

Occupational accidents and affecting factors of metal industry in a factory in Ankara

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Abstract

Objective: According to the statistics of the Social Security Institution, 18672 occupational accidents occurred in the metal industry in 2008 in Turkey. Whereas 78 of these accidents resulted in death, 252 people became permanently incapable of working. In 2008, 369677 working days were lost as a result of occupational accidents. Evaluating the reasons for and the results of accidents in the metal industry and contributing to the development of recommendations for prevention in accordance with the information obtained. **Method:** The study was conducted with 201 of 210 workers working in heavy metal manufacturing and construction in the building company between April 2008 and June 2008. **Results:** The frequency of occupational accidents among the metal workers was 22% between January 2007 and June 2008. The reasons for the workers' accidents are listed as; insufficient use of personal protective equipment (44%), carelessness (37%), and personal reasons, not to be taken of security measures at machines and looms/ unsuitable machines (both 17%). **Conclusion:** The study demonstrates that the accidents mostly occur because of failure to use of personal protective equipment, insufficient vocational training.

Key Words: Occupational, accident, metal industry, prevention

Ankara'da bir metal sanayi fabrikasında iş kazaları ve etkileyen faktörler

Özet

Amaç: 2008 yılında Sosyal Güvenlik Kurumu'nun verilerine göre metal sanayisinde 18672 iş kazası meydana gelmiş ve 369677 işgünü kaybı olmuştur. Bu kazalardan 78 tanesi ölüme sonuçlanırken, 252 kişi kalıcı olarak işgöremez hale gelmiştir. Metal sanayisinde meydana gelen kazaların sebep ve sonuçlarını inceleyerek, elde edilen bilgiler doğrultusunda kazaların önlenmesine yönelik tavsiyelerin geliştirilmesi amaçlanmıştır. **Yöntem:** Araştırma, Ankara'da faaliyet gösteren ağır metal imalat, konstrüksiyon ve inşaat sanayi şirketinde 2008 Nisan-2008 Haziran döneminde çalışan 210 işçinin 201'ine anket uygulanmasıyla yürütülmüştür.

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Bulgular: Ocak 2007 ve Haziran 2008 tarihleri arasında metal işçilerinin iş kazası sıklığı %22 bulunmuştur. İş kazalarının nedenleri olarak yetersiz kişisel koruyucu ekipman kullanımı (%44), dikkatsizlik (%37), kişisel nedenler (%17) ile makine ve tezgahlarda güvenlik önlemlerinin alınmaması/makinelerin uygun olmaması (%17) belirtilmiştir. **Sonuç:** Çalışma, iş kazalarının çoğunlukla kişisel koruyucu ekipmanın kullanımındaki eksiklikten ve yetersiz mesleki eğitimden kaynaklandığını ortaya koymuştur.

Anahtar Kelimeler: İş, kaza, metal sanayi, önleme

Introduction

Industrialization, while providing benefits to communities, also leads to serious problems in the life of working people. Some of the leading problems of the work environment are produced by occupational accidents and illnesses that workers are exposed to. The economic and social structures of a country are effectively relate to the occurrence of occupational accidents and illnesses¹. The worker community, work conditions and environment present to be a serious problem not only in advanced industrials societies but also in countries moving towards industrialization. The size and the modernization of enterprises affect the number of occupational accidents².

An accident is a sudden and unexpected event that causes material and moral damage³. The World Health Organization defines an accident as "an unplanned and unexpected event"⁴. The International Labor Organization (ILO) also treats occupational accidents as unexpected and unplanned events that cause a certain damage or injury⁵.

According to the ILO, every year approximately 2.2 million people die because of occupational accidents and diseases. Every year 270 million occupational accidents occur in the world. Again ILO studies show that approximately 4% of all world's GNP (1.25 trillion dollars) is lost due to occupational accidents and diseases⁶.

In Turkey 72963 occupational accidents were detected according to the statistics of the Social Security Institution (SGK) 2008. Whereas 865 of these have resulted in deaths, 1452 people have become permanently incapable of working.

As a result of occupational accidents, 1855980 work-days have been lost in 2008⁷.

The metal sector have quite common sub-sectors related with its structure and is known with being motor sector characteristic in our country. This sector includes a wide area like: iron and steel, cast iron, crude steel, steel pipes, ferro alloys, base metal industry such as non-ferrous metals including aluminum and copper, consumer electronics, telecom equipment, military electronics, other professional and industrial equipment, computers. Due to its structure the metal industry is one of the heavy and dangerous industries, representing basic features that involve risks, requiring constant audit, information, experience and expertise⁸.

According to the statistics of SGK 18672 occupational accidents occurred in the metal sector in 2008 in Turkey. 78 of these accidents resulted with death and 252 people have become permanently incapable of working. In 2008, 369677 working days were lost as a result of occupational accidents.

When the last 3 years' statistics of the SGK were analyzed, 25% of the accidents in 2008, 39.2% in 2007, 39% in 2006 occurred in the metal workers.

9% of the fatal occupational accidents in Turkey in 2008, 10% in 2007, 7% in 2006 occurred in the metal workers^{7,9}.

In 2007 and 2008, occupational accidents all over the Turkey were observed to occur mostly in the production sectors of goods and machinery from metals (respectively 13% and 9%). When production sector of goods and machinery from metal are analyzed, there were 345099

lost workdays in 2007 and 323696 lost workdays in 2008 and 98% of these were accidents that resulted in injuries that can be treated with ambulatory care^{10,11}.

This study aims to assess the reasons for and results of accidents in the metal sector and to contribute to the development of recommendations for their prevention on the basis of this information.

Method

The study was conducted with workers working in heavy metal manufacturing, construction and building industry company, at where one of the researchers was occupational physician, between April 2008 and June 2008. In this workplace, heavy metal works such as turnkey industrial plants, rotary kilns, boiler manufacturing/assembly work, pipe bridges manufacturing/assembly work, mechanical assembly and electrical work are done. No woman is working except clerical and accounting works. Because its business is included in the scope of heavy and dangerous works, it is forbidden here to run a woman or child worker. Reaching to the all workers was aimed, but the questionnaire could be given to 201 of 210 workers. Response rate of the questionnaire was 95.7%. Accidents that occurred between January 2007 and June 2008 were asked to the workers.

In this study, the socio-demographic characteristics of the workers such-as age, marital status, educational level, income level, habits, illnesses and work section, professional title, working hours, shift status were investigated. The characteristics of occurred occupational accidents that occurred were; place, day, hour, type, reasons for the accident, organ injured by the accident, number of lost work days. Occupational accident is defined, in the questionnaire as 'the event, as a result emergency medicine care was needed, occurred while the employers are doing their job.

The questionnaire, as an instrument for collecting data, was completed by the

workers during the final two hours of one week, without any interruption of the working schedule the workers answered the questions voluntarily after they had been provided with information and the nature of the investigation had been explained to them. They were called from work teams one by one. The questionnaire was carried out by a face to face interview with each worker by the occupational physician of the company. Ethics committee approval was not obtained, because the study was conducted in the content of applications of occupational medicine.

The dependent variable of the survey was 'having an occupational accident' and the independent variables were age, marital status, educational level, income level, smoking and drinking alcohol, task, department and shift status.

The data were evaluated using the SPSS 16.0 statistical analysis computer program. In the statistical analysis, the Chi-square test was used for variables in the census. $p < 0.05$ was considered statistically significant.

Results

The mean age of the metal workers was 35.4 ± 8.1 and the median age was 35. 4% were of the workers between 31 and 40 years old, and 88. 0% were married. All workers working in this business had social insurance. 42.0% were literate or had graduated from primary school. 58.0% had an average monthly income between 1001–1500 TL. 57.0% smoked cigarette and 7.0% drank alcohol. 14.0% reported having some health problems. The most frequent stated illnesses were hypertension (3.0%), hernia (3.0%), renal stone (2.0%) and asthma (1.0%).

The metal workers' mean daily working hour was 9. 5 hours and the mean weekly working hour were 64.5 hours. Workers had been working in this business for 6.7 ± 6.5 years. The mean total time of work experience was 15.5 ± 8.7 years (median14).

Table 1. Sociodemographic Characteristics and Occupational Accidents of the Study Population

	Occupational Accident	
	Yes n (%)	No n (%)
Age Groups		
20 – 30	23 (34.0)	44 (65.0)
31 – 40	15 (19.0)	64 (81.0)
41 – 50	7 (14.0)	42 (85.0)
51 and over	0 (0)	6 (100)
	$\chi^2=9.61$	p= 0.02
Marital Status		
Single	12 (52.0)	11 (47.0)
Married	33 (18.0)	145 (81.0)
	$\chi^2=11.40$	p= 0.001
Educational Level		
Literate / Primary School Graduate	19 (22.0)	67 (78.0)
Secondary School Graduate	8 (19.0)	36 (81.0)
General High School Graduate	12 (36.0)	22 (64.0)
Vocational/Technical High School Graduate	6 (20.0)	24 (80.0)
College/University Graduate	0 (0)	6 (100)
	$\chi^2=5.52$	p= 0.23
Average Monthly Income		
≤1000 TL.	18 (29.5)	43 (70.5)
1001 – 1500 TL.	26 (22.0)	93 (78.0)
≥1501 – 2000 TL.	1 (4.76)	20 (95.24)
	$\chi^2=5.55$	p= 0.06
Smoking		
No	25 (22.0)	90 (78.0)
Yes	13 (20.0)	53 (80.0)
Quitted	7 (35.0)	13 (65.0)
	$\chi^2=2.13$	p= 0.34
Drinking Alcohol		
No	4 (27.0)	11 (73.0)
Yes	39 (22.0)	140 (78.0)
Quitted	2 (29.0)	5 (71.0)
	$\chi^2=0.35$	p= 0.83
Chronic Illnesses		
No	40 (23.0)	132 (77.0)
Yes	5 (17.0)	24 (83.0)
	$\chi^2=0.23$	p= 0.63

The frequency of workers having an occupational accident among the metal workers was 22.4% (45 people) between January 2007 and June 2008. When occupational accidents are analyzed by age groups the 20-30 age group is the one in which occupational accidents occur most

frequently, with the frequency of 34.0%. a statistically significant difference was found in the frequency of occupational accidents by age groups ($p<0.05$). The frequency of having occupational accident in married workers was 18.0% and in single workers was 52.0% ($p<0.05$). The frequency of

occupational accidents in literate/primary school graduates was 22.0%, in vocational/technical high school graduates was 20.0% and in general high school graduates was 35.0%. The group having 1001–1500 TL as an average monthly income is the group that has the most occupational accidents ($p>0.05$). The frequency of having an occupational

accidents in workers that smoked and that had quit drinking alcohol were 21.0% and 28.0% respectively (with $p>0.05$ for both) (Table 1).

No statistically significant difference was found between frequency of occupational accident and status of getting vocational training, task, department of work, shift-work (Table 2).

Table 2. Occupational Accidents of Metal Workers by Status of Getting Vocational Training, Task, Department of Work and Shift-work

	Occupational Accident			
	Yes		No	
	n	%	n	%
Status of Getting Vocational Training				
Yes	29	20.3	114	79.7
No	16	27.6	42	72.4
		$\chi^2=0.88$	$p=0.34$	
Task				
Foreman	18	17.0	88	83.0
Co-foreman	25	31.0	56	69.0
Technician	2	14.0	12	86.0
		$\chi^2=5.66$	$p=0.05$	
Department				
Manufacturing	24	23.0	80	77.0
Other*	21	21.64	76	78.36
		$\chi^2=0.01$	$p=0.94$	
Shift -Work				
No	37	24.0	120	76.0
Yes	8	18.0	36	82.0
		$\chi^2=0.31$	$p=0.58$	

*Other: Pre-manufacturing, Welding, Painting, Lathe, Finishing, Packaging, Shipment-packaging, Electricity and Warehouse.

Table 3. Distribution of Workers Having an Occupational Accident by Type of Accident

Type of Accident	n	%*
Compression, crush	11	24.4
Burr	10	22.2
Falling of a component	9	20.0
Cuts	5	11.1
Burn, welding burn	4	8.9
Falling	3	6.7
Head trauma	1	2.2
Fracture/dislocation	1	2.2
Sprain	1	2.2

*Column percentage is estimated over 45 people. Because more than one choice can be signed, column percentage is more than 100%.

The most common accidents that the workers were exposed to identified as compression and crush (24.4%), burr prick

into the eye (22.2%), falling of a component (20.0%) and cuts (11.1%) (Table 3).

Table 4. Distribution of Workers Having an Occupational Accident by Place, Day, and Time of Accident and How Many Years After the Worker Started Work in This Workplace

	n	%
Place of Accident		
Production	20	44.0
Other*	25	56.0
Day of Accident		
Monday	7	15.55
Tuesday	7	15.55
Wednesday	8	17.77
Thursday	2	4.44
Friday	9	20.0
Saturday	8	17.77
Sunday	4	8.88
Time of Accident		
07:00 -09:30	6	13.33
09:31 - 12:00	10	22.22
12:01 - 14:30	8	17.77
14:31 -17:00	10	22.22
17:01 - 20:00	3	6.66
Work Day	8	17.77
How Many Years After the Worker Started Work in This Workplace		
≤1 year	10	22.22
1-2 years	11	24.44
3-10 years	18	40.0
≥10 years	6	13.33

*Others: Pre-production, Welding, Painting, Lathe Packaging, Shipment- Packaging.

According to the present study, the majority of the workers having 1 accident (44.0%) had the accident in the manufacturing department. The frequency of accidents in the pre-production and the painting department was found to be 18.0% and 11.0% respectively. Workers having two separate accidents had their accidents in the production department with a frequency of 43.0%. In the list of showing the day of the accident, the most common day was Friday (20.0%), the second were Wednesday and Saturday, both with a frequency of 18.0%. The day on which

accidents were lowest, was Thursday with a frequency of 4.0%. The accidents occurred mostly between 09:31-12:00 and 14:31-17:00, both with a frequency of 22.0%. The frequency of workers affected by exposure to welding fumes and light throughout the work day was 18.0%. The accident frequency of workers working in this company for 12 months was 22.0% and the workers working for 1-2 years was 24.0%. It was shown that the accident frequency was increasing until 10 years- over work duration (Table 4).

Table 5. Distribution of Workers Having an Occupational Accident by the Reason for the Accident

Reason for Accident	n	%*
Insufficient use of personal protective equipment	4	44.0
Carelessness	17	38.0
Not taking security measures at machines and looms/ unsuitableness of machines	8	18.0
Personal reasons (fatigue, sleeplessness, illness, alcohol and drug use, stress, cannot estimate risks)	8	18.0
Inexperience	1	11.0
Hurry	1	11.0
Did not use personal protective equipment	4	9.0
Lack of adequate audits	2	4.0
Unsuitableness of worker and work	2	4.0
Lack of personal protective equipment	1	2.0

*Column percentage is estimated over 45 people. Because more than one choice can be entered, column percentage is more than 100%.

The reasons for the workers' accidents were listed as; insufficient personal protective equipment in use (44.0%), carelessness (38.0%), personal reasons and not taking security measures at machines and looms/ unsuitableness of machines (both 18.0%) (Table 5).

In accidents, the affected organs were listed as eyes with a frequency of 31.0%, fingers with a frequency of 27.0%, ankles and feet with a frequency of 16.0%

and the rest (26.0%) were head, face, shoulders and arms, wrists and hands, elbows, toes, body and spine. The duration of incapacity for work for workers having an accident was determined as; stay away from work for 1 or 2 days 48.9%, between 8 days and 1 month 31.1%, between 3 days and 1 week 11.1%. 2.2% of the workers stayed away from work for between 2 months and 1 year (Table 6).

Table 6. Distribution of Workers Having an Occupational Accident by the Result of the Accident

Result of Accident	n	%*
I stayed away from work for 1 or 2 days	22	48.9
I stayed away from work between 8 and 1 month	14	31.1
I stayed away from work between 3 days and 1 week	5	11.1
I have not received any scar	1	2.2
I got small, unimportant scars	1	2.2
I stayed away from work between 2 months and 1 year	1	2.2
I stayed away from work between 31 days and 59 days	1	2.2

*Column percentage is estimated over 45 people. Because more than one choice can be signed, column percentage is more than 100%.

Discussion

The group having an average monthly income of 1000 TL-lower was found to have the highest frequency of occupational accidents. Supporting this result, a study made in United States of America (U.S.A.) of

the relationship between socio-economic status and the occurrence of fatal and non-fatal occupational accidents, found that the workers earning the lowest incomes, less than 6250 US Dollars, had a higher

frequency of accidents than the workers earning more than that level¹².

The workers, who had not gotten vocational training, had accidents more than the workers who had taken the training. 71.0% of the workers stated that they had vocational training. In this study, the metal workers said that they had taken vocational training an apprentice period (90.0%). Bacak found the frequency of taking vocational training as 80.0% in a study involving 195 workers in 2002¹³. In another study, 36.0% of the workers working in an industrial site in Gemlik stated that they had received vocational training¹⁴. In another study of a furniture factory by Balcı et al. in Kayseri, 55.0% of the workers said that security related training was provided in the workplace in 2005¹⁵. Kişioğlu et al. found the frequency of vocational training in Isparta in 2004 to be 45.0%¹⁶. These results show that the importance of vocational training in the workplace is not considered essential and the subject is neglected.

In the Turkish Employers' Association of Metal Industries' (MESS) "Statistics of Occupational Accidents and Illnesses in MESS' Members-2007" report, the frequency of accidents was shown as 27.0%¹⁷, in a report for 2008 it was shown as 28.0%¹⁸ and for 2009 as 21.0%¹⁹. In the present study, this frequency was found as 22.0%. Although the frequencies of accidents by years are close to each other, the difference between reports and studies is thought to originate from the number of analyzed workplaces.

In terms of the type of accidents, the most common accidents were identified as compression and crush (24.0%), burr prick into the eye (22.0%) and falling of a component (20.0%). In the MESS 2009 statistics the most common 3 types were listed as cuts with 20.0%, compression between two objects with 17.0% and falling of the worker with 11.0%¹⁹.

It's understood that the accidents occur mostly in production and pre-production departments by means of this study. Similarly in the MESS 2009 report, it is seen that of the 3761 wounded workers

81.0% were injured in production departments¹⁹.

Accidents occurred most frequently on Fridays, between 09.31 and 12.00 and 14.31 and 17.00. In the MESS 2009 report, accidents mostly occurred at the third (14.0%) and the second (13.0%) hour of the shift, whereas for the annual report of SGK 2008, first and third hour of the shift showed the higher figures^{7,19}.

The frequency of accidents is highest during the first 1-2 years after starting to work. The annual report, SGK 2008 states that accidents occur most frequently when workers have 1 year - lower of work experience⁷.

The most important reasons for accidents are listed as; insufficient use of personal protective equipment (44.0%), carelessness (38.0%), and personal reasons and not taking security measures at machines and looms/ unsuitableness of the machines (both 18.0%). Also MESS 2009 report stated that accidents are caused by: working carelessly (65.0%), not to using personal protective equipment (11.0%) and unsafe use of hardware or tools (8.0%)¹⁹. It's thought that the being made from inappropriate material and incorrect size for the worker, could be the reasons to be not using personal protective.

The most frequently injured organs were listed as; eyes (31.0%), fingers (27.0%), ankles and feet (16.0%). The MESS 2009 report also lists as; fingers (31.0%), wrists and hands (12.0%) and ankles and feet (11.0%)¹⁹.

As a conclusion, it is understood that accidents mostly occur in workers who are between 20 and 30 years of age, single, high school graduate, working as assistant and have an average monthly income of 1000 TL - lower. It can be seen that the most common type of accident is by compression and crush, the most common result is a burr prick into the eye. Accidents occur most frequently in the production department and the most frequent reason for an accident is insufficient use of personal protective equipment.

As can be understood from the present study, there have been few studies of this subject and those are studies made in the past years. The only reference we could find for use in our study was a report prepared by the union and statistical yearbooks of Social Security Administration. And this causes the study to be lacking in making significant comparisons. However, the present study shows that accidents mostly occur because of a lack of the use of personal protective equipment and also the

insufficiency of the vocational training. Support for using personal protective equipment is very important according to the results of this study; as is support for using machinery protectors and these should be considered as basic protective approaches. Receiving continuous in-service trainings should be provided for all workers. Work environment and health surveillances should be done actively by the occupational physician and occupational safety specialist.

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