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Comparison of practices related to occupational health and safety in microscale wood-product enterprises

Yener Top *, Hakan Adanur, Mehmet Öz

Vocational School of Gumushane, University of Gumushane, Baglarbasi Mah., 29100 Gumushane, Turkey

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ABSTRACT

Risk factors in the workplace vary according to the sector and scale of the business. Small and medium-sized enterprises, especially those within the scope of the wood-products manufacturing industry, are considered to be risky, and have a relatively high accident rate. Here, we focus on the timber and furniture industries, two subsectors of the wood-products industry. A total of 47 enterprises was visited and asked to participate in a formal structured questionnaire. The findings show that the usage of personal protective equipment (PPE) was low, that lighting was often inadequate, and that these enterprises typically lacked routine organising and cleaning practices. The subsectors and the occupational health and safety practices were found to be independent, and a statistically significant relationship could only be established between the subsectors in terms of the use of dust masks and goggles. Despite the unfavourable working conditions, only one business out of 47 reported having an employee with symptoms of occupational diseases.

1. Introduction

An employee may be exposed to many risk factors in the work environment. Exposures to chemical, physical, biological and ergonomic risks can lead to occupational diseases, and exposures to structural factors or improper practices can lead to preventable accidents (Corrao et al., 2012). The incidence of these risk factors is related to the industry sector and the scale of the business (Hasle and Limborg, 2006).

Historically, the wood-products industry has been regarded as one of the most dangerous manufacturing industry sectors. Wood-products manufacturing is often labour-intensive and production-oriented, and employees typically work at a fast pace, sometimes putting their health and safety at risk. Such labour-intensive practices may result in a high priority being given to manufacturing in order to meet production quotas; however, this priority conflicts with health and safety (Michael and Wiedenbeck, 2004; Evans et al., 2005; Holcroft and Punnett, 2009).

The wood-products and furniture manufacturing industries represent a high-risk group, according to a risk analysis conducted by considering the production process as well as the chemicals used in the process, particularly the quantity of chemicals and the potential for them to become airborne in the work environment (Kim and Park, 2006).

Firm size is one of the factors that are significantly related to safety (Hadjimanolis and Boustras, 2013), and the rate of work-environment accidents in small enterprises is higher than that in large firms (Sinclair and Cunningham, 2014; Fabiano et al., 2004 cited by Masi and Cagno (2015)). Prevention of occupational accidents and diseases is often difficult for small enterprises because they typically have few health and safety resources, are unable to hire staff who will be allocated to health and safety activities, and often are unable to identify occupational hazards and manage regulations (Schneider, 2005; Malkin et al., 2006). Malkin et al. (2006) reported that small-scale enterprises engaged in the manufacture of pallets exhibited significant occupational safety and health risks. Buyukekmekci (2002) found that more than 70% of occupational accidents occurred in enterprises with 50 employees or less. Kim and Park (2006) reported that micro-sized enterprises with fewer than five employees in the Republic of Korea were excluded from some medical practices, and such enterprises were incompetent in terms of issues related to occupational health. Hasle and Limborg (2006) also noted that most small business owners believe occupational health and safety to be the responsibility of the employees.

Dust, noise and slip, trip and fall (STF) are physical risk factors. The first of these, i.e., wood dust, is an inevitable hazard in the wood-products industry (Mikkelsen et al., 2002; Warnock and Vonasek, 2009). Wood dust generated during the production process causes problems for wood-products enterprises (Warnock and Vonasek, 2009), and the dust easily becomes suspended in

* Corresponding author. Tel.: +90 534 5211581.
E-mail address: yenertop@gumushane.edu.tr (Y. Top).

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the air so that it may be inhaled by employees (Mikkelsen et al., 2002). The International Agency for Research on Cancer has classified wood dust as a human carcinogen (Mikkelsen et al., 2002; Warnock and Vonasek, 2009). In addition, it has been reported that exposure to wood dust increases the risk of asthma, chronic bronchitis, rhinorrhoea and decreased lung function (Mikkelsen et al., 2002).

Noise is a common hazard in many enterprises, including sawmills, the iron and steel industry and foundries. Noise-induced hearing loss is one of the most common occupational hazards in many countries. The main noise elements due to wood-processing machines are cutter heads and circular saws. In furniture manufacturing, equivalent sound pressure levels can reach 106 dBA (Gerges et al., 2001). Barli (1998) reported that 33–47% of forest industry employees suffer from tinnitus, headaches, irritability, or partial hearing loss.

STF accidents are an important class of incidents resulting in death or injury in the workplace. These occur as a result of complex interactions between the risk factors, which can be categorised in three groups, i.e., personal, environmental and work-related factors. In the US, 681 deaths in 2001 were caused by STF-related occupational injuries. Such deaths accounted for 14.5% of all fatal occupational accidents (Hsiao, 2014). Warnock and Vonasek (2009) noted that sawdust can create a significant slip hazard.

To protect workers from hazard in the workplace the following controls should be considered in order of decreasing effectiveness: (i) elimination, (ii) substitution, (iii) isolation, (iv) engineering controls, (v) administrative controls and (vi) PPEs. Elimination involves removing the hazard completely, while substitution will replace the hazard or hazardous work practice. Isolation means to separate the hazard or hazardous work practice from worker, while engineering controls describes the effort to minimise the risk by adapting tool or equipment. Administrative controls comprises procedure changes, employee training and instillation of signs and warning labels. Finally, PPEs intend to place a barrier between the worker and the hazard (Zaraliakos, 2013). Likewise, Reese (2008) points out that engineering checks, warning signs, predetermined safe work practices and administrative control methods should be applied to maintain control over working conditions. However, these checks are often not applicable to small and medium-sized enterprises because of the scarcity of resources (Schneider, 2005; Malkin et al., 2006). Methods of protecting the employees of such enterprises from hazards include the provision of PPE and information about its use (Reese, 2008). Akbar-Khanzadeh et al. (1995) stated that wearing PPE is the best option if industrial hygiene and other safety methods cannot satisfactorily protect employees. Lombardi et al. (2009) reported that wearing PPE to protect the eyes against foreign objects, chemicals, hot parts, biological agents and radiation is particularly effective.

The risk of accidents and occupational disease is greater in small- and medium-sized enterprises (SMEs). Furthermore, the forest-products industry is particularly hazardous. Here, we focus on microscale furniture and timber manufacturing enterprises. The objectives of the study are to address the following questions.

1. Given the high accident risk in terms of the industry and scale, are PPE and machine guards used in these enterprises?
2. What is the current status and what are the current practices with regard to physical accidents and occupational disease factors, including lighting, noise, dust and organisation and cleaning in the work environment?
3. Are there any significant differences between furniture and timber manufacturing enterprises in terms of occupational health and safety practices?

2. Materials and methods

2.1. Materials

SMEs constitute a significant fraction of the economy of all countries and a considerable share of all employees (Hasle and Limborg, 2006; Malkin et al., 2006; Cunningham et al., 2014), and they also have a higher safety risk related to work (Park et al., 2002; Hasle and Limborg, 2006; Kim and Park, 2006; Malkin et al., 2006).

In Turkey, SMEs are important in all sectors of the economy, and the rate of injuries is relatively high. Enterprises with fewer than 50 employees make up 91.41% of all enterprises in Turkey (TSI, 2015), and these businesses account for 70% of all work-related injuries (Buyukekmekci, 2002). Moreover, Turkey has the highest work-related injury (WRI) rate in Europe and second in the world (Chamber of Mechanical Engineers, 2013), with 74,841 injuries in 2012 (Social Security Institution of Turkey, 2012). A total of 2523 WRIs, 8 of which were fatal, were registered in sawmills (935) and furniture manufacturing (1588) in 2012, which accounts for 3.7% of the total for Turkish SMEs (Social Security Institution of Turkey, 2012). Sawmills and furniture manufacturing are classified sub-sections of the manufacturing sector (Section D), and are coded as Sections 20 and 36, respectively, within the Statistical Classification of Economic Activities in the European Community (ISIC Rev.3.1) (Eurostat, 2015). According to Turkish Statistical Institute (TSI) data, there are 79 enterprises in Gumushane that fall under Sections 20 and 36 (TSI, 2015). Sawmills and furniture-manufacturing enterprises account for 28.4% of all manufacturing in the province. Enterprises operating in the sawmill and furniture manufacturing subsections in the province of Gumushane are micro-sized (Top et al., 2013). The sawmills produce mainly structural timber from poplar, and the furniture enterprises mainly use engineered woods.

A field study was initiated to survey each business; however, it was not possible to visit all enterprises (not all addresses could be identified in the records of the Gumushane and Kelkit Chamber of Commerce), and some non-registered enterprises were identified using information obtained from the enterprises that participated to questionnaire. As a result, the final number of completed questionnaires was 47, which corresponds to 59.5% of the enterprises in the wood sectors in Gumushane, Turkey.

2.2. Methods

A formal standardised questionnaire was designed to collect the data on practices related to occupational health and safety in microscale wood-product enterprises and conducted with the owners of enterprises. To reach the intended enterprises, personal interviews which is one of the four main methods available in survey research was chosen. This method requires little effort from companies to participate. One of the researchers asked the questions and noted the answer on the questionnaire. Since the questions are simple, most of them have yes/no choice of answers. In the case that the respondents do not understand the questions, these can be explained by the researchers. Therefore, no pre-test of the questionnaire was carried out. Some data were gathered by another researcher/s through direct observations (e.g., whether there were safety practices in workplaces, including work organisation and cleaning, as well as measures to prevent accidents and the availability of fire extinguishers) during questionnaire. In addition to questionnaire and direct observation, photographs were also taken (with permission) to illustrate current work environment conditions and devices related work safety.

Table 1
Use of PPE in the sawmill and furniture-manufacturing sectors.

PPE		Sawmill		Furniture		Total	
		Count	Column N (%)	Count	Column N (%)	Count	Fraction of total (%)
Gloves	Not used	8	50	19	61.3	27	57.4
	Used	8	50	12	38.7	20	42.6
Dust mask	Not used	14	87.5	16	51.6	30	63.8
	Used	2	12.5	15	48.4	17	36.2
Work shoes	Not used	15	93.8	29	93.5	44	93.6
	Used	1	6.3	2	6.5	3	6.4
Earplugs	Not used	15	93.8	30	96.8	45	95.7
	Used	1	6.3	1	3.2	2	4.3
Goggles	Not used	15	93.8	20	64.5	35	74.5
	Used	1	6.3	11	35.5	12	25.5

The questions were open-ended, multiple-choice and with two options (i.e., yes/no). The open-ended questions were grouped according to similarities of answers. The questions referred to ten topics: (i) PPEs used in microscale woodworking enterprises, (ii) reasons for not using PPEs, (iii) safety guards on machines and the occurrence of warning signs, (iv) existing of practices against accidents, (v) availability of fire extinguisher, (vi) work clothing, (vii) storage of products and materials in the workshop, (viii) types of lighting, (ix) dust-removal facilities and (x) occurrence of symptoms of occupational diseases.

2.3. Data analysis

The data were analysed by using the IBM Statistical Package for the Social Sciences (SPSS) ver. 19.0 (IBM Corp., 2010). Crosstabs were used to present the data gathered by questionnaire. These tables include frequencies and percentages of frequencies within subsectors. Chi-square tests were performed on the dataset to assess whether paired observations on subsectors were independent. The H_0 and H_a hypotheses were defined as follows, and H_0 was rejected when the p-value was less than the significance level (i.e., $p < 0.05$).

H_0: variables are independent or there is no relation between them.
H_a: variables are dependent or there is relation between them.

3. Results

Table 1 lists the usage of PPE in enterprises operating in the timber and furniture subsectors. The rate of usage of dust masks and goggles in the timber manufacturing enterprises was low. The most widely used items of PPE in timber and furniture enterprises were work gloves and dust masks, respectively. The items of PPE that were used the least were safety shoes and hearing protection.

A statistically significant relationship was established in terms of the use of goggles and dust masks between sectors, i.e., the use of dust masks and goggles in the timber industry was significantly lower than that in the furniture industry ($p < 0.05$). There were no statistically significant relationships in terms of the use of other PPE between the subsectors ($p > 0.05$).

Table 2 lists the reasons cited by employees for not using PPE while working. The most common reason was that PPE causes discomfort while working.

Table 3 lists the availability of guards on machines and the occurrence of warning signs. Overall, 31.9% of machines were found to lack guards. A total of 37.5% of the enterprises did not have machines with guards in the timber sub-sector, and 29.0% of the enterprises did not have machines with guards in the furniture sector. Although our questionnaire has no question on the removal of the safe guards, some respondents stated that they removed the protective parts of the machines because they interfered with their ability to perform the task, sometimes because the employees used the machine outside of its intended purpose.

Table 2
Reasons given by employees for not using PPE at work.

Reasons for not using PPE	Count	%
It causes discomfort while working	14	35.5
It makes it difficult to perform the task	6	15.5
No habit of using it	6	15.4
The furniture/work is easier with bare hands	3	7.7
Masks cause perspiration	2	5.1
Safety shoes are heavy	2	5.1
The employer does not provide it	2	5.1
Gloves prevent working	2	5.1
It brings additional costs	1	2.6
Gloves cause risk while working with the machine	1	2.6

Table 3
Availability of guards on machines and the occurrence of warning signs.

Subsectors		Guards on machines		Warning signs	
		No	Yes	No	Yes
Sawmill	Count	6	10	15	1
	Within sawmills (%)	37.5	62.5	93.8	6.3
	Fraction of total (%)	12.8	21.3	31.9	2.1
Furniture	Count	9	22	29	2
	Within furniture enterprises (%)	29.0	71.0	93.5	6.5
	Fraction of total (%)	19.1	46.8	61.7	4.3
Total	Count	15	32	44	3
	Fraction of total (%)	31.9	68.1	93.6	6.4

Table 4
Use of practices to prevent accidents in the workplace.

Subsectors		Practices to prevent accidents	
		No	Yes
Sawmill	Count	13	3
	Within sawmills (%)	81.3	18.8
	Fraction of total (%)	27.7	6.4
Furniture	Count	27	4
	Within furniture enterprises (%)	87.1	12.9
	Fraction of total (%)	57.4	8.5
Total	Count	40	7
	Fraction of total (%)	85.1	14.9

Fig. 1. Examples of poor practices that may lead to accidents: (left) unguarded moving parts, (centre) obstructed working space and (right) exposed cables.

Table 5
Availability of fire extinguishers in the work environment.

Subsectors		Availability of fire extinguishers	
		No	Yes
Sawmill	Count	7	9
	Within sawmills (%)	43.8	56.3
	Fraction of total (%)	14.9	19.1
Furniture	Count	14	17
	Within furniture enterprises (%)	45.2	54.8
	Fraction of total (%)	29.8	36.2
Total	Count	21	26
	Fraction of total (%)	44.7	55.3

Table 6
Use of work clothing.

Subsectors		Clothing worn by employees		
		Work clothing	Casual clothing	Other
Sawmill	Count	2	12	2
	Within sawmills (%)	12.5	75.0	12.5
	Fraction of total (%)	4.3	25.5	4.3
Furniture	Count	8	22	1
	Within furniture enterprises (%)	25.8	71	3.2
	Fraction of total (%)	17.0	46.8	2.1
Total	Count	10	34	3
	Fraction of total (%)	21.3	72.3	6.4

No relationship was found between the availability of guards on machines and the subsectors ($p > 0.05$).

Only three of the 47 enterprises (6.4%) were found to have warning signs for hazards, as listed in Table 3. No relationship was found between the availability of warning signs in the work environment and the subsector ($p > 0.05$).

Table 4 lists the existence of practices aiming to prevent accidents, including simple work environment organisation and cleaning. The number of enterprises that observed these practices was low in both subsectors. A total of 85.1% of timber and furniture enterprises failed to organise their work environments to prevent accidents. There was no relationship between the practices used to prevent accidents and the subsector ($p > 0.05$).

Examples of poor practices, including storage of semi-finished products in spaces allowed for moving products and in spaces that were supposed to enable movement between machines, exposed cables and unguarded moving parts of machines can be seen in Fig. 1.

Flammable materials are used in forest-product manufacturing enterprises, and accumulation of sawdust on the machines may cause fires (Corrao et al., 2012). Despite that, 44.7% of the enterprises surveyed stated that they did not have any fire extinguishers in Table 5. There was no relationship between the availability of fire extinguishers and the subsector ($p > 0.05$).

The use of proper protective clothing may prevent some accidents; however, the usage of clothing was only 4.3% in sawmills and 17% in furniture manufacturing. The rate of enterprises in which employees wore casual clothing was 72.3%, as can be seen from the data listed in Table 6.

Inappropriate storage of partially finished products between machines restricts the available workspace, and may lead to accidents. Table 7 lists the occurrence of partially completed products being stored between machines. Such practice was observed in 57.4% of workplaces, including storage of products as well as the materials used in manufacturing. For example, storage of partially finished products in front of a banding machine was observed, as shown in Fig. 2. There was no relationship between the storage of products and materials between machines and the sectors ($p > 0.05$).

Table 7
Storage of partially finished products or materials between machines.

Subsectors		Storage between machines	
		No	Yes
Sawmill	Count	6	10
	Within sawmills (%)	37.5	62.5
	Fraction of total (%)	12.8	21.3
Furniture	Count	14	17
	Within furniture enterprises (%)	45.2	54.8
	Fraction of total (%)	29.8	36.2
Total	Count	20	27
	Fraction of total (%)	42.6	57.4

Inadequate lighting is an important cause of accidents in the workplace, and also contributes to poor efficiency. Table 8 lists the types of lighting used in the different sectors. The use of florescent lamps was higher than the use of compact fluorescent lamps and other types of lighting.

Examples of lighting devices used by some enterprises are shown in Fig. 3. Many of these lighting devices were in unsatisfactory condition due to the accumulation of dirt and dust.

Table 9 lists the usage of dust removal facilities, typically involving extraction of the dust generated during cutting, thus preventing it from becoming airborne, rather than removal of pollutants in the atmosphere of the work environment (see Fig. 4). The usage of dust-removal facilities did not differ significantly between sectors ($p > 0.05$).

Only one business stated that its employees had symptoms of an occupational disease, representing a rate of 2.1%. During the survey, the belief that wood cannot be pathogenic because it is a

Fig. 2. Examples of inappropriate storage of partially finished products and materials.

Table 8
Types of lighting used to illuminate the workplace.

Subsectors		Means of lighting		
		Florescent	Compact fluorescent lamp	Other
Sawmill	Count	12	2	2
	Within sawmills (%)	75.0	12.5	12.5
	Fraction of total (%)	25.5	4.3	4.3
Furniture	Count	23	7	1
	Within furniture enterprises (%)	74.2	22.6	3.2
	Fraction of total (%)	48.9	14.9	2.1
Total	Count	35	9	3
	Fraction of total (%)	74.5	19.1	6.4

Table 9
Usage of dust-removal facilities in the workplace.

Subsectors		Removal of dust	
		No	Yes
Sawmill	Count	6	10
	Within sawmills (%)	37.5	62.5
	Fraction of total (%)	12.8	21.3
Furniture	Count	15	16
	Within furniture enterprises (%)	48.4	51.6
	Fraction of total (%)	31.9	34
Total	Count	21	26
	Fraction of total (%)	44.7	55.3

natural material was commonly reported. There was no relationship between the occurrence of symptoms of occupational disease and the subsectors ($p > 0.05$) (see Table 10).

4. Discussion

The most widely used items of PPE in the forest-products industry in Gumushane province were gloves, followed by dust masks and then goggles. Hearing protection was the least used type of PPE. Comparing the use of PPE among subsectors, the rate of the use of dust masks and goggles was significantly higher in furniture enterprises than that in timber enterprises. The reason for this may be the engineered woods used in furniture production, which have significantly lower moisture content than the logs used in timber production. The sawdust generated during cutting is finer, and so it presents a greater inhalation hazard. The low dust-mask usage in timber-producing enterprises can be attributed to the belief that

Fig. 4. Example of dust-removal facilities.

the sawdust generated during the processing of logs is less harmful, partly due to the belief that wood is not harmful since it is a natural product. Kalliny et al. (2008) carried out a survey of ten large-scale woodwork factories, and found that size-fractional dust

Fig. 3. Examples of lighting.

Table 10
Occurrence of symptoms of occupational diseases.

Subsectors		Symptoms of an occupational disease in employees	
		No	Yes
Sawmill	Count	16	0
	Within sawmills (%)	100	.0
	Fraction of total (%)	34	.0
Furniture	Count	30	1
	Within furniture enterprises (%)	96.8	3.2
	Fraction of total (%)	63.8	2.1
Total	Count	46	1
	Fraction of total (%)	97.9	2.1

levels have been reported to be the highest in factories producing furniture and fitted kitchens.

We found that the least widely used type of PPE was hearing protection (Table 1). Park et al. (2002) established that noise-induced hearing loss is high in wood manufacturing, and Gómez et al. (2010) reported employees were exposed to a noise level of 89.5–103 dBA, on average, for 2.38 h per day. Reinhold et al. (2015) also reported that the noise level of 84.2–94.4 dB(A) in the wood industries exceeded the permitted level. Cındık and Akyuz (1998) reported that employees of small- and medium-sized forest-product industries "constantly operate in dust and smoke, and the high noise generated by the machines cause significant amount of discomfort to the environment", and that the usage of PPE was only 3.7%. Ilhan et al. (2013) found that 2.8% of employees in factories producing furniture used hearing protection and safety shoes, 35.2% used gloves, 6.8% used masks, and 2.3% used goggles. We found greater use of dust masks (36.2%) and goggles (25.5%) than reported by Ilhan et al. (2013) and similar usage of other items of PPE.

We found that the most common reason for failure to use PPE was that it caused discomfort while working. Moreover, 2.6% of enterprises stated that the use of PPE presented additional risks. Barli (1998) found that employees often reported that the use of PPE interfered with operating machines, and that they preferred not to use PPE. Arcury et al. (2015) reported that workers did not favour using PPE because it restricted their movement, was not comfortable, or was poorly fitting. Akbar-Khanzadeh et al. (1995) reported that failure to wear PPE correctly, or the use of dirty of ill-fitting PPE, caused discomfort and posed a serious risk to the health of the employee. A study of carpentry workshops revealed that the employees frequently used inappropriate PPE (Gómez et al., 2010).

Our data shows that the safety guards on machines in the furniture sector were not used with the rate of 29% and there was no relationship between the existence of the guards and the subsectors. Deficiencies in protective measures in machines, or a lack thereof, is a common problem that leads to accidents (Yigit, 2008). Sogutlu and Eroglu (2008) found that 29.2% of furniture industry enterprises did not use machine guards, and that there was no relationship between the presence of guards on machines and subsectors. Uysal et al. (2005) reported that old machines without protective components or those with inadequate protective components were used in most enterprises operating in the furniture industry. Our results are similar to those presented in the survey performed by Sogutlu and Eroglu (2008).

We found that the only 6.4% of enterprises displayed warning signs or instructions relating to hazards in the furniture and timber subsectors. Sogutlu and Eroglu (2008) reported that 42.4% of the enterprises had such warning signs (although many were inadequate), and that 36.4% of the enterprises had no such signs. Uysal et al. (2005) analysed accidents in small- and medium-sized furniture manufacturing enterprises, and found that very few of the enterprises had warning signs.

Machines in the workplaces contain hazards and exposure to those hazards can result in injuries (Chinniah, 2015) even if they are equipped with adequate safe guards. Despite this, Gardner et al. (1999) reported that guards were frequently removed since it is difficult to do the job with the guards in place. This result was confirmed by Chinniah (2015). This particular study reports that permanently removed guards coincided with 8 accidents. The reason(s) of removal were found out by Gardner et al. (1999) as (i) difficulty to do job with the guards; by Chinniah (2015) as (i) operators complaining about lack of visibility, (ii) finding of maintenance personal it tedious and (iii) rapid removal of products without stopping machines. Our data further strengthen the observation made by Gardner et al. (1999) and Chinniah (2015). The prime reason for removing guards was close/similar to the above mentioned studies. We found that many simple practices for preventing accidents were lacking in 85.1% of workplaces. For example, storage of waste in the vicinity of the machine rather than its removal was a particularly common issue, as well as storage of partially finished products between machines and exposed cabling. Aybek et al. (2003) and Ilhan et al. (2013) reported that poorly organised work environments are the second-most significant factor leading to accidents. Malkin et al. (2006) reported that enterprises producing wooden pallets often had poor housekeeping practices, and observed piles of dust, which present fall and fire risks. Gómez et al. (2010) reported that organisation and cleaning in enterprises they investigated did not satisfy minimum safety standards. Becker (2001) reported that maintenance and cleaning in the work environment can eliminate many safety problems.

Sripaiboonkij et al. (2009) reported that construction carpenters and workers in the furniture sector are the occupational groups most commonly exposed to wood dust particles. In the furniture sector sensitising and irritant chemicals such as thinners, lacquers, glues and preservatives are used. Especially the skin, which is exposed to these chemicals, is affected (Kurt et al., 2011). In order to eliminate or reduce the effects in the work environment protective personal clothings (PPCs) are used (Holmér, 2006). For example, Eriksson et al. (2004) shown that "clothing effectively reduces the amount of resin acids reaching the skin of the worker in Swedish carpentry workshops and sawmills". The usage of PPCs was low in both subsectors (21.3%), and employees typically wore casual clothing in this present study.

More than half of the enterprises (as shown in Table 7) stored partially finished products in inappropriate locations, such as between machines. The stored materials included intermediate products as well as auxiliary materials used during production. In particular, enterprises operating in the furniture industry stored products in the working area around machines and in areas between the machines, as the workplaces were not sufficiently large to provide adequate storage space. Such practices negatively impact productivity as well as health and safety. Gardner et al. (1999), in their study on mechanical equipment injuries in small manufacturing business, found that 39 of cases, workspace was inadequate, and materials left lying around as most workplaces had no proper storage space.

The lighting, a substantial risk factor effecting occupational health safety, was involved in the present study. We found that approximately 75% of enterprises used fluorescent lighting. Daylight was also used, but not exclusively. Fluorescent light sources cause vibration (Yigit, 2008), and Barli (1998) reported that they may lead to accidents due to stroboscopic effects. Gómez et al. (2010) reported that 50% of the enterprises had inadequate

lighting. Many of the enterprises included in this study had poor lighting because of the accumulation of dust (see Fig. 3). In addition, we found a lack of uniform lighting, which is particularly important in furniture enterprises, because good lighting is required to correctly dimension the materials.

We found that almost half of the enterprises lacked fire extinguishers. Top (2015) reported that relatively primitive stoves were the main source of space heating in micro-sized furniture-manufacturing enterprises. This poses a potential accident risk. Sogutlu and Eroglu (2008) found that 99% of the enterprises possessed fire extinguishers, but that the employees in 39.4% of the enterprises were not trained in their use. Gómez et al. (2010) also reported a lack of fire extinguishers.

We found that only 55.3% of enterprises contained satisfactory equipment for dust removal during cutting. The work environment was noticeably dustier in furniture manufacturing enterprises that lacked dust extraction systems. Sogutlu and Eroglu (2008) reported that only 1% of the enterprises had a general ventilation system. Vaizoglu et al. (2005) reported that 79% of furniture manufacturing enterprises had no ventilation system. Malkin et al. (2006) reported that in some cases where a ventilation system was available, it was not used and operatives worked with non-ventilated saws.

We found that 97.9% of enterprises reported they had no employees with occupational diseases or symptoms of an occupational disease, and only one business reported an employee with symptoms of an occupational disease. According to SSI data for 2012, the number of occupational diseases in Turkish forest-products industry was four. According to the same data, no occupational diseases were reported in the furniture industry (Social Security Institution of Turkey, 2012). However, this may be because not all cases were registered. A recent study of workers in the Czech Republic suggested that the number of cases of occupational respiratory diseases was larger than the reported number (Brhel, 2003).

5. Conclusion

We have investigated several factors related to occupational diseases and accidents in micro-sized wood-processing enterprises. We found that the lighting, dust extraction, organisation of the work environment, availability of warning signs, use of machine guards, and availability of fire extinguishers were inadequate in a large number of workplaces. In such a work environment, the only method to protect employees against occupational diseases and accidents is using PPE; however, the usage of PPE was found to be low. The most common items of PPE were gloves in the timber industry and dust masks and goggles in the furniture industry. The most significant obstacle to the use of PPE was found to be discomfort while working. Moreover, employees were found to remove guards on machinery.

A comparison between subsectors showed that only the use of dust masks and goggles differed between the furniture industry and the timber industry in a statistically significant manner, and no relationships were found in other practices between the subsectors.

Farina et al. (2015) reported that "the literature reports only few studies regarding safety in small businesses, and those concerning micro-enterprises are almost non-existent". Results of this present study and others, which are or will be done, enable researchers and experts to compare microscale and small businesses regarding safety practices. Therefore, we believe that the results presented in this study add new insights into safety practices in developing countries, exemplified with Turkey. Studies like this will help to reduce the lack of knowledge in this regard.

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References

Akbar-Khanzadeh, F., Bisesi, M.S., Rivas, R.D., 1995. Comfort of personal protective equipment. Appl. Ergon. 26, 195–198.
Arcury, T.A., Summers, P., Rushing, J., Grzywacz, J.G., Mora, D.C., Quandt, S.A., Lang, W., Mills, T.H., 2015. Work safety climate, personal protection use, and injuries among Latino residential roofers. Am. J. Ind. Med. 58, 69–76.
Aybek, A., Guvercin, Ö., Hursitoglu, C., 2003. Teknik personelin iş kazalarının nedenleri ve önlenmesine yönelik görüşlerinin belirlenmesi üzerine bir araştırma. KSÜ Fen ve Mühendislik Dergisi 2, 6 (in Turkish).
Barli, Ö., 1998. Orman endüstri işletmelerinde insan sağlığını etkileyen fiziksel çevre faktörleri. Tr. J. Agric. Forest. 22, 521–524 (in Turkish).
Becker, J.E., 2001. Implementing 5S: to promote safety & housekeeping. Prof. Saf. 46, 29–31.
Brhel, P., 2003. Occupational respiratory diseases in the Czech Republic. Ind. Health 41, 121–123.
Buyukekmekci, N., 2002. Afyon mermer fabrikaları işçi sağlığı ve iş güvenliğinin deg ˘erlendirilmesi. Dumlupınar Üniversitesi, 119, Thesis, Kütahya (in Turkish).
Chamber of Mechanical Engineers, 2013. Final Report of VII. National Occupational Health and Safety Convention, April 2013. <http://www.mmo.org.tr/etkinlikler/isag/etkinlik_metin.php?etkinlikkod=260&metin_kod=1072> (accessed 12.01.15) (in Turkish).
Chinniah, Y., 2015. Analysis and prevention of serious and fatal accidents related to moving parts of machinery. Saf. Sci. 75, 163–173.
Cındık, H., Akyuz, K.C., 1998. Trabzon ilindeki küçük ve orta ölçekli orman ürünleri sanayi işletmelerinin yapisi, sorunları ve çözüm önerileri. Tr. J. Agric. Forest. 22, 7–11 (in Turkish).
Corrao, C.R.N., Mazzotta, A., La Torre, G., De Giusti, M., 2012. Biological risk and occupational health. Ind. Health 50, 326–337.
Cunningham, T.R., Sinclair, R., Schulte, P., 2014. Better understanding the small business construct to advance research on delivering workplace health and safety. Small Enterprises Res. 21, 148–160.
Eriksson, K., Wiklund, L., Larsson, C., 2004. Dermal exposure to terpenic acids in Swedish carpentry workshop and sawmills. Ann. Occup. Hyg. 48, 267–275.
Eurostat, 2015. METADATA. Statistical Classification of Economic Activities in the European Community, Rev. 1.1. <http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=NACE_1_1&StrLanguageCode=EN&IntPcKey=581535&StrLayoutCode=HIERARCHIC> (accessed 10.02.15).
Evans, D.D., Michael, J.H., Wiedenbeck, J.K., Ray, C.D., 2005. Relationships between organizational climates and safety-related events at four wood manufacturers. Forest Prod. J. 55 (6), 23–28.
Farina, E., Bena, A., Dotti, A., 2015. Impact on safety of a preventive intervention in metalworking micro-enterprises. Saf. Sci. 71, 292–297.
Gardner, D., Cross, J.A., Fonteyn, P.N., Carlopio, J., Shikdar, A., 1999. Mechanical equipment injuries in small manufacturing businesses. Saf. Sci. 33, 1–12.
Gerges, S.N.Y., Sehrndt, G.A., Parthey, W., 2001. Noise sources. In: Nelson, D.I., Schwela, D.C. (Eds.), Occupational Exposure to Noise. World Health Organization, Geneva, pp. 103–124.
Gómez, M.E., Sanchez, J.F., Cardona, A.M., Pioquinto, J.F., Torres, P., Sanchez, D., Camargo, L.M., Castaneda, R.A., Villamizar, R.H., Cremades, L.V., 2010. Health and working conditions in carpenter's workshops in Armenia (Colombia). Ind. Health 48, 222–230.
Hadjimanolis, A., Boustras, G., 2013. Health and safety policies and work attitudes in Cypriot companies. Saf. Sci. 52, 50–56.
Hasle, P., Limborg, H.J., 2006. A review of the literature on preventive occupational health and safety activities in small enterprises. Ind. Health 44, 6–12.
Holcroft, C.A., Punnett, L., 2009. Work environment risk factors for injuries in wood processing. J. Saf. Res. 40, 247–255.
Holmér, I., 2006. Protective clothing in hot environments. Ind. Health 44, 404–413.
Hsiao, H., 2014. Fall prevention research and practice: a total worker safety approach. Ind. Health 52, 381–392.
IBM Corp., 2010. IBM SPSS Statistics for Windows, Version 19.0. IBM Corp., Armonk, NY.
Ilhan, A., Kosar, G., Karapinar, A., Gedik, T., 2013. Analysis of underlying causes of the occupational accidents and diseases in furniture manufacturing in Sakarya province. Kastamonu Univ. J. Forest. Fac. 13, 202–210 (in Turkish).
Kalliny, M.I., Brisolara, J.A., Glindmeyer, H., 2008. A survey of size-fractionated dust level in the U.S. wood processing industry. J. Occup. Environ. Hyg. 5, 501–510.
Kim, H., Park, D., 2006. Selecting high-risk micro-scale enterprises using a qualitative risk assessment method. Ind. Health 44, 75–82.
Kurt, E., Demir, A.U., Cadirci, O., Yildirim, H., Ak, G., Eser, T.P., 2011. Occupational exposures as risk factors for asthma and allergic diseases in a Turkish population. Int. Arch. Occup. Environ. Health 84, 45–52.
Lombardi, D.A., Verma, S.K., Brennan, M.K., Perry, M.S., 2009. Factors influencing worker use of personal protective eyewear. Accid. Anal. Prev. 41, 755–762.

Malkin, R., Lentz, T.J., Topmiller, J., Hudock, S.D., Niemeier, R.W., 2006. The characterization of airborne occupational safety and health hazards in selected small businesses; manufacturing wood pallets. Ind. Health 44, 58–63.
Masi, D., Cagno, E., 2015. Barriers to OHS interventions in small and medium-sized enterprises. Saf. Sci. 71, 226–241.
Michael, J.H., Wiedenbeck, J.K., 2004. Safety in the wood products industry. Forest Prod. J. 54, 10.
Mikkelsen, A.B., Schlünssen, V., Sigsgaard, T., Schaumburg, I., 2002. Determinants of wood dust exposure in the Danish Furniture Industry. Ann. Occup. Hyg. 46, 673–685.
Park, H., Ha, E., Kim, J., Jung, H., Paek, D., 2002. Occupational health services for small-scale enterprises in Korea. Ind. Health 40, 1–6.
Reese, C.D., 2008. Handbook of Safety and Health for the Service Industry, first ed. CRC Press, New York, p. 432.
Reinhold, K., Järvis, M., Tint, P., 2015. Practical tool and procedure for workplace risk assessment: evidence from SMEs in Estonia. Saf. Sci. 71, 282–291.
Schneider, S., 2005. An assessment of occupational safety and health hazards in selected small businesses manufacturing wood pallets – Part 1. Noise and physical hazards. J. Occup. Environ. Hyg. 2, D18–D21.
Sinclair, R.C., Cunningham, T.R., 2014. Safety activities in small businesses. Saf. Sci. 64, 32–38.
Social Security Institution of Turkey, 2012. Employment Injury and Occupational Diseases Statistics for 2012. <http://www.sgk.gov.tr/wps/portal/tr/kurumsal/istatistikler/sgk_istatistik_yilliklari> (accessed 15.01.15).
Sogutlu, C., Eroglu, F., 2008. The investigation of physical conditions of the furniture enterprises in Ankara. J. Polytech. 11, 373–378 (in Turkish).
Sripaiboonkij, P., Phanprasit, W., Jaakkola, M.S., 2009. Respiratory and skin effects of exposure to wood dust from the rubber tree *Hevea brasiliensis*. Occup. Environ. Med. 66, 442–447.
Top, Y., 2015. Waste generation and utilisation in micro-sized furniture-manufacturing enterprises in Turkey. Waste Manage. 35, 3–11.
Top, Y., Adanur, H., Öz, M., Yasar, M., 2013. Structural Analysis of Manufacturing Enterprises in Forest Products Industry's Sub-sectors in Province of Gumushane. Unpublished Final Report, 66, Gumushane (in Turkish).
Turkish Statistical Institute, 2015. Genel sanayi ve işyeri sayımı-2002. <http://www.tuik.gov.tr/VeriBilgi.do?alt_id=1079> (accessed 15.01.15).
Uysal, B., Özciftci, A., Kurt, Ş., 2005. Analysis of industrial accidents occurred in small and medium-sized furniture manufacturing firms in Turkey. Gazi Univ. J. Sci. 18, 439–451.
Vaizoglu, S.A., Aycan, S., Akin, L., Kocdor, P., Pamukcu, G., Muhsinoglu, O., Özer, F., Evci, E.D., Guler, C., 2005. Determination of formaldehyde levels in 100 furniture workshops in Ankara. Tohoku J. Exp. Med. 207, 157–163.
Warnock, M., Vonasek, W., 2009. With proper dust collection woodworkers breathe easy: for the safety of workers, as well as machinery, a proper dust collection system is a necessary piece of equipment for any wood products facility. http://www.thefreelibrary.com/With proper dust collection woodworkers breathe easy: for the safety-a0193297523 (accessed 01.03.15).
Yigit, A., 2008. İş güvenliği ve iş sağlığı. second ed. Alfa Aktüel, Bursa, p. 235 (in Turkish).
Zaraliakos, J., 2013. Strategically Reduce Hand Injuries Using the Hierarchy of Hazard Control. <https://www.aist.org/AIST/aist/AIST/Publications/safetyfirst/13_augSafety_First.pdf> (accessed 17.07.15).