** Some Regulations on Occupational Health and Safety.

| Regulation | Date | ONN |
|---|---|---|
| Regulation on Labor Law | 06.04.2004 | 25425 |
| Health and Safety Precautions in Working with Asbestos | 25.01.2013 | 28539 |
| Pressure Equipment Regulation | 03.03.2018 | 30349 |
| First Aid Regulation | 29.07.2015 | 29429 |
| Regulation on Health and Safety Conditions in the Use of Work Equipment | 25.04.2013 | 28628 |
| Regulation on Duties, Authorities, Responsibilities and Training of Occupational Safety Experts | 29.12.2012 | 28512 |
| Regulation on Occupational Hygiene Measurement, Test and Analysis Laboratories | 24.01.2017 | 29958 |
| Labor Force Regulation | 11.10.2008 | 2701 |
| Personal Protective Equipment Regulation | 29.11.2006 | 26361 |
| Health and Safety Signs Regulation | 11.09.2013 | 28762 |

In professions where manpower is used intensively, occupational accidents continue to be a problem in addition to occupational diseases both in our country and globally. Occupational disease can be defined as a temporary or permanent illness, physical or mental disability suffered by the insured due to a recurring reason due to the nature of the job he/she works or performs or the conditions of work (Akarsu et al., 2013). The concept of work accidents can be defined as unplanned events that arise from unsafe actions and conditions, endanger the life safety of employees, often lead to injuries, damage to machinery and equipment, or production to stop for a while (Ceylan, 2011). It can be thought that with the rapid development of technology, occupational safety measures can be taken more easily for employees and occupational diseases can be reduced. However, the emergence of new machinery, equipment, chemicals, etc. has brought with it new problems. In addition, it has been determined that most of the occupational accidents that occur unfortunately arise from the faulty behavior of employees, that is, from human factors (Nişancı and Demirören, 2020). Although it is quite difficult to determine the accident percentage in this regard, there are studies stating that the majority of accidents, even approximately 85%, are caused by human errors, albeit in different sectors (Akbıyıklı and Dikmen, 2018; Patterson and Shappell, 2010; Suhma et al., 2021; Kumar et al., 2016; Yuliana and Ardhyaksa, 2019; Liu et al., 2019). The International Labour Organization (ILO) estimates that 2.78 million deaths are recorded worldwide each year due to work-related causes, and as a result of these incidents, approximately 3.94% of global GDP is spent on assistance for the injured people and their families, medical assistance, some training processes and procedures to reduce new accidents, days off and reduced productivity of organizations, which has a significant impact on various aspects of society (Reis et al., 2024). It is clear that occupational accidents also cause serious losses for countries. According to the ILO, the cost of occupational accidents and diseases to countries is estimated to be between 1% and 6% of a country's gross domestic product. This rate is around 6% in countries where the system does not work properly (ILO, 2019). It can be said that the financial loss caused by occupational accidents and diseases for Türkiye is over 4%. This reveals that the financial loss for 2022 is over 600 billion TL ( Ceylan and Kaplan, 2024 ). In Türkiye, 2590007 workplace accidents occurred between 2019 and 2023, and 7275 employees lost their lives. Considering 2023, when only 681655 workplace accidents were recorded and 1972 fatal accidents occurred a workplace accident occurs approximately every 46 seconds in Türkiye, and five employees lose their lives due to workplace accidents every day (Özdemir, 2024).

When the attention is turned on the fight against accidents, it can be seen that technical practices are given importance. In such a case, employees must believe in and implement these measures. Another method that may be effective in reducing occupational accidents is to have employee representatives determined among the employees to ensure coordination between the employees and the employer, thus increasing the dialogue and taking precautions against accidents in advance (Orhan and Uysal, 2019). Risk assessment has become essential in order to reduce the occurrence of accidents increase safety and improve results which are the natural result of many factors brought together such as developing technology, increasing system integration and competition to gain an advantage in the market. The definition of hazard should also be taken into consideration in these evaluations. Hazard is the potential for harm or damage that exists in the workplace or may come from outside and may affect the employee or the workplace. Risk is the possibility of loss, injury, or other harmful outcomes resulting from the hazard (Ergun et al., 2019). In some cases, risk assessment begins with the identification of the hazard, even if it is difficult to define or is unpredictable. The following situation can be described as an example of one of the unpredictable hazards. In Article 15 of the Occupational Health and Safety Law No. 6331, the employer's responsibilities within the scope of health surveillance include performing a health examination according to the danger level of the workplace at periodic intervals prescribed by the ministry, upon first entry to work, job changes, and upon return to work after absences from work. Accordingly, a chest radiography can be taken. During the shooting of these graphs, photons with high energy lose some of their energy as they pass through the body. This lost energy is mostly absorbed by the breasts. Photons that pass through the breast tissue while preserving their energy reach the film cassette. Some photons scatter back from the film cassette, causing the organs to be exposed to radiation again. Radiation can cause damage to the Deoxyribo Nucleic Acid (DNA) molecule. In addition, if the damage caused by radiation to DNA is not repaired by Breast Cancer gene 1 (BRCA1) and Breast Cancer gene 2 (BRCA2), cancer cells will form. Damages that may occur in the BRCA1 and BRCA2 genes may also cause mutations in future generations. If the damaged BRCA gene is transferred from mother or father to children, the risk of children developing breast cancer in later ages may be 85%, the risk of developing ovarian cancer may be around 50%, and the risk of contracting these diseases under the age of forty may be around 75% (Uçak, 2021). DNA can be seriously damaged by ionizing radiation. Ionizing radiation is radiation whose energy is high enough to remove electrons from an atom. The interaction of ionizing radiation with the cell and causing DNA damage is shown in Figure 1 and Figure 2, respectively.

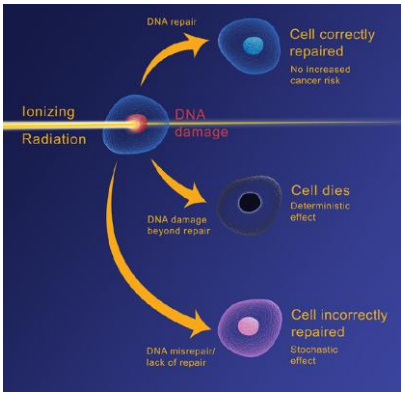


**Figure 1.** Interaction of Ionizing Radiation With a Cell
(Radiation Health Effects - Canadian Nuclear Safety Commission, 2019).


**Figure 2.** DNA Damage Caused by Radiation Breaking the Double Helix of the DNA Strand
(Radiation Health Effects - Canadian Nuclear Safety Commission, 2019).

Radiation may have direct or indirect effects (See Figure 3). In the direct effect, the incoming radiation hits the atom or molecule, causing ionization there. This results in two adjacent chemically reactive fragments. If the two parts in this separation immediately combine to form the same original molecule, no damage occurs, but in a large macromolecule such as DNA, the single or double helix of DNA can be broken by direct impact. In the indirect effect, free radicals are formed as a result of energy transfer to the atom, and these cause the molecule to break down. A free radical is an extremely reactive and electrically neutral atom with an unshared electron in its orbit (Akyolcu et al., 2010; Yeyin, 2015).

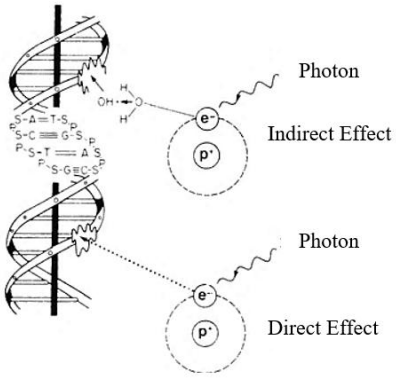


**Figure 3.** Demonstration of Direct and Indirect Effects of Radiation (Akyolcu et al., 2010).

Direct and indirect radiation can lead to consequences that can lead to the destruction of the structural integrity of the entire DNA macromolecule. Radiation, which can cause the breakdown of bases and sugars in the DNA molecule, can also be responsible for the breakdown of hydrogen and sugar-phosphate bonds. Radiation can cause damage to the cell, a decrease in the rate of cell division, and the formation of substances that are not normally found in the cell and can cause cell disintegration upon receiving ionizing radiation. Cells exposed to serious amounts of radiation may die (Akyolcu et al., 2010; Yeyin, 2015). An example of the interaction of radiation with the cell is given in Figure 4, and the division process for cells affected by radiation is given in Figure 5.

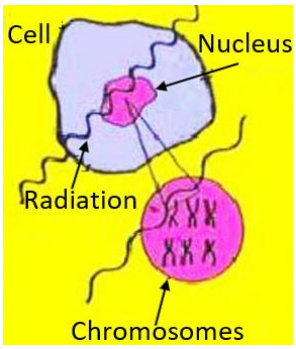


**Figure 4.** Demonstration of the Interaction of Radiation With the Cell (Coşkun, 2011).

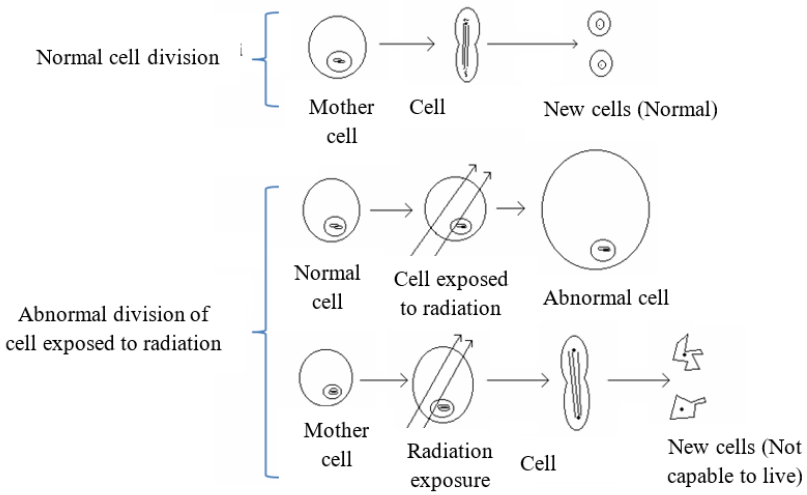


**Figure 5.** Schemes of Division Processes for Normal and Radiation-Affected Cells (Coşkun, 2011).

Radioactivity can be described as the disintegration or decay of a radioactive atomic nucleus. There are different units used for different physical concepts in radioactivity but there are also units that can be used for the same concept and they can be converted to each other. The unit of radioactivity is Becquerel, symbolized as Bq, and represents the number of nuclei that decay per second. There is also Curie (Ci) as a similar unit for the same concept, and there is a conversion between them and Bq as 1 Ci = $3.7x10^{10}$ Bq. The concept of energy dose, which is related to radiation, is defined as the radiation absorption dose of a substance, or in other words, it is the amount of energy stored by radiation in 1 kg of air, water, tissue, or any material. The unit of this energy dose is Gray (Gy) and corresponds to 1 Joule of energy accumulation in 1 kg of material. Gray describes the physical effect of radiation but does not provide information about the biological consequences of this energy accumulation in tissue. This means that equal doses of the same amount of radiation from different sources (such as α, β, γ) produce unequal biological effects. It is possible to explain this by the fact that a certain amount of energy accumulation of α radiation per tissue causes more biological damage than the same amount of energy of γ radiation. This is because the body can repair damage from radiation spread over a large area more easily than from radiation concentrated in a small area. At this point, it is inevitable to talk about the quality coefficient. Quality coefficients or quality factors are used to compare the biological effects of different types of radiation (See Table 2). For example, α radiation is considered to be 20 times more harmful in terms of its biological effects than the biological effects of χ rays or γ rays. Equivalent Dose (H) is the unit used to express biological activity and is found by multiplying Energy Dose and Quality Factor. The mathematical expression is given as in Equation 1.

$$\mathrm{H(Sv)} = \text{Energy Dose(Gy)}.\,\text{Quality Factor(Q)} \tag{1}$$

The unit of equivalent dose is Sievert (Sv). Sievert is the unit frequently used because it is the unit that is meaningful in terms of biological damage. If the simultaneous effect of several types of radiation is to be calculated as an equivalent dose, all measurements are converted to Sv units and summed.

**Table 2.** Radiation Type and Quality Factor Table (Radiation Measurement Units and Conversions, 2022).

| Radiation type | Quality factor (Q) |
|---|---|
| χ rays | 1 |
| γ rays | 1 |
| β rays | 1 |
| α radiation | 20 |
| Electrons | 1 |
| Protons | 2 |
| Neutrons | 5-20 |

Different tissues and organs exposed to the same amount of radiation are affected differently by radiation. Accordingly, weight factors ($W_T$) for tissues and organs are also defined (See Table 3).

**Table 3.** Table of Weight Factors ($W_T$) by Tissue or Organs (Radiation Measurement Units and Conversions, 2022).

| Tissue or Organ | Weight Factor ($W_T$) |
|---|---|
| Testes | 0.20 |
| Colon | 0.12 |
| Bone marrow | 0.12 |
| Lung | 0.12 |
| Stomach | 0.12 |
| Bladder | 0.05 |
| Breast | 0.05 |
| Thyroid | 0.05 |
| Liver | 0.05 |
| Skin | 0.01 |

It is possible to receive radiation, albeit at relatively low levels, from electronic devices such as mobile phones, computers, etc. that are frequently used in daily life. In addition, studies estimate that approximately 1-2% of all cancer cases in the world may be a result of radiological examinations. While the radiation exposure during one-way chest radiography is 0.02mSv, this value increases to 5-7 mSv in lung tomography. Even though a threshold radiation value at which the risk of cancer increases has not been defined, it can be said that there is a direct proportion between this risk and the radiation dose received (Lung Computerized Tomography and Radiation Safety, 2016). Radiation, which is mentioned above and whose negative consequences are clearly stated, penetrates the human body in every chest X-ray, even though it is in low doses. For people who change jobs several times during the year, this practice naturally results in taking more doses.

In this study, regarding a very important issue such as radiation, the frequency of radiation exposure of private sector employees due to the examinations carried out during their employment, occupational health and safety awareness on this subject, and also occupational health and safety subscales were examined in the light of different parameters. The work here which investigates the frequency of radiation exposure and occupational health and safety awareness of employees in different working sectors according to their gender, age group, sector and education level, is one of the pioneering studies in this field.
In this research, the employment/periodic examination forms of private sector employees working under the Occupational Health and Safety Law No. 6331 published on 30.06.2012 were examined by obtaining the permission of the employees in accordance with the Personal Data Protection (KVKK) law. In parallel with the periodic inspection information, survey questions were prepared and a survey was conducted among field employees in plastic injection, electrical contracting, construction, textile and other business lines in the private sector. The fact that field workers and employers who are exposed to radiation do not have sufficient health awareness and knowledge about radiation, and that it may negatively affect the health of not only the employees in that workplace but also the entire society, reveals the importance of this issue.
This article is organized as follows: in the material and method part of the article the problem of research, the purpose, importance, limitation, assumptions, hypotheses, and all the issues related to the research were given in detail. In the research and discussion part of the article, all the data obtained and all the results of the analysis were presented. The last part of the article is the conclusion part.

## 2. Material and Method

### 2.1. Problem of Research

In this research, it is foreseen that the health awareness and knowledge of radiation of field workers and employers who are exposed to radiation due to examinations performed for reasons such as employment may not be sufficient, and by taking radiological analyzes into consideration, it is aimed to investigate the frequency of radiation exposure and occupational health and safety awareness levels of private sector employees within the framework of different parameters. In addition, a comprehensive research was conducted on the occupational health and safety sub-criteria of employees under different parameters in the place where this study was conducted.

### 2.2. Purpose, Importance and Original Value of the Research

Within the scope of this research, the employment periodic examination forms of private sector employees working under the Occupational Health and Safety Law No. 6331 were examined by taking the permission of the employees within the framework of Personal Data Protection (PDP) law and in addition to the periodic examination information, survey questions were prepared and this survey was conducted among field workers in textile and other business lines such as plastic injection, electrical contracting, and construction. It was aimed to examine the frequency of radiation exposure and occupational health and safety awareness levels of the employees participating in the research according to the gender, age group, sector, and educational status of the participants. This study is one of the pioneering studies in this field, carried out within the framework of the parameters mentioned above. The studies that can be considered similar to the study presented here have mainly been conducted on professionals working in the health field, such as nuclear medicine nurses, doctors, radiography workers, etc. (Harris et al., 2019; Uçar et al., 2020; Abuzaid et al., 2019; Kyaw, 2024; Yunus et al., 2014). However, the study presented here is related to the workers from different sectors as mentioned above.

### 2.3. Limitations of the Research

The fact that this research covers only private sector employees, only covers the opinions of these employees, and focuses on issues such as the participant's general perception of occupational safety and how often they are exposed to radiation constitute the limitations of the study.

### 2.4. Assumptions of the Research

Within the scope of the study, it was assumed that the occupational safety perceptions of private sector employees would be determined realistically in relation to the population of the research. It was assumed that the answers given by the participants to the survey questions were sincere and realistic and that the participants were not influenced by each other while answering the survey questions.

### 2.5. Hypotheses of the Research

In this research, questions such as how often private sector employees change jobs and whether they have a chest X-ray taken when changing jobs were asked, additionally the survey questions given in the following parts of the article releted to the sub-dimensions of the Occupational Health and Safety Perception Scale were asked the and the results were examined and interpreted for the following hypotheses. The following hypotheses were predicted for this research:
There is a statistically significant difference between employees' perceptions of occupational safety and educational differences.
There is a statistically significant difference between employees' perceptions of occupational safety and sector differences.
There is a statistically significant difference between employees' perceptions of occupational safety and their gender.
There is a statistically significant difference between employees' occupational safety perceptions and age groups.

### 2.6. Population and Sample of the Research

The population of the research consists of field employees during the period in which the study was conducted, no sampling technique was chosen and it was aimed to reach all employees. The survey, which was prepared to determine employees' perceptions of occupational safety and how frequently they are exposed to radiation, was applied to randomly chosen 121 employees from different sectors in a time interval of three months due to the COVID-19 pandemic conditions.

### 2.7. Data Collection Tools of the Research

The survey, prepared to determine employees' perceptions of occupational safety and the amount of radiation they are exposed to, consists of two parts. While the first part of the study included questions about the demographic status of the employees, the second part included questions to measure the employees' perceptions of occupational safety and the frequency of radiation exposure.

### 2.8. Collection of Research Data

Permission was received from the Istanbul Gelişim University Ethics Committee to conduct the surveys. While collecting the data for the research, the COVID-19 pandemic conditions were taken into consideration and a survey method was applied to the employees by making an appointment and informing them in advance. The employees were accompanied online while filling out the survey and were asked to notify the researcher if there was a question or any issue that was not understood in the questions in the survey.

### 2.9. Data Analysis Method of the Research

The data were examined with validity, reliability, frequency distribution, arithmetic mean, standard deviation, factor, independent sample t test, Chi-square test, Mann-Whitney U test, and Kruskal Wallis test using the SPSS 25 package program. Factor analysis was applied to determine the construct validity of the scale of the applied survey form. As a result of factor analysis, a literature review was conducted and employees' perceptions of occupational safety were grouped by factor.

### 2.10. Ethical Aspect of the Study

In order to conduct the study, approval was received from the Ethics Committee of T.R. Istanbul Gelisim University at 05.05.2021 with the decision number 2021-16-15. The study group was informed about the purpose of the research and their consent was obtained.

## 3. Results and Discussion

In this research, Cronbach Alpha reliability analysis was used to test the reliability of the variables of the scale consisting of a total of 20 questions prepared to measure the Occupational Health and Safety Perception attitudes of private sector employees working under the Occupational Health and Safety Law No. 6331, and the results are given in Table 4. According to the results in Table 4, the ratio of 0.77 shows that the scale is quite reliable (Arof et al, 2018). Within the framework of this research, private sector employees working under the Occupational Health and Safety Law No. 6331 were evaluated by taking into account the parameters stated below. Evaluations were made in terms of socioeconomic and demographic characteristics, gender, education level, working time and experience, etc. A total of n=121 people participated in the survey. The employees are 40.5% female (n=49) and 59.5% (n=72) male. As a result of the question asked about the ages of the employees participating in this research, it was determined that the most participants (n = 41 people) were between the ages of 26-35 with a rate of 33.9%. 27 people (22.3%) in the age group of 18-25, 31 people (25.6%) in the age group of 36-43, 16 people (13.2%) in

the age group of 44-51, and those who stated that they were 52 years old and over were the smallest group and this corresponds to a rate of 5% (n = 6 participants).

**Table 4.** Reliability Analysis Table.

| Occupational Health and Safety Perception Scale (OHSPS) | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Alpha Value if Item Deleted |
|---|---|---|---|---|
| Question 1) I have information about Occupational Health and Safety Law No. 6331 | 71.35 | 47.658 | 0.401 | 0.759 |
| Question 2) I have been informed about Occupational Health and Safety before. | 70.37 | 47.579 | 0.486 | 0.752 |
| Question 3) As an employee, I show the necessary sensitivity to occupational safety rules. | 70.45 | 51.460 | 0.310 | 0.766 |
| Question 4) Sufficient importance is given to occupational health and safety issues in our workplace. | 71.84 | 47.933 | 0.406 | 0.759 |
| Question 5) A personnel must receive Occupational Health and Safety training before starting work. | 70.02 | 53.697 | 0.095 | 0.776 |
| Question 6) I think Occupational Health and Safety will have an impact on our working lives. | 70.07 | 53.364 | 0.131 | 0.774 |
| Question 7) It increases the efficiency and quality of work if Occupational Health and Safety rules are followed. | 70.14 | 54.139 | 0.042 | 0.778 |
| Question 8) We are regularly warned by our superiors about occupational safety at our workplace. | 71.53 | 48.839 | 0.361 | 0.762 |
| Question 9) I believe that my supervisors have sufficient knowledge about Occupational Health and Safety. | 71.23 | 49.038 | 0.428 | 0.758 |
| Question 10) Warning signs regarding Occupational Safety are sufficient in our workplace. | 71.44 | 49.022 | 0.420 | 0.758 |
| Question 11) There are written signs in our workplace explaining the use and working principle of the devices. | 71.21 | 46.738 | 0.573 | 0.746 |
| Question 12) We use personal protective equipment in our work at our workplace. | 70.77 | 47.739 | 0.565 | 0.749 |
| Question 13) We were informed in advance about the accident risks of the devices we use in our workplace. | 71.25 | 49.231 | 0.349 | 0.763 |
| Question 14) I know what work accidents occur in our profession and to which our colleagues are exposed. | 70.59 | 50.,496 | 0.399 | 0.761 |
| Question 15) I know what my legal rights are if I encounter an accident at my workplace. | 70.95 | 51.443 | 0.269 | 0.768 |
| Question 16) I know our legal rights in case of an occupational disease that we may encounter in our future working lives. | 71.16 | 47.546 | 0.613 | 0.746 |
| Question 17) I know what occupational diseases are. | 71.25 | 47.718 | 0.505 | 0.752 |
| Question 18) I have information about the dangers and risks related to our profession. | 70.58 | 50.262 | 0.420 | 0.760 |
| Question 19) I have knowledge about eliminating dangers and risks related to my profession. | 70.54 | 51.192 | 0.322 | 0.765 |
| Question 20) I have at least one relative (relative, friend, acquaintance) who had a work accident or occupational disease at workplaces where I worked before. | 71.75 | 56.441 | -0.169 | 0.815 |

In the research conducted on the educational status of the study group, it was seen that the majority were high school graduates with a rate of 39.7% (n = 48 participants). On the other hand, it was observed that the number of university graduates was the lowest, with a rate of 17.4% (n = 21 participants), and the number of secondary school graduates was close to this rate (19.8% and n = 24 participants). 28 people who are primary school graduates constitute the 23.1% group. From the questions asked to the participants to learn about the sector they work in, it was revealed that they worked most in the construction sector (n=38 participants, with a rate of 31.4%), and metal works the least (n=8 participants, with a rate of 6.6%). The number of people working in plastic injection is 21 (17.4%), the number of people working in the textile industry is 22 (18.2%), and the number of people working in other sectors is 32 (26.4%). As a result of the questions asked to investigate their work experience, it was noted that the work experience of the employees participating in the research was quite low. People with 3-5 years of work experience constitute the largest group with a rate of 34.7% and n = 42 people, while the rate of those with only 1-2 years of work experience is 16.5% (n = 20 people). The number of people with work experience between 6-10 years is 35 (28.9%), and the number of people with work experience over 10 years is 24 (19.8%). Considering these results, more than half of the employees in the research group, that is, 51.2% (n = 62 people), have not yet had more than 5 years of experience in their sectors.

From the answers given to the question about how many times employees changed jobs in the last year, it was revealed that they changed jobs at a high rate in the last year. 43% of the employees in the research group (n=52 people) stated that they changed jobs once in the last year, and 38% (n=46 people) stated that they changed jobs twice. The number of people who changed jobs 3 times is 17 (14.4%), there are 2 people who changed jobs 4 times (1.7%), 1 person who answered more (I don't remember) (0.8%) and 3 people who did not want to answer (2.5%) constitute the rest of the group. According to the results obtained, it was revealed that the majority of the employees in the research group had changed jobs in the last year, while 106 people (87.6%) among the employees stated that they had a chest X-ray taken during the job change, 11 people (9.1%) stated that they did not have it taken, and 4 people (3.3%) stated that they did not want to answer the question. These results showed that the employees participating in the study were exposed to radiation at least twice in the last year because they had a chest x-ray when changing jobs. In addition, as examinations may be carried out for different reasons such as work accidents etc. during the year, the frequency of exposure to radiation may increase. One of the positive results of the study is that a high rate of 91.7% (111 people) of the employees participating in the study attended the Occupational Health and Safety training meeting. The number of people who declared that they did not attend the training is 10, which corresponds to a very low rate of 8.3%. Although the high rate of participation in training indicates that employees' awareness of occupational health and safety has increased, the fact that they frequently have chest radiography shows that this awareness does not make a sufficient contribution, especially to radiation exposure.

**Table 5.** T-Test Results table on Participants' Occupational Health and Safety Perception Attitudes

| Occupational Health and Safety Perception Scale (OHSPS) | Test Value=3 | | | | | |
|---|---|---|---|---|---|---|
| | t | df | Sig. (2-tailed) | Mean Difference | Mean | Sd |
| Question 1) I have information about Occupational Health and Safety Law No. 6331 | 3.198 | 120 | 0.002 | 0.314 | 3.31 | 1.080 |
| Question 2) I have been informed about Occupational Health and Safety before. | 15.095 | 120 | 0.000 | 1.298 | 4.30 | 0.946 |
| Question 3) As an employee, I show the necessary sensitivity to occupational safety rules. | 20.221 | 120 | 0.000 | 1.215 | 4.21 | 0.661 |
| Question 4) Sufficient importance is given to occupational health and safety issues in our workplace. | -1.839 | 120 | 0.068 | -0.174 | 2.83 | 1.038 |
| Question 5) A personnel must receive Occupational Health and Safety training before starting work | 31.178 | 119 | 0.000 | 1.642 | 4.64 | 0.577 |
| Question 6) I think Occupational Health and Safety will have an impact on our working lives. | 29.739 | 120 | 0.000 | 1.587 | 4.59 | 0.587 |
| Question 7) It increases the efficiency and quality of work if Occupational Health and Safety rules are followed. | 28.901 | 120 | 0.000 | 1.521 | 4.52 | 0.579 |
| Question 8) We are regularly warned by our superiors about occupational safety at our workplace. | 1.380 | 120 | 0.170 | 0.124 | 3.12 | 0.988 |
| Question 9) I believe that my supervisors have sufficient knowledge about Occupational Health and Safety. | 5.595 | 120 | 0.000 | 0.430 | 3.43 | 0.845 |
| Question 10) Warning signs regarding Occupational Safety are sufficient in our workplace. | 2.851 | 120 | 0.005 | 0.223 | 3.22 | 0.861 |
| Question 11) There are written signs in our workplace explaining the use and working principle of the devices. | 5.423 | 120 | 0.000 | 0.455 | 3.45 | 0.922 |
| Question 12) We use personal protective equipment in our work at our workplace. | 11.885 | 120 | 0.000 | 0.884 | 3.88 | 0.818 |
| Question 13) We were informed in advance about the accident risks of the devices we use in our workplace. | 4.762 | 120 | 0.000 | 0.413 | 3.41 | 0.955 |
| Question 14) I know what work accidents occur in our profession and to which our colleagues are exposed. | 17.249 | 120 | 0.000 | 1.066 | 4.07 | 0.680 |
| Question 15) I know what my legal rights are if I encounter an accident at my workplace. | 10.633 | 120 | 0.000 | 0.711 | 3.71 | 0.735 |
| Question 16) I know our legal rights in case of an occupational disease that we may encounter in our future working lives. | 7.050 | 120 | 0.000 | 0.504 | 3.50 | 0.787 |
| Question 17) I know what occupational diseases are. | 5.047 | 120 | 0.000 | 0.413 | 3.41 | 0.901 |
| Question 18) I have information about the dangers and risks related to our profession. | 17.249 | 120 | 0.000 | 1.074 | 4.07 | 0.685 |
| Question 19) I have knowledge about eliminating dangers and risks related to my profession. | 17.905 | 120 | 0.000 | 1.116 | 4.12 | 0.685 |
| Question 20) I have at least one relative (relative, friend, acquaintance) who had a work accident or occupational disease at workplaces where I worked before. | -0.907 | 120 | 0.366 | -0.107 | 2.89 | 1.303 |

In the research, the Occupational Health and Safety perception attitudes of private sector employees were examined with a single sample T-Test (Test value: 3) (see Table 5). A 5-point Likert scale was used in this research. (1: Strongly disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly agree). The results were evaluated at the 5% significance level. According to the results, the participants declared that they were undecided on questions 1, 8, 9, 10, 11, 13 and 17. On the other hand, it was understood that they had a positive opinion about questions 2, 3, 5, 6, 7, 14, 18 and 19. The questions on which the participants expressed negative opinions were questions 4 and 20.

In Table 6 given in the appendices, descriptive statistics such as mean, standard deviation, minimum, and maximum value of the Occupational Health and Safety Perception Scale scores for the employees participating in the research are given. When this table is examined, in the Occupational Health and Safety Perception Scale, the Perception of Knowing Risks subscale received the highest score, while the Occupational Health and Safety Law Awareness subscale received the lowest score. The fact that employees' perception of knowing the risks is high can be considered positive, but the fact that Occupational Health and Safety Law Awareness remains at a low score is a very remarkable result.

**Table 6.** Descriptive Statistics of Occupational Health and Safety Perception Scale Scores

| **Occupational Health and Safety Perception Scale (OHSPS) Subscales** | **n** | **Min** | **Max** | $\bar{x}$ | **s** |
|---|---|---|---|---|---|
| Perception of Knowing the Rules | 121 | 6.00 | 30.00 | 20.52 | 3.83 |
| Perception of Knowing Risks | 121 | 12.00 | 30.00 | 22.88 | 2.98 |
| Perception of Knowing Its Impact on Life | 121 | 8.00 | 20.00 | 17.95 | 1.85 |
| Occupational Health and Safety **(**OHS) Law Awareness | 121 | 5.00 | 13.00 | 13.33 | 2.29 |

A hypothesis of the research study, "There is a statistically significant difference between employees' perceptions of occupational safety and their gender," was partially confirmed according to the results given in Table 7 because there was no statistically significant difference in all subscales of the Occupational Health and Safety Perception Scale when the gender of the employees was taken into consideration. Mann-Whitney U test results are given here. Considering the employees' gender, it was determined that there was a statistically significant difference between the scores they received from the sub-dimensions of Knowing the Risks and the Perception of Knowing the Impact on Life, which are sub-dimensions of the Occupational Health and Safety Perception Scale ($p<0.05$).

**Table 7.** Comparison of Occupational Health and Safety Perception Scale Scores of Employees According to Their Gender

| **Occupational Health and Safety Perception Scale (OHSPS) Subscales** | **Gender** | **n** | **Mean Rank** | **Sum of Ranks** | **U** | **Z** | **p** |
|---|---|---|---|---|---|---|---|
| Perception of Knowing the Rules | Female | 49 | 62.49 | 3062.00 | 1691.000 | -0.387 | 0.698 |
| | Male | 72 | 59.99 | 4319.00 | | | |
| | Total | 121 | | | | | |
| Perception of Knowing Risks | Female | 49 | 49.63 | 2432.00 | 1207.000 | -2.991 | **0.003*** ** |
| | Male | 72 | 68.74 | 4949.00 | | | |
| | Total | 121 | | | | | |
| Perception of Knowing Its Impact on Life | Female | 49 | 68.19 | 3273.00 | 1359.000 | -2.033 | **0.042** ** |
| | Male | 72 | 55.38 | 3987.00 | | | |
| | Total | 121 | | | | | |
| OHS Law Awareness | Female | 49 | 64.99 | 2701.50 | 1476.500 | -1.534 | 0.125 |
| | Male | 72 | 55.13 | 4679.50 | | | |
| | Total | 121 | | | | | |

The significance levels are *** for 99%, ** for 95% , and * for 90%.
A comparison was also made with the Chi-Square test and similar results were obtained (See Table 8). According to these two results, it was determined that there was a statistically significant difference between the perception of knowing the risks and the perception of knowing the impact on life of the employees participating in the research and their gender. It was revealed that female employees had a higher Perception of Knowing the Impact on Life than male employees, while male employees had a higher Perception of Knowing the Risks.
According to Bedük, et al., 2016 it is mentioned that women take more risks than men for different reasons. It is seen that gender factor has been an important and effective element in shaping social status in societies especially

according to the norms in society. While this situation indicates that men do not take some risks, it supports the fact that the male employees in our study have a high perception of knowing the risks. The fact that the perception of female employees in our study about knowing the impact on life is high in the same sample study given above it is said that women can balance their work and family life. This situation supports the fact that women have a high level of awareness about the impact of different conditions in working life on their lives. No significant difference was observed regarding the other two subscales.

**Table 8.** Comparison of Chi-Square Analysis According to Gender of Employees

| **Gender** | **Perception of Knowing the Rules** | | | |
|---|---|---|---|---|
| | 5-11 | 12-15 | 16-18 | Sig.(p) |
| Male | 23.6% | 40.3% | 36.1% | 0.251 |
| Female | 24.5% | 26.5% | 49.0% | |
| Total | 24.0% | 34.7% | 41.3% | |
| **Gender** | **Perception of Knowing Risks** | | | |
| | 12-20 | 21-23 | 24-30 | |
| Male | 8.3% | 34.7% | 56.9% | 0.037** |
| Female | 24.5% | 34.7% | 40.8% | |
| Total | 14.9% | 34.7% | 50.4% | |
| **Gender** | **Perception of Knowing Its Impact on Life** | | | |
| | 8-16 | 17-18 | 19-20 | 0.048** |
| Male | 31.9% | 25.0% | 43.1% | |
| Female | 25.0% | 12.5% | 62.5% | |
| Total | 29.2% | 20.0% | 50.8% | |
| **Gender** | **OHS Law Awareness** | | | |
| | 5-11 | 12-15 | 16-18 | |
| Male | 18.1% | 55.6% | 26.4% | 0.099* |
| Female | 14.3% | 79.6% | 6.1% | |
| Total | 16.5% | 65.3% | 18.2% | |

The significance levels are *** for 99%, ** for 95% , and * for 90%.

Table 9 shows the results of comparing the scores of the Occupational Health and Safety Perception Scale of the participants in the study according to their age groups. In this context, the results of the Kruskal-Wallis test are shown, and it has been revealed that there is no statistically significant difference between the scores of the participants in the Occupational Health and Safety Perception Scale sub-dimensions according to their age groups. Accordingly, the hypothesis predicted in the research, "There is a statistically significant difference between employees' occupational safety perceptions and age groups," could not be confirmed.

**Table 9.** Comparison of Employees' Scores According to Their Ages

| **Subscale Group** | **Age** | **n** | **Mean Rank** | **Sd.** | **$X^2$** | **p** |
|---|---|---|---|---|---|---|
| Perception of Knowing the Rules | 18-25 | 27 | 69.74 | 4 | 9.06 | 0.059* |
| | 26-35 | 41 | 66.32 | | | |
| | 36-43 | 31 | 58.08 | | | |
| | 44-51 | 16 | 49.63 | | | |
| | 52 and above | 6 | 30.75 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Risks | 18-25 | 27 | 58.07 | 4 | 8.25 | 0.083* |
| | 26-35 | 41 | 53.84 | | | |
| | 36-43 | 31 | 61.56 | | | |
| | 44-51 | 16 | 82.59 | | | |
| | 52 and above | 6 | 62.58 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Its Impact on Life | 18-25 | 26 | 63.44 | 4 | 1.26 | 0.868 |
| | 26-35 | 41 | 63.27 | | | |
| | 36-43 | 31 | 58.56 | | | |
| | 44-51 | 16 | 55.16 | | | |
| | 52 and above | 6 | 53.08 | | | |
| | Total | 121 | | | | |
| OHS Law Awareness | 18-25 | 27 | 57.67 | 4 | 2.11 | 0.715 |
| | 26-35 | 41 | 64.79 | | | |
| | 36-43 | 31 | 55.18 | | | |
| | 44-51 | 16 | 66.03 | | | |
| | 52 and above | 6 | 66.75 | | | |
| | Total | 121 | | | | |

The significance levels are *** for 99%, ** for 95% , and * for 90%.
In the study, employees were compared according to their sector-based distribution with the Kruskal-Wallis test for the Occupational Health and Safety Perception Scale (See Table 10). The results revealed that there was a statistically significant difference between the scores of the employees participating in the study from the subscales of Knowing the Risks and Perception of Knowing the Rules ($p<0.05$).

**Table 10.** Comparison of Occupational Health and Safety Perception Scale Scores of Employees According to Sector Differences

| Subscale Group | Sectors | n | Mean Rank | Sd. | $X^2$ | p |
|---|---|---|---|---|---|---|
| Perception of Knowing the Rules | Plastic Injection | 21 | 82.52 | 4 | 13.29 | **0.010*** ** |
| | Metal Works | 8 | 55.00 | | | |
| | Construction | 38 | 49.05 | | | |
| | Textile | 22 | 57.55 | | | |
| | Other | 32 | 64.94 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Risks | Plastic Injection | 21 | 54.21 | 4 | 10.23 | **0.037** ** |
| | Metal Works | 8 | 84.69 | | | |
| | Construction | 38 | 68.71 | | | |
| | Textile | 22 | 46.80 | | | |
| | Other | 32 | 60.14 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Its Impact on Life | Plastic Injection | 21 | 64.79 | 4 | 5.06 | 0.281 |
| | Metal Works | 8 | 40.44 | | | |
| | Construction | 38 | 57.75 | | | |
| | Textile | 22 | 57.86 | | | |
| | Other | 31 | 68.02 | | | |
| | Total | 120 | | | | |
| OHS Law Awareness | Plastic Injection | 21 | 74.38 | 4 | 4.44 | 0.350 |
| | Metal Works | 8 | 59.81 | | | |
| | Construction | 38 | 61.47 | | | |
| | Textile | 22 | 54.95 | | | |
| | Other | 32 | 56.11 | | | |
| | Total | 121 | | | | |

The significance levels are *** for 99%, ** for 95% , and * for 90%.
Another hypothesis predicted in the research, "There is a statistically significant difference between employees' perceptions of occupational safety and sector differences", was partially confirmed. The comparison made with Chi-Square Analysis also revealed similar results (See Table 11).

According to the results of the Kruskal-Wallis test, it was determined that there was a statistically significant difference between the perception levels of Knowing the Rules and Knowing Their Impact on Life, which are sub-dimensions of the Occupational Health and Safety Perception Scale, according to the educational status of the participants ($p <0.05$) (See Table 12). “There is a statistically significant difference between employees' perceptions of occupational safety and educational differences” was partially confirmed. A comparison was also made with the Chi-Square test according to the educational status of the participants in the research, and according to the results obtained here, it was determined that there was a statistically significant difference between the employees' Perception of Knowing the Rules and Their Impact on Life and their education (See Table 13).

**Table 11.** Comparison of Chi-Square Analysis According to Differences in Employees Based on Sector

| **Sectors** | **Perception of Knowing the Rules** | | | |
|---|---|---|---|---|
| | 5-11 | 12-15 | 16-18 | Sig.(p) |
| Plastic Injection | - | 28.6% | 71.4% | 0.001*** |
| Metal Works | - | 87.5% | 12.5% | |
| Construction | 36.8% | 36.8% | 26.3% | |
| Textile | 27.3% | 31.8% | 40.9% | |
| Other | 28.1% | 25.0% | 46.9% | |
| Total | 24.0% | 34.7% | 41.3% | |
| **Sectors** | **Perception of Knowing Risks** | | | 0.030** |
| | 12-20 | 21-23 | 24-30 | |
| Plastic Injection | 4.8% | 61.9% | 33.3% | |
| Metal Works | - | 12.5% | 87.5% | |
| Construction | 10.5% | 31.6% | 57.9% | |
| Textile | 22.7% | 36.4% | 40.9% | |
| Other | 25.0% | 25.0% | 50.0% | |
| Total | 14.9% | 34.7% | 50.4% | |
| **Sectors** | **Perception of Knowing Its Impact on Life** | | | 0.667 |
| | 8-16 | 17-18 | 19-20 | |
| Plastic Injection | 19.0% | 19.0% | 61.9% | |
| Metal Works | 50.0% | 25.0% | 25.0% | |
| Construction | 28.9% | 26.3% | 44.7% | |
| Textile | 31.8% | 18.2% | 50.0% | |
| Other | 29.0% | 12.9% | 58.1% | |
| Total | 29.2% | 20.0% | 50.8% | |
| **Sectors** | **OHS Law Awareness** | | | 0.389 |
| | 5-11 | 12-15 | 16-18 | |
| Plastic Injection | 4.8% | 76.2% | 19.0% | |
| Metal Works | 12.5% | 62.5% | 25.0% | |
| Construction | 18.4% | 60.5% | 21.1% | |
| Textile | 13.6% | 81.8% | 4.5% | |
| Other | 25.0% | 53.1% | 21.9% | |
| Total | 16.5% | 65.3% | 18.2% | |

The significance levels are *** for 99%, ** for 95% , and * for 90%.

**Table 12.** Comparison of Occupational Health and Safety Perception Scale Scores According to the Educational Status of Employees

| **Subscale Group** | **Education** | **n** | **Mean Rank** | **Sd.** | **$X^2$** | **p** |
|---|---|---|---|---|---|---|
| Perception of Knowing the Rules | Primary Education | 28 | 45.05 | 3 | 15.82 | **0.001*** ** |
| | Secondary Education | 24 | 65.08 | | | |
| | High School | 48 | 74.01 | | | |
| | University | 21 | 47.86 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Risks | Primary Education | 28 | 64.39 | 3 | 2.103 | 0.551 |
| | Secondary Education | 24 | 54.21 | | | |
| | High School | 48 | 64.51 | | | |
| | University | 21 | 56.21 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Its Impact on Life | Primary Education | 28 | 56.73 | 3 | 10.07 | **0.018** ** |
| | Secondary Education | 24 | 48.75 | | | |
| | High School | 47 | 60.13 | | | |
| | University | 21 | 79.79 | | | |
| | Total | 120 | | | | |
| OHS Law Awareness | Primary Education | 28 | 66.61 | 3 | 5.84 | 0.119 |
| | Secondary Education | 24 | 46.77 | | | |
| | High School | 48 | 65.94 | | | |
| | University | 21 | 58.50 | | | |
| | Total | 121 | | | | |

The significance levels are *** for 99%, ** for 95% , and * for 90%.

**Table 13**. Comparison of Chi-Square Analysis according to the Educational Status of Employees

| **Education level** | **Perception of Knowing the Rules** | | | |
|---|---|---|---|---|
| | 5-11 | 12-15 | 16-18 | Sig.(p) |
| Primary Education | 42.9% | 35.7% | 21.4% | 0.004*** |
| Secondary Education | 12.5% | 41.7% | 45.8% | |
| High School | 10.4% | 33.3% | 56.3% | |
| University | 42.9% | 28.6% | 28.6% | |
| Total | 24.0% | 34.7% | 41.3% | |
| **Education level** | **Perception of Knowing Risks** | | | 0.335 |
| | 12-20 | 21-23 | 24-30 | |
| Primary Education | 10.7% | 39.3% | 50.0% | |
| Secondary Education | 25.0% | 33.3% | 41.7% | |
| High School | 8.3% | 31.3% | 60.4% | |
| University | 23.8% | 38.1% | 38.1% | |
| Total | 14.9% | 34.7% | 50.4% | |
| **Education level** | **Perception of Knowing Its Impact on Life** | | | 0.012** |
| | 8-16 | 17-18 | 19-20 | |
| Primary Education | 28.6% | 32.1% | 39.3% | |
| Secondary Education | 45.8% | 16.7% | 37.5% | |
| High School | 29.8% | 21.3% | 48.9% | |
| University | 9.5% | 4.8% | 85.7% | |
| Total | 29.2% | 20.0% | 50.8% | |
| **Education level** | **OHS Law Awareness** | | | 0.202 |
| | 5-11 | 12-15 | 16-18 | |
| Primary Education | 3.6% | 71.4% | 25.0% | |
| Secondary Education | 29.2% | 62.5% | 8.3% | |
| High School | 14.6% | 64.6% | 20.8% | |
| University | 23.8% | 61.9% | 14.3% | |
| Total | 16.5% | 65.3% | 18.2% | |

The significance levels are *** for 99%, ** for 95% , and * for 90%.

The last research conducted within the framework of this study is to compare the scores of the Occupational Health and Safety Perception Scale of the participants according to their work experience. As a result of the scores obtained from the sub-dimensions of the Occupational Health and Safety Perception Scale according to their work experience using the Kruskal-Wallis test, it was determined that there was no statistically significant difference within the framework of the Occupational Health and Safety Perception Scale according to the differences in the work experience of the employees (See Table 14).

**Table 14.** Comparison of Occupational Health and Safety Perception Scale Scores According to Employees' Work Experience Differences

| **Subscale Group** | **Year** | **n** | **Mean Rank** | **Sd.** | **$X^2$** | **p** |
|---|---|---|---|---|---|---|
| Perception of Knowing the Rules | 1-2 Years | 20 | 64.45 | 3 | 5.17 | 0.163 |
| | 3-5 Years | 42 | 67.46 | | | |
| | 6-10 Years | 35 | 60.37 | | | |
| | Over 10 Years | 24 | 47.73 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Risks | 1-2 Years | 20 | 56.48 | 3 | 4.58 | 0.205 |
| | 3-5 Years | 42 | 57.48 | | | |
| | 6-10 Years | 35 | 58.61 | | | |
| | Over 10 Years | 24 | 74.42 | | | |
| | Total | 121 | | | | |
| Perception of Knowing Its Impact on Life | 1-2 Years | 19 | 63.61 | 3 | 0.521 | 0.914 |
| | 3-5 Years | 42 | 60.73 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 6-10 Years | 35 | 61.30 | | | |
| | Over 10 Years | 24 | 56.48 | | | |
| | Total | 120 | | | | |
| OHS Law Awareness | 1-2 Years | 20 | 56.13 | 3 | 3.01 | 0.390 |
| | 3-5 Years | 42 | 66.31 | | | |
| | 6-10 Years | 35 | 54.43 | | | |
| | Over 10 Years | 24 | 65.35 | | | |
| | Total | 121 | | | | |

## 3. Conclusion and Results

Work accidents and occupational diseases, as emphasized in the research, appear as an important problem both in Türkiye and in the world. It is very difficult to say that there is sufficient awareness of safety and health issues for employees and employers. Lack of sufficient knowledge about radiation, especially among employees exposed to radiation and employers, may threaten the health of not only the employees in that sector and region but also the health of the entire society.

In this study, a comprehensive research was conducted on a group of employees with distinctive characteristics such as different working sectors, different ages, different education levels, etc., within the scope of their frequency of exposure to radiation and their awareness of the Occupational Health and Safety Perception Scales. As can be expected due to the sectors in which they work, most of the people in the research group are male. In the research group of 121 people, there were 72 men (59.5%) and 49 women (40.5%). In terms of age, it can be said that this research was conducted with a young group because 33.9% of the participants (41 people) are between the ages of 26-35, and the number of people aged 52 and over is only 6 (5%). In terms of education levels, it is seen that the majority of the participants are high school graduates, with 48 participants (39.7%), and 21 people are university graduates (17.4%). Considering the sectors in which they work, 31.4% (38 people) of the participants work in construction, 18.2% (22 people) in textile, 17.4% (21 people) in plastic injection fields, while the remainings 26.4% (32 people) work in other sectors.

When the same people are examined in terms of their work experience, it is understood that the majority of the group consists of people with 3-5 years of work experience, with a rate of 34.7% (42 people). The group with work experience of 10 years or more remains at 19.8% (24 people). One of the results obtained is that employees change jobs frequently. Even though it is thought that they change jobs at least once a year due to these job changes, it is understood from this study that they have a chest X-ray taken at each change. Considering that similar examinations may be carried out in work accidents and similar injuries in the same year, it would be appropriate to take precautions for this study group in order to prevent the frequency of radiation exposure. Aside from the fact that the research group participants changed jobs frequently, the fact that the participation rate of these people in the Occupational Health and Safety training was quite high with 91.7% which is a positive result. Ensuring that all workers attend the Occupational Health and Safety information meeting and ensuring that this rate is 100% is one of the most important steps to be taken for employee occupational health and safety.

One of the hypotheses of the study, "There is a statistically significant difference between employees' perceptions of occupational safety and their gender", has been partially confirmed as seen from the results obtained. In this study, the Mann-Whitney U test was applied to compare the scores of the Occupational Health and Safety Perception Scale of the employees according to their gender, and according to the results obtained, there was a statistically significant difference ($p<0.05$) between the scores obtained for the Perception of Knowing the Risks and Knowing the Impact on Life, which are sub-dimensions of the Occupational Health and Safety Perception Scale. According to these results, it was revealed that the Perception Level of Knowing the Impact on Life of female employees was higher than that of male employees, while the Perception Level of Knowing the Risks was found to be higher in male employees. In addition, the results for the Occupational Health and Safety Perception Scale's Law Awareness and Perception of Knowing the Rules sub-dimension levels were independent of gender differences. Similarly, it is emphasized in the literature that perception differences may increase in gender groups. (Bedük et al., 2016; Çerezci et al., 2024).

Another hypothesis of the research, "There is a statistically significant difference between employees' occupational safety perceptions and age groups", could not be confirmed by the results obtained. According to the results of the Kruskal-Wallis test, no statistically significant difference emerged between the scores received by the employees from the sub-dimensions of the Occupational Health and Safety Perception Scale.

The hypothesis of the study which states that "There is a statistically significant difference between employees' perceptions of occupational safety and sector differences", was partially confirmed. The results of the Kruskal-Wallis test showed that there was a statistically significant difference between the scores obtained from the Perception of Knowing the Risks and Knowing the Rules sub-dimensions of the Occupational Health and Safety Perception Scale ($p<0.05$). While it was observed that the Perception Level of Knowing the Risks of metal works employees was higher than that of employees in other sectors, it was observed that the Perception of Knowing the Rules level of employees in the plastic injection industry was higher than that of employees in other sectors. The

high risk perception of workers working in metal works can be considered a positive situation. According to Yılmaz, 2021 approximately 35% of fatal occupational accidents in Türkiye occur in the construction sector each year, and one of the important reasons for occupational accidents occurring on construction sites is the lack of knowledge and awareness of workers regarding occupational safety. This study supports the sector-based occupational safety awareness situation revealed in our study, especially in the construction sector.

The last hypothesis determined for this research, "There is a statistically significant difference between employees' perceptions of occupational safety and educational differences", was partially confirmed according to the results obtained. In the comparison made according to educational status, according to the results of the Kruskal-Wallis test, it was determined that there was a statistically significant difference between the perception levels of Knowing the Rules and Knowing Their Impact on Life, which are sub-dimensions of the Occupational Health and Safety Perception Scale ($p<0.05$). Accordingly, the perception level of Knowing the Rules, one of the sub-dimensions of the Occupational Health and Safety Perception Scale, was found to be high in high school graduate employees. It is thought-provoking that the results were the same for university and primary school graduates for the same level in question. The reason for the high perception of knowing the rules of the high school graduates may be related to the type the high schools they graduated from. Thera are vocational or technical high schools in which the school curricula are planned directly in accordance with the field of work, their perception of knowing the rules regarding occupational health and safety in the relevant work sectors may be high. There are some documents and guides which are prepared for Vocational and Technical Education Schools in cooperation with the Ministry of National Education and the General Directorate of Occupational Health and Safety of the Ministry of Labor and Social Security. Accordingly, it is an expected situation that the awareness of the students who graduated from these high schools is high regarding Occupational Health and Safety. In one of the studies supporting this estimate, it is emphasized that 78% of the vocational high school students selected as a sample received up to 8 hours of Occupational Health and Safety training, and the percentage of students who received up to 12 hours of Occupational Health and Safety training was 6.6% (Bayguş , 2019). This situation supports the fact that the high school students can have high awareness of Occupational Health and Safety in terms of Knowing the Rules.

Finally, it was observed that the level of Perception of Knowing the Impact on Life was high for university graduate employees.

In addition to the results stated above, it was observed that there was no statistically significant difference between the scores of the employees participating in the research from the Occupational Health and Safety Perception Scale sub-dimensions according to their work experience.

Additionally, it can be said that the employees in the sample group were exposed to radiation as a result of having their chest x-rays taken frequently due to frequent job changes, even if it is predicted that it does not reach harmful levels (Güdük et al.,2018). Potential illnesses that may arise due to radiation should be prevented by taking certain precautions, such as preventing employees from changing jobs so frequently or limiting the number of chest x-rays taken on a yearly basis. It is also necessary to create a common awareness while taking precautions against work accidents and occupational diseases. More than 3.6 billion X-ray examinations, thirty-seven million nuclear medications, and seven and a half million radiation treatments are performed each year worldwide. Radiation exposure in medical settings affects 20% of the global population, and this number is increasing. It was noted that even among healthcare professionals examined in this study, most had insufficient knowledge about radiation exposure safety and many were inadequate in implementing radiation protection procedures (Allam et al., 2024).The actual knowledge levels of workers on OHS measures in the workplace is significantly lower than their perceived knowledge levels. Some protective measures and actions such as occupational safety expert, employee representatives, tarinings about OHS and etc. can positively affect the safety awareness of employees (Yılmaz, 2021). According to Malysa et al., 2024 awareness and knowledge in the field of occupational health and safety can transform into the level of safety culture in the workplace and therefore can also set the direction for further improvement activities in the field of occupational health and safety. The results of the study conducted by Tasnova and Rafizul , 2024, shows that occupational health and safety training has a positive effect on the attitudes and safety behaviors of the workers participating in the study, making them more conscious of avoiding occupational injury or illness, and also increasing awareness of the risk of infectious diseases. On the other hand, companies have the chance to improve employees' understanding and awareness of current safety procedures and risks through effective and periodic information implementation, and as a result, contribute significantly to achieving zero accidents in the workplace. During these efforts, companies should also pay attention to other factors such as safety culture and employee participation (Widyasmoro et al., 2025). These findings also comfirm the importance of the our study conducted and presented here.

In conclusion, it is necessary to raise the awareness of employees in Türkiye and other countries by making their participation in Occupational Health and Safety information trainings mandatory, so that they can contribute positively to the health and safety of themselves and other employees around them at work, as well as to the protection of national wealth by eliminating financial losses that may occur due to accidents that could be avoided.

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**Conflict of Interest**

No conflict of interest was declared by the authors.

**References**

Abuzaid, M.M., Elshami, W., Shawki, M., Salama, D., 2019. Assessment of compliance to radiation safety and protection at the radiology department, International Journal of Radiation Research, 17(3): 439-446

Akbıyıklı, R., Dikmen, S. Ü., 2018. İnşaat Şantiyelerinde İş Sağlığı ve İş Güvenliği (İSG) Yönetiminin Ana Belirteçleri. Düzce Üniversitesi Bilim ve Teknoloji Dergisi, 6, 1391-1409

Akciğer Bilgisayarlı Tomografisi ve Radyasyon Güvenliği, https://toraks.org.tr/site/news/3220 adresinden erişildi. Erişim tarihi: 01.09.2023

Akarsu, H., Burak, A., Çakmak, E., Doğan, B., Boz Eravcı, D., Karaman, E., Koçak., D., 2013. Meslek Hastalıkları, T.C. Çalışma ve Sosyal Güvenlik Bakanlığı, Çalışma ve Sosyal Güvenlik Eğitim ve Araştırma Merkezi, Özyurt Matbaacılık, Ankara, 48s

Akyolcu, M. C. ve Ark., 2010. İyonizan Radyasyonun Biyolojik Etkileri. ss.449-468, Editör:Dursun Ş. Biyofizik Ders Kitabı , İstanbul Üniversitesi Yayınevi, 598s

Allam, S.M.E., Algany, M.M.A.A., and Khide, Y.I.A., 2024. Radiation safety compliance awareness among healthcare workers exposed to ionizing radiation, BMC Nursing 23, 208

Arof , K.Z.M, Ismail, S., Saleh A. L., 2018. Contractor's Performance Appraisal System in the Malaysian Construction Industry : Current Practice , Perception and Understanding, International Journal of Engineering & Technology, 7 (3.9) 46-51

Bayguş, D., 2019. Bir Mesleki ve Teknik Anadolu Lisesi Öğrencilerinde İş Sağlığı ve Güvenliği Bilgi Düzeyi ve İş Kazaları Sıklığı, Yüksek Lisans Tezi, Gazi Üniversitesi, Türkiye

Bedük, A.,Eryeşil,K., Oğuz,H., 2016. Kadın ve Erkek Girişimcilerin Algılama Farklılıkları. Selçuk Üni. Sosyal Bilimler Meslek Yüksekokulu Dergisi. 19(41),1-15

Ceylan, H., 2011. Türkiye'deki İş Kazalarının Genel Görünümü ve Gelişmiş Ülkelerle Kıyaslanması. International Journal of Engineering Research and Development,3 (2),18-24.

Ceylan, H., Kaplan, A., 2024. Fatal Occupational Accidents in Turkey from a City and Country Perspectiv , Urban Academy, 17(1), 231-254

Coşkun, Ö., 2011. İyonize Radyasyonun Biyolojik Etkileri. Süleyman Demirel Üniversitesi Teknik Bilimler Dergisi. 1(2),13-17

Çerezci,D., Tutgun-Ünal, A., Cerezci, F., 2024. Elektromanyetik Radyasyon Maruziyet Algısı Ölçeğinin Geliştirilmesi: Geçerlilik ve Güvenilirlik Analizleri. Düzce Üni.Bilim ve Teknoloji Dergisi. 12(1),247-263

Durgut, Ş. V.,1999. Sağlık kuruluşlarında iş ve güvenliği ve meslek hastalıkları ve İ.Ü. Cerrahpaşa Tıp Fakültesi ile S.S.K. İstanbul Hastanelerinde İş Güvenliği ve Meslek Hastalıklarına ilişkin bir araştırma, T.C. İstanbul Üniversitesi, Sosyal Bilimler Enstitüsü, İşletme Fakültesi, Hastane ve Sağlık Kuruluşlarında Yönetim Bilim Dalı, Yüksek Lisans Tezi, İstanbul,133s

Ergun, A. R., Atalay, Ö., Tülü, M., Acar, İ., Özmen, M., Işık, M. K., 2019. Kamuda İş Sağlığı ve Güvenliği (6331 Sayılı İSG Kanununun Kamuda Uygulanması), T.C. Aile, Çalışma ve Sosyal Hizmetler Bakanlığı İş Sağlığı ve Güvenliği Genel Müdürlüğü, Matus Basımevi, Ankara, 68s

Güdük,Ö.,Kılıç,C. H, Güdük,Ö., 2018. Radyasyonun zararlı etkileri Hakkında Hastaların Bilgi Düzeyinin Değerlendirilmesi: Bir Hastane Örneği. Adıyaman Üni.Sağlık Bilimleri Derg. 4(2),874-889.

Harris, A., Loomis, J., Hopkins, M., Bylund, J., 2019. Assessment of Radiation Safety Knowledge Among Urology Residents in the United States, Journal of Endourology 33(6): 492-497.

Kumar P., Gupta S., Agarwal M., Singh U., 2016. Categorization and standardization of accidental risk-criticality levels of human error to develop risk and safety management policy, Safety Science (85) 88–98,

Kyaw, S.S., 2024. A Study On Radiation Protection Awareness Among Radiation Workers (Case Study: Selected Hospitals In Yangon), Yüksek Lisans Tezi, Yangon Üniversitesi, Mynmar

Liu W., Chen X., and Sun Q., 2019. Development of Enterprise Accident Early Warning System Based on IOT. Springer International Publishing AG, part of Springer Nature 2019 P. M. F. M. Arezes (Ed.): AHFE 2018, AISC 791, 139–148

Malysa, T., Furman, J., Kuczynska-Chalada, M., Tyranski, M., Blasko, P., 2023. Survey of Employees' Awareness Regarding Occupational Health and Safety in the Automotive Industry, Scientific Papers of Silesian University of Technology Organization and Management Series No.182, 229-243

Nişancı, Z. N., Demirören, J. K., 2020. Davranış Odaklı İş Güvenliği Uygulamalarının İş Güvenliği Kültürüne Etkisi. Journal of Yasar University, 2020, Special Issue on 3rd International EUREFE Congress, 21-39

Orhan, S., Uysal, S., 2019. İş Sağlığı ve Güvenliğinin Sağlanmasında Çalışan Temsilciliğinin Önemi. Yorum-Yönetim-Yöntem Uluslararası Yönetim-Ekonomi ve Felsefe Dergisi 7(1), 1-16

Özabacı, M. N., 1990. Tedavi edici saglık hizmetlerinde çalışan hemşirelerde görülen meslek hastalıkları ve nedenlerinin araştırılması, T.C. İstanbul Üniversitesi, Sağlık Bilimleri Enstitüsü, Hemşirelik Anabilim Dalı, Psikiyatri Hemşireliği Bilim Dalı, Yüksek Lisans Tezi, İstanbul, 94s

Özdemir, M., 2024. Work Accidents, Occupational Diseases, and Lost Workdays in Türkiye's Forestry Sector:
Increasing Risks and Improvement Proposals for the 2019-2023 Period, Journal of Apitherapy and Nature 7(2), 141-153

Patterson J. M., Shappell S. A., 2010. Operator error and system deficiencies: Analysis of 508 mining incidents and accidents from Queensland, Australia using HFACS, Accident Analysis and Prevention, 42, 1379–1385

Radiation Health Effects - Canadian Nuclear Safety Commission, https://www.cnsc-ccsn.gc.ca/eng/resources/radiation/radiation-health-effects/ adresinden erişildi. Erişim tarihi: 06.03.2024

Radyasyon Ölçüm Birimleri ve Dönüşümleri, https://www.afad.gov.tr/kbrn/radyasyon-olcum-birimleri-ve-donusumleri adresinden erişildi. Erişim tarihi: 01.09.2023

Reis, B.L.dos, Leal, G.C.L., Souza, R.C.T.de., 2024. Work accidents in Brazil: a perspective from registered accidents in the manufacturing industry from 2018 to 2023, Brazilian Journal of Health Review, 7(9) p. e75263

Suhma F. M., Marchianti A. C. N., Ma'rufi I., 2021. Effect of Unsafe Actions and Conditions with Work Accidents in the Rotary Section of Plywood Industry Pt.x Jember, Indonesia. Medico-legal Update, 21(3), 274-279

Tasnova, S.I., Rafizul, I.M., 2024. Assessing the Efficacy of Training Program to Promote a Positive Occupational Health and Safety Culture Among Informal Workers at Open Dump Site in Khulna Using Inductıve Thematic Analysis, 7th International Conference on Civil Engineering for Sustainable Development (ICCESD 2024), Bangladesh

Uçak, U., 2021. İş sağlığı ve güvenliği algılarının radyasyona maruz kalma sıklığı kapsamında değerlendirilmesi (Bazı Özel Sektör Çalışanlarına Yönelik Uygulama). T.C. İstanbul Gelişim Üniversitesi Lisansüstü Eğitim Enstitüsü, Yüksek Lisans Tezi, Türkiye

Uçar, M., Akkoç, A., Topçuoğlu, M., Öztürk, S. A., Demir, M., 2020. Evaluation of exposure and awareness of radiation in healthcare professionals exposed to ionizing radiation, Acta Medica Alanya 4(3):285-290

Widyasmoro, A., Elnardy, M.C., Supriyadi, S., Zaharuddin, Z., 2025. The Influence of Safety Briefing, Knowledge and Awareness of Occupational Safety and Health in Realizing Zero Accidents in the Work Environment, 6 (1),14-21

Yeyin, N., 2015. Radyasyonun Biyolojik Etkileri. Nükleer Tıp Seminerleri, Galenos Yayınevi,3,139-43

Yılmaz, F., 2021. Analysis of the interaction between safety measures and workers' safety awareness from the construction workers' perspective, Engineering, Construction and Architectural Management 30 (1), 41-55

Yuliana L., Ardhyaksa D.,2019. Analysis Of Unsafe Action And Unsafe Condition Based On Occupational Health And Safety Card reporting programs. Journal of Global Research in Public Health, 4 (2), 78-86

Yunus, N.A., Abdullah, M.H.R.O., Said, M.A., Ch'ng, P.E., 2014. Assessment of radiation safety awareness among nuclear medicine nurses: a pilot study, Journal of Physics: Conference Series 546 , 012015.