Questionnaires were administered in 272 textile, chemical, food, metal products, and woodworking firms in ten cities in industry-dense areas to assess the general OHS situation in Turkey. This paper explores the portion related to exposures of workers to physical and ergonomic hazards. OHS experts where available, firm owners, partners, or engineers responsible for safety were asked to answer structured questions regarding percentages of workers exposed to specific hazards. About 65% of respondents reported exposures to noise risks among at least some percentage of employees; 26.3% reported more than 50% of employees were so exposed. In more than 60% of the firms employees were exposed to ergonomic risks related to the need to meet production quotas and the need to maintain constant posture. The most prevalent risk factors in five industries and the relative frequencies of exposed employees are described. Key words: occupational health; industrializing country; working conditions; risk exposures.

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The application of the Republic of Turkey to become a full member in the European Union calls for large reforms in this developing country. Improving the occupational health and safety (OHS) situation to meet the EU standards is one of the giant projects undertaken by the Turkish government via the support of EU funds. In many industrializing countries occupational health is treated as a trivial matter. Due to the arguably insufficient international cooperation and the unavailability of funds, many developing countries are reluctant to act upon this problem. However, the process of accession into the EU has provided Turkey with both the incentive and the funds to improve the OHS situation in the country.

Unfortunately, it would be very difficult (if not impossible) to assess the effectiveness of the measures taken by the government and whether improvements have been achieved or not, because there are no studies on OHS that cover the entire country, to our knowledge. The very few studies conducted in a more local fashion are far from establishing a general picture. A few such studies are cited here as examples. In probably the most general one, the authors examine the descriptive characteristics and demographic properties of occupational accidents in Turkey utilizing secondary data from the Social Insurance Institution. However, obviously the accidents recorded by the institution are the ones that are “reported as occupational accidents.” Furthermore, the data from the institution do not reflect exposures of workers to occupational hazards in the workplace.

Another study investigated the lead levels in blood of traffic policemen in the city of Bursa, and yet another examined fatalities from occupational accidents in the city of Kocaeli. An even more micro-level investigation has been done as field work, evaluating the exposures of workers in a single plant (hazardous waste incinerator) and concluding that further research is necessary to assess the health effects of pollutants in workers and the general population. There are a few other studies that deal with occupational exposures to chemicals and cancer risks.

The small number of relevant studies and their limited scopes call for further exploration of the general OHS situation in Turkey. To our knowledge, there is no scientific study that has focused on exposures to physical and/or ergonomic risks in Turkey. The present study attempted to elucidate one aspect of worker health. We explored the exposures to occupational hazards of the employees in textile, food, chemical, metal products, and woodworking firms located in ten industry-dense cities in Turkey.

The European Foundation for the Improvement of Living and “Working Conditions 2003 report Working Conditions in the Accessing and Candidate Countries” provides a summary of the working conditions in Turkey according to a survey conducted in 2002. Although this report has more coverage than our
The industries studied are different. The report provides very brief statistics regarding broader industry categories (such as manufacturing, wholesale, mining, etc.); however, it does not include a demographic breakdown of exposures in more specifically defined industries (such as textiles, chemicals, metals, etc.). Furthermore, the brief statistics reflect only the physical environments in their analysis and do not include more detailed occupational hazards, as we have done in the present study. Hence, their results are not directly comparable with the results of this study, since they report the exposure rates in terms of percentages of employees, whereas we report them at the firm level. Furthermore, they questioned the employees, whereas we interviewed OHS specialists or owners/partners or engineers responsible for OHS in the company.

The contribution of the present paper to the literature is twofold. First, to our knowledge, no other study of the general working conditions in specific industries in Turkey has been conducted, using either secondary or primary data source. Hence, this research, as a part of the EU project to improve the OHS standards in this developing country to the EU standards, attempted to collect primary data and shed some light on the working conditions in these industries in Turkey. Second, this study may be the only reference point for further studies of the OHS situation in general in Turkey.

This study may also provide the only general reference point for Turkish policymakers in assessing the improvements in the OHS situation. That the lack of reliable data on occupational diseases and accidents in industrializing countries makes it difficult to make comparisons with industrialized countries adds to the importance of the descriptive findings in this paper. In that respect, the objective of the paper is to provide a general picture of physical and ergonomic risk exposures in the selected industries.

METHODS

Study Setting

Because of budget and time constraints, only five industries and ten cities could be included in this study. These were determined via several interviews and consultations with the head job inspector and occupational health and safety experts in the Ministry of Work and Social Security. A similar procedure was followed in structuring the questions in the survey. The towns and industries covered in this study were:

- **Towns**: Adana, Ankara, Denizli, Eskişehir, Gaziantep, İzmir, Kayseri, Kocaeli, Konya, Manisa
- **Industries**: textile, chemical, food, metal products, woodworking

The same budget and time limitations resulted in a sample size of 272 firms of the 30,000 firms from the firm database. Every firm in the sample was visited by the field force, and the OHS specialist (if available) or the person in charge of operations and/or worker health was asked to fill out a structured questionnaire. All 272 questionnaires were completed within the December 2004–March 2005 period.

Sampling

The list of firms in ten cities within the selected industries, provided by the General Directorate of Occupational Health and Safety, includes approximately 30,000 firms. The general characteristics of the firm-list data were determined, to be taken into consideration during the process of sampling. A disproportionately large share of the firms was located in Ankara (30%) and İzmir (28%). Other cities seem to range from 3% to 6% in terms of the numbers of firms relative to the total number of firms in ten cities and five industries (30,000). The distribution of firm sizes is right-skewed, where the larger firms are relatively smaller in number. The largest category is that of small firms with fewer than ten employees. Other size categories are 10–49, 50–249, and over 250 employees. The largest subcategory is that of firms in the metal products industry with 0–9 employees, in the city of Ankara. The smallest subcategory is that of firms in the woodworking industry with 250 or more employees, in nine cities (0 firms); there seem to be only three firms in this subcategory, and all are located in Kayseri. Distributions of the sample according to firm size and industry categories are shown in Table 1.

The selected characteristics imply that a simple random sampling procedure would not provide us with
a representative sample. Hence, a combination of quota and judgmental sampling procedures was adopted whereby geographic, industrial, and firm-size distributions were controlled. Once the number of firms in each subcategory was determined, a random selection procedure was conducted. The subjectively set minimum limits that were approved by the general directorate were to include: at least 35 firms from each industry, at least ten firms from each city, and at least 20 firms with 0–9 employees from each industry. In determining the numbers of firms according to population and judgmental criteria percentages, all fractions were rounded up. The subjectively set limitations allowed a wider representation of the less industrialized cities. The allocation of the numbers of firms among industries in each city was also based on the set quotas as well as judgment. The allocated number of firms in each cross category of industries and cities was based on a random sampling procedure.

**Interview Process**

A structured questionnaire was administered via face-to-face interview by a field force to the occupational health experts/specialists where possible (firms with fewer than 50 employees are not required to have one by law) and/or people responsible for the health of workers, such as firm owners, partners, or engineers. The respondents were asked to specify the percentages of the workforce exposed to several different hazards. The descriptive results are organized according to three main categories: industry, city, and firm size (in terms of the number of workers employed). Since the firm database was not up to date and five of the firms refused to participate, a fall-back sample list based on random selection was generated holding industry, town, and firm size constant.

**Data Management**

Since a large proportion of the sample was composed of small or medium-sized firms where there are no OHS experts, the risk factors were defined in simple terms and questions were structured accordingly. For example, noise risk was presented as a working condition in which workers have to shout in order to communicate. Non-ionizing radiation refers to microwave, high-frequency electromagnetic area, welding light, etc. Vibration covers local and general body vibration. Temperature, humidity, wind draft, and illumination-related risks are presented as causing discomfort. Ergonomic risks are more straightforward. Production quota refers to having to meet a production quota within a given period of time. Maintaining a constant posture for a long time and carrying heavy loads is self explanatory. Repetitive-movements risk is defined as repeating movements every couple of minutes for at least an hour. All questionnaires were coded and entered into SPSS 12.01 (SPSS, Inc., Chicago, IL). Since the study was exploratory and the sample size was not adequate to make comparisons among cross categories, inferential statistics were not used.

**RESULTS**

Table 2 summarizes the general frequency distribution of the responses, indicating that at least some of the employees were exposed to the listed physical hazards. The most prevalent risk was exposure to noise, such that in 64% of the firms, at least some employees needed to shout in order to communicate in the workplace. In about 37.7% of the firms less than half of the employees, and in 26.3% of the firms more than half of the employees, were exposed to the noise risk (not shown here, but available upon request). Noise was the most prevalent risk at the firm level.

About 23.8% of the respondents indicated that workers were exposed to non-ionizing radiation (e.g., microwaves, high frequency electromagnetic fields, and welding light) in their firms. The third most commonly observed hazard was uncomfortably low temperature, with an 18.3% frequency. Hand and/or body vibration was in fourth place, at 17.9%. Other risks such as wind current/draft, high temperature, humidity, low illumination, and ionizing radiation (X-ray) were reported for about 15% or less of the firms.

Table 3 shows the percentages of firms that reported exposures of at least some of the employees to ergonomic hazards. Notice that the most common ergonomic risk factor appears to have been the requirement to meet production quotas (in 68.5% of firms).
the firms). The second most commonly observed ergonomic risk (60.4%) was maintaining the same posture for a long time. Movements that are repeated every few moments during at least an hour period were reported by 52.8% of the respondents. Carrying heavy loads was a risk that employees were exposed to in about half of the firms. The fifth ergonomic risk factor was trying to keep pace with automated machines, and was reported for 41.8%.

**Physical Risk Exposures**

In this section we explore the distribution by industry of physical risk exposures with respect to the percentages of workers exposed. Table 4 shows the industry breakdown of the relative frequencies of firms for each risk factor according to the rate of exposed workers. The most prevalent risk factor, noise, was mostly observed in woodworking: 83.3% of the firms in this industry reported that such a working hazard existed for at least some of their employees. In 37% of the woodworking firms, more than 75% of the employees were exposed to this risk. Metal products and textile firms followed woodworking, with 77.3% and 66.7%, respectively. In 26.1% of the firms almost all employees were exposed to noise. In the textile industry, exposure rates of employees to noise were predominantly between 0 and 25%. Other exposure rates appear to have been evenly distributed in the textile industry. In the chemical and food industries less than half of the firms reported that noise was a problem in their workplaces. Table 4 summarizes the distribution of exposure to physical factors among the five industries.

Employees in about 63.6% of metal product firms were reported to be exposed to non-ionizing radiation, such as welding light and microwaves. In the chemical and food industries less than 2.5% of the firms admitted this risk.

Interestingly, low temperature was most commonly observed in the woodworking industry, with 31.5% of the firms from this sector reporting this risk. The chemical, metal, and food industries followed woodworking, with 24.4%, 19.5%, and 12.5%, respectively.

Hand and/or body vibration was most common in the metal products and textile industries, with 26.1% and 23.1% of the firms, respectively. Exposure rates for these industries indicate that mostly between 0 and 25% of the employees were exposed to vibration. In woodworking 15.1%, in chemicals 12.2%, and in food 8.5% of the firms admitted the existence of vibration in their working environments.

Woodworking, metal products, and chemical industries ranked at the top three in terms of the percentages of firms in which employees are working in environments where wind currents/drafts pose a risk to their health.
percentages of firms in which employees were required to meet the pace of automated machines were relatively low, 45.2% in chemicals, 37.7% in woodworking, 35.4% in food, and 30.7% in metal products. The exposure rate is of employees in woodworking was more than 75%. In all industries less than 10% of the firms reported employee compensation schedules that depended on the number of items produced.
DISCUSSION

We explored the extent and nature of physical and ergonomic risk exposures in five industries and ten cities in Turkey. The limitations of the study need to be addressed before a brief discussion of the results.

First, the results rely on the responses of the people interviewed. It was not possible to validate their answers. Although some of the interviewees were OHS specialists, others were not, and although the pollsters were trained to explain the questions we cannot be sure how well the respondents understood the OHS terms.

Second, the study was exploratory and therefore the results are descriptive. Because the numbers of observations were insufficient in some cross categories, inferential statistics tools (estimation, hypothesis testing, forecasting, etc.) were not employed. However, even the descriptive statistics provide important insights.

Third, the sample may not be representative of the firm population in Turkey, due to both the small sample size and the limited number of cities. The cities and industries included were determined via consultations with the General Directorate of Occupational Health and Safety. The directorate’s information needs were reflected in the distribution of the firms in the sample.

Fourth, the focus of this paper is on physical and ergonomic hazards only. This does not mean that other risks such as chemical hazards and occupational accidents are not important. However, those risks are not included.

Even though the European Foundation’s survey results are not directly comparable with our results, both studies seem to have found high levels of exposures to noise, repetitive movements, and maintaining a constant posture. Other developing countries may be interested in the results of this survey for possible comparisons and future work, since exposures to physical and ergonomic hazards in specific industries may be similar among developing countries.
Despite the limitations of the study, the results provide useful information for Turkish policymakers in elucidating the natures and extents of exposures to physical and ergonomic risks. In the Turkish textile, chemical, food, metal products, and woodworking industries, the most commonly observed risk was found to be exposure to noise. As might be expected, the percentages of employees exposed to the noise and non-ionizing radiation risks were considerably higher in the metal products industry than in other industries. Aside from noise, hand or body vibration in textiles, non-ionizing radiation in metal products, low temperature in chemicals and woodworking, and high temperature in the food industries appear to have been the most prevalent physical occupational hazards. As for the ergonomic risk factors, keeping pace with automated machines and meeting production quotas in the textile industry, meeting production quotas in chemicals and metal products, carrying heavy loads in woodworking, and maintaining a constant posture for a long time in the food industry were the most commonly reported hazards. Although noise appears to have been a common problem in all of the sectors covered in this study, the distributions of both ergonomic and other physical risk factors suggest that different policies and priorities regarding OHS may be necessary for different industries. The food industry appears to have relatively higher employee exposure percentages than other industries in terms of maintaining a constant posture for a long time, whereas, percentages exposures to the ergonomic risk of pressure to meet production quotas appear to be higher in the textile and chemical industries.

Both the prevalent risk factors and the percentages of employees exposed to the physical and ergonomic hazards appear to vary considerably across industries. The Turkish government’s commitment to the improvement of the OHS situation in Turkey to meet EU standards calls for careful inspection of the hazard exposure distribution among industries to come up with sound policies. One suggestion may be to systematically provide tailor-made training and education programs to employees and employers in different industries, emphasizing the most prevalent hazards. Also, our results may indicate a need to set industry-specific goals proportionate with the prevalent risks within the industry in the systematic plans to improve the OHS situation in Turkey. However, for more general policy decisions, further research including other industries and cities not covered in this study, is necessary.

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