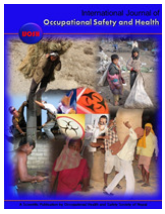

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Original Article

Occupational Safety and Health Studies in Nepal

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Abstract:

Occupational safety and health are key issues today, with growing industrialization and labor market. To introduce and maintain a high standard of safety and health at workplace, it is essential to have an overall picture of the present workplace scenario, different hazards and probable health effects.

This is a review of all previously published articles on occupational safety and health in Nepal. Key words such as Nepal, Occupation, Safety, and Health were used to search for relevant articles in PUBMED and Google Scholar.

A total of 15 research articles were found, which dealt with different forms of work, like agriculture, health services, child labor, small scale household industries, brick kilns, and textile factories.

The overall status of occupational safety and health does not look satisfactory. Standard work situations and criteria have to be set up and regular monitoring should be done to ensure the maintenance of quality at work.

Key Words: environment, exposure, hazards, labor, work place

Introduction

Occupational safety and health is the science of anticipation, recognition, evaluation and control of hazards arising in or from the workplace, which could impair the health and well-being of workers, and also impact the surrounding communities and the environment [1].

According to Nepal labor force survey, 2008, the total number of currently employed persons increased from 9463 thousand in 1998/99 to 11779 thousand in 2008. Likewise, the proportion of paid employees increased slightly from 16.0 percent in 1998/99 to 16.9 percent in 2008. Moreover based on the classification of industry, 73.9 percent of people are working in the agricultural sector and 26.1 percent in non-agriculture. Among the employed persons, nearly 68 percent worked 40 hours and more, 20 percent 20-39 hours, 11 percent 1-19 hours and an insignificant proportion reported that they did not work in the reference week in 2007/8. With such background, it is immensely important that workers have a healthy and safe environment at work, which should be of certain standards [2].

Since 1919, the International Labor Organization has maintained and developed a system of international labor standards aimed at promoting opportunities for women and men to obtain decent and productive work, in conditions of freedom, equity, security and dignity. In today's globalized economy, international labor standards are essential components in the international framework for ensuring that the growth of the global economy provides benefits to all [3]. Although occupational safety and health is a very important issue at an individual, social and national level, it has not received much attention so far in Nepal. This is evidenced by the very limited literature available on the status of occupational safety and health in Nepal. Thus, this study is carried out to get a general outline of the status of occupational health and safety in Nepal.

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Methods

This is a review which summarizes all the original research articles on occupational safety and health in Nepal, previously published in national and international scientific journals. PUBMED and Google Scholar were used to search for relevant articles using the terms "Nepal, Occupation, Safety, and Health". The main purpose of the review was to have an overall picture of Occupational health and safety in Nepal. This review included only original research articles, other articles such as reviews, editorial, comments, letters were excluded.

The initial search gave 35 articles. Five were reviews, two editorials, and two letters to the editor, and accordingly excluded. The remaining articles were screened for relevancy based on title and abstracts, which narrowed down the search to 12 articles. To ensure that no relevant article was missed, the reference lists of those 12 articles were scrutinized. This added three more relevant articles. Thus, this review finally includes 15 original research articles on occupational safety and health in Nepal published during the time period 2003 - 2011. The study was conducted in the month of April, 2011.

Results

The 15 articles focus on workplace standards, different hazards present and their probable effects on health.

Atreya's work mainly focused on safety measures and hazards of pesticides used in agriculture and their effect on human health. In one of his studies, he surveyed 291 households using insecticides in a rural area in Nepal every week for seven months. He then correlated the act of spraying pesticides with acute health symptoms developed among the people who sprayed the pesticide. He noted that exposure to pesticides was clearly associated with problems like headache, muscle twitching/pain, chapped hands, excessive sweating, eye irritation, skin irritation/burn, weakness, respiratory depression, chest pain and throat discomfort. Likewise, pesticide users adopted few protective measures while spraying, limited largely to wearing long-sleeved shirts (68% of the application episodes) and long pants (58%). Spraying was undertaken without any protection 15% of the time. When an individual applied pesticides on agricultural farms, the predicted probability of acute illnesses was 0.41 compared to 0.18 for exposure to the local environment among non-users. The study also found that for the sample population, the average annual treatment costs and productivity losses from pesticide exposure were Nepalese Rupees (NRs) 172.54 for users and NRs 105.34 for nonusers for similar illnesses. The annual average cost of avertive actions for users was NRs 175. The average cost of exposure was estimated to be NRs 162.34 for a pesticide user and NRs 18.62 for a non user.

Atreya carried out another study in Panchkhal and Deubhumi Baluwa Village Development Committees of Kavreplanchowk

Table I List of articles included in the review

SN	Author	Year	Title
1.	Atreya K[4]	2008	Health costs from short-term exposure to pesticides in Nepal
2.	Atreya K[5]	2005	Health costs of pesticide use in a vegetable growing area, central mid-hills, Nepal
3.	Atreya K[6]	2008	Probabilistic assessment of acute health symptoms related to pesticide use under intensified Nepalese agriculture
4.	Atreya K[7]	2007	Pesticide use knowledge and practices: A gender differences in Nepal
5.	Joshi SK[8]	2008	Occupational health in small scale and household industries in Nepal: A situation analysis
6.	Joshi SK[9]	2003	Possible occupational lung cancer in Nepal
7.	Shrestha BP[10]	2008	Work Related Complaints among Dentists
8.	Gurubacharya DL[11]	2003	Knowledge, attitude and practices among health care workers on needle-stick injuries
9.	Shrestha SK[12]	2006	Study of Hepatitis B among different categories of health care workers.
10.	Pradhan A[13]	2003	Backache prevalence among groups with long and normal working day
11.	Joshi S[14]	2011	Health problems of Nepalese migrants working in three Gulf countries
12.	Pun K[15]	-	Occupational safety and health situation in industrial sector in Nepal
13.	Murthy VK[16]	-	Occupational health and safety study (OHSS) of brick industry in the Kathmandu valley
14.	Paudyal P[17]	2011	Exposure to dust and endotoxin in textile processing workers
15.	Joshi et al[18]	2009	Child labour in Nepal and associated hazards: a descriptive study

district in the central hills of Nepal. He interviewed 443 households using pesticide and 126 households not using pesticides as control. Individuals were scheduled for weekly interviews. Data was collected during 2005 by two methods: one-time and multiple visits. Data on pesticide dose and exposure, appearance of acute symptoms, and use of safety gear were collected through multiple visits at one-week intervals over seven months. It was found that individuals were unwilling to wear personal protective equipments during the spraying of pesticides to reduce health hazards. The average magnitudes of insecticide and fungicide exposure to individuals (including 'zero' values of control events) were 0.22 ml/l and 2.37 g/l per hour, respectively.

Atreya also looked into the difference among male and female on the knowledge and practice of pesticide use. He interviewed a total of 325 males and 109 females during 2005 to assess gender differences on knowledge, attitude and practices of pesticide use. He found less than 8% individuals were trained for Integrated Pest Management. None of the males and females smoked, drank and ate while spraying pesticides and all believed that pesticides were harmful to human health, livestock, plants and their environment. However, there were gender differences on knowledge on the effect of wind direction during spraying ($p = 0.032$), prior knowledge on safety measures ($p = 0.016$), reading and understanding of pesticides labels ($p = 0.001$), awareness of the labels ($p = 0.001$) and protective covers. Almost all respondents were aware of negative impacts of pesticide use on human health and environment irrespective of gender; however, females were at higher risk due to lower level of pesticide safety awareness.

In a different set up, Joshi et al [8] conducted a cross sectional study in ten small scale industries of Kathmandu valley; the industries were randomly selected from the list of the industries prepared by the researchers during a preliminary survey. There were 545 respondents, they were personally interviewed. Among the workers, there were 135 children less than 16 years of age. A qualified physician conducted their physical examination and occupational health risk assessment using an assessment form developed by Harrington JM et al [19]. The industries included:

Table II Different industries and people working there

SN	Industry	Number of adult workers	Number of child workers
1.	Metal industry	30	10
2.	Paint (Coating) Industry	25	0
3.	Tent industry	60	0
4.	Drinking water bottling plant	48	0
5.	Brick kiln	78	35
6.	Stone crusher plant	67	25
7.	Construction industry	47	15
8.	Embroidery industry	32	18
9.	Instant noodle industry	72	0
10.	Carpet industry	86	32
	Total	545	135

Majority of the workers were illiterate and earned less than NRs. 5000 a month. Children were screened for health problems. Except for lower respiratory tract infection, the prevalence of all selected diseases was found to be high. Those selected conditions included ear problem (53%), upper respiratory tract infection (38.5%), musculoskeletal problem (33.3%), eye problem (33.3%), abdominal problem (31.1%) and skin problem (26%).

In a similar set up,[13] Pradhan A conducted a cross sectional study among 64 households from a ward in Kirtipur to look at the prevalence of backaches among workers due to normal and long work hours. For the comparison, the working day of up to seven hours per day was defined as normal working day whereas more than seven hour was defined as long working day for the study. The study included participants from different kind of jobs like agriculture, factory work, cap/shawl/textile/carpet weaving, carpentry, catering, daily wage based work, electrician, shopkeeping, mechanic, service, student and rest with no specified job. Sixty out of 64 were involved in agriculture. The study revealed that 25(75.8%) of respondents who work long hours experienced backache compared to 15(48.4%) who work normal hours.

In another cross-sectional survey, Joshi et al evaluated the health problems of Nepalese migrants during their stay abroad. Using a convenience sampling, participants who had just returned from Gulf countries and migrants who were about to go to those countries after a vacation in Nepal were recruited at the airport. The inclusion criteria for the study were: adult people who had work experience of at least six months in one of the three Gulf countries (Qatar, Saudi Arabia and United Arab Emirates), who were in Nepal at the time of recruitment and who had returned to Nepal within the last 12 months (on their annual leave or for any other reason). The total number of participants surveyed was 408. Out of the respondents only 31 (7.6%) were female. The mean age of the respondents was 32±6.5 years. More than half of respondents, 224 (54.9%), were involved in various types of construction work such as laborer, scaffolder, general helpers and others.

This survey found that more than half, 231 (56.6%), of the respondents suffered from some type of health problem during their last 12 months of stay abroad. Among the 231 respondents who experienced a health problem, 71(30.7%) had fever or headache, 49 (21.2%) had respiratory symptoms, 46 (19.9%) had musculoskeletal problems, 45(19.5%) had gastrointestinal illness, and 32 (13.9%) had injuries/poisoning. A quarter of the total respondents, 102 (25.0%), reported experiencing some type of injury or accident at their workplace during their last job. Different types of cuts, 41 (40.2%), and fractures or dislocations, 21 (20.6%), were the most common type of injuries. Temperature related illness (17.6%) (such as heat stroke) and other accidents and falls (11.8%) were also common. The survey also found that only one third of the respondents, 149 (36.5%), were insured for health services in the countries where they were working.

Likewise, in a case control study, Joshi et al [9] assessed the relation of lung cancer with possible occupational exposure. The study subjects consisted of all cases of lung cancer and the control group of all cases of colon cancer that attended Bhaktapur Cancer Hospital from July to October 2001. Using a structured questionnaire, they obtained information about their education, father's occupation, family history of cancer, present and past medical history, diet pattern, smoking habit, history of alcohol intake, present and past heating and cooking system at home, intake of any carcinogenic drug, past and present occupational history. Questionnaire about the occupation included information like location of different work places, duration of work in those occupations, types of industries and job duties. Exposure prone occupations like agriculture, construction of buildings, construction of roads and bridges, manufacturing, and transport were categorized as exposed occupations. A detailed smoking history was also obtained for all subjects who had ever smoked regularly for more than six months.

There were 85 cases of lung cancer and 40 cases of colon cancer. Mean age for the lung cancer and colon cancer cases differed significantly between the groups, 59 and 42 years, respectively. 42.4% of the lung cancer cases and 20% of the colon cancer cases had consumed alcohol in the past. Mean smoking pack year for the cases and controls were 19 and 3.1, respectively. Variables like sex, diet, father's history of occupation, family history of cancer, history of carcinogenic drugs, heating and cooking habit were not significantly different between the cases and the controls. Among the cases 23 subjects had worked in non-exposed and 62 in exposed occupations whereas among the controls 27 subjects had worked in non-exposed and 13 in exposed occupations. The crude odds ratio (OR) for the exposed workers was 5.59 (95% CI: 2.47-12.6). After adjustment for smoking habit alone and for smoking habit, alcohol habit, smoking pack year, education and age altogether the OR was 4.8 (95% CI: 2.02-11.4) and 4.2 (95% CI: 1.4-12), respectively.

Likewise, three studies were found which assessed the work situations and health among health workers.

Shrestha et al conducted a cross-sectional study among 68 dental surgeons to assess the possible work related health problems. There were 39(57%) male surgeons with mean age 29.5, and 29(43%) female with mean age 24.9. The major problems were neck pain among 40 of them, shoulder pain among 32 and back pain among 54. Fifty dentists (73.5%) thought they practiced the right posture and 18 (26.5%) thought they did not. Fifty (73.5%) felt that their musculoskeletal complaints were significantly contributed to by their dental work.

Likewise, total number of days with shoulder pain was 0.71±0.84, back pain was 2.09±1.57, and neck pain was 1±1.18. Meanwhile, total number of work days lost due to back pain was 0.64±1.73 days.

In another study, Gurubacharya et al evaluated the working situation in a tertiary health center by assessing the knowledge, attitude and practice of 70 nurses and paramedical staffs from different departments of that center. Data collection was carried out using a standardized questionnaire. It was found that 54(77%) of the respondents didn't know their anti HBs, HIV, HBc status. 28 (40%) didn't have HBsAg vaccination ever and 36(86%) didn't check Anti HBs antibodies after HB vaccination. Needle stick injury was reported in 54(74%), with a frequency of 1-2 per year among 27(52%), 3-4 among 12 (23%) and 5-6 among 13(25%).

When inquired about the practice of using gloves during phlebotomy procedures, 43(63%) answered that they use gloves occasionally, while 11(16%) reported they never used gloves. Twenty four (34%) of the respondents had no idea of Universal Precaution Guidelines. Likewise, none of the respondents knew about needleless safety devices.

In one more study in hospital setting, Shrestha et al estimated the frequency of hepatitis B virus (HBV) infection among different categories of health care workers. The cross-sectional study was conducted in a tertiary health center and included a total of 145 health workers. Blood samples were tested for HBV surface antigen (HBsAg), surface antibody (anti-HBs) and core antibody (anti -HBc). Anti-HBc was positive in 14.5% and HBsAg in 1.4% of health workers. Little less than twenty one percent (20.9%) of non-professional staff, 19.2% of nurses, 5.6% of laboratory workers and 3.1% of doctors had evidence of past or present HBV infection. Around fifty percent of health workers, with only 16.7% of laboratory workers and 27.9% of non-professional staff, had received a full course of HBV vaccination. The significant risk factors associated with past or present HBV infection were lack of hepatitis B vaccination ($p<0.05$) and being a nurse ($p<0.05$) and non-professional staff, who clean the used instruments ($p<0.05$).

In a descriptive study, Pun K collected relevant data from 10 labor offices under the Ministry of Labor and Transportation Management, which keep records pertaining to the occupational safety and health conditions in industrial establishments of Nepal for the past 10 years. It was reported that nearly 12 million workers were engaged in employment in Nepal. Based on the classification of industry 73.9% were engaged in agriculture sector and only 26.1% were engaged in non-agriculture sector. It is estimated that each year approximately 20000 workers meet accidents at workplace which lead to about 200 lives lost in Nepal.

The major causes of occupational hazards found in different work sectors were:

1. Unsafe working conditions
2. Lack of supervision and training
3. Use of old machinery and equipment
4. Lack of sufficient maintenance
5. Bad house-keeping practices
6. Violation of safety rules
7. Overcrowded production units with very congested space

Some work activities were noted to have high risks;

1. Working with machine and equipment
2. Use of electricity
3. Building and Construction works
4. Use of chemicals in industries
5. Dusty worksites

The number of work places and the frequency of their inspections have been listed as:

Table III Labor inspection records

Years	2001/ 02	2002/ 03	2003/ 04	2004/ 05	2005/ 06	2006/ 07	2007/ 08	2008/ 09
Number of establishments	3617	3630	3473	3514	3425	3578	N/A	3599
Number of workers	359373	307536	306430	310900	310145	311069	N/A	313190
Number of inspections made	1581	1515	1131	992	699	959	N/A	1138

Table IV Trends of industrial injuries

Years	2001/ 02	2002/ 03	2003/ 04	2004/ 05	2005/ 06	2006/ 07	2007/ 08	2008/ 09
Number of establishments	3617	3630	3473	3514	3425	3578	N/A	3599
Number of workers	359373	307536	306430	310900	310145	311069	N/A	313190
Number of accidents	46	36	39	38	33	50	N/A	68
Fatal	6	6	6	10	6	13	N/A	13
Serious	23	16	17	12	12	18	N/A	12
Minor	17	14	16	16	15	19	N/A	43

Brick kilns are considered one of the most hazardous workplace. Murthy et al conducted an observational study in factories following Fixed Chimney Bull Trench Kiln (FCBTK) and Vertical Shaft Brick Kiln (VSBK) brick manufacturing technologies. Total four factories were studied, two from each type of technology. The study was carried out in four different spells during a period of one year and it included surveillance of the working environment and of workers' health. The work environment air monitoring to quantitatively assess the dust, gas and heat pollution was carried out by standard procedures using calibrated and sensitive monitoring equipments. Simultaneous health examination of listed workers in each factory by qualified medical professionals on four occasions was also performed. The occupational safety aspect was evaluated by observation and assessment of existing safety practices in place.

The dust and heat pollution was found to be higher at FCBTK brick technology compared to VSBK brick making technology. Likewise, sulfur dioxide (SO_2) gas monitoring indicated that VSBK factories were associated with higher SO_2 levels; the average levels were within prescribed threshold limit value. The thermal stress (radiant heat) prevalent in FCBTK fireplaces was higher compared to the fireplace work at VSBK technology. The difference was statistically significant suggesting that FCBTK brick making technology exerted a higher thermal stress on the firemasters.

The study also indicated that the proportion of workers complaining about health problems were higher in FCBTK.

Among workers with health problems, gastrointestinal tract, skin related illnesses, respiratory complaints and genitourinary tract problems were more prevalent for FCBTK workers than for VSBK workers. Detailed blood pressure measurment indicated that the FCBTK technology induced higher blood pressure. The environmental monitoring data also definitively suggested prevalence of heat stress at FCBTK factories compared to VSBK factories.

The study findings suggested the workers at VSBK factories were better organized; they were involved in work under roof and had a factory-like environment.

In another study to evaluate the exposure to dust and endotoxin, Paudyal et al conducted an cross sectional study in four sectors of textile industry in Kathmandu, including garment making, carpet making, weaving and recycling. Personal exposure to inhalable dust and airborne endotoxin was measured during a full-shift for 114 workers. Personal exposure to cotton dust was generally low (geometric mean 0.81 mg/m^3) compared to the UK workplace exposure limit (2.5 mg/m^3) but nearly 18% (n = 20) of the workers sampled exceeded the limit. Exposures were lowest in the weaving and the garment sector (GM = 0.30 mg/m^3), higher in the carpet sector (GM = 1.16 mg/m^3), and highest in the recycling sector (GM = 3.36 mg/m^3). Endotoxin exposures were high with the overall data (GM = 2160 EU/m^3) being more than 20-fold higher than the Dutch health-based guidance value of 90 EU/m^3. The highest exposures were in the recycling sector (GM = 5110 EU/m^3) and the weaving sector (GM = 2440 EU/m^3) with lower levels in the garment sector (GM = 157 EU/m^3).

The highest endotoxin concentrations expressed as endotoxin units per milligram inhalable dust were found in the weaving sector (GM = 165 EU/mg). There was a statistically significant correlation between inhalable dust concentrations and endotoxin concentrations ($r = 0.37$; $P < 0.001$) and this was particularly strong in the garment ($r = 0.82$; $P = 0.004$) and the carpet sector ($r = 0.81$; $P < 0.001$).

Among all forms of labor, child labor is one of the most exploited forms. Joshi et al conducted a qualitative observational study in 19 different work sectors, which employed child laborers below 16 years of age. After inspections of the workplaces, they listed different hazards they found in the workplace, which could severely affect the health of the child workers.

1. Lack of hygiene in the workplace
2. Airborne contaminants
3. Chemicals at the workplace
4. Noise and illumination of the workplace
5. Work load (long work hours, heavy load or both)
6. Work posture (sitting, standing, crowded work/machinery, etc.)
7. Tools and equipment (sharp, hammering, power-driven)

Discussion

This is a review of all the previously published articles on status of occupational safety and health in Nepal. As it was found, there were very few researches pertaining to the area. Even the few researches found were diverse in their field coverage, so, a cumulative analysis was not possible. Poudel KC et al also stressed the lack of researches in this field [20].

There were four studies that dealt with use of pesticide and its effect in terms of health and cost. All the four studies were carried out by the same person. The results carry great significance because in Nepal, 73.9 percent of the employed people work in the agriculture, which is a huge number [2]. So, anything related to agriculture have big implications and as Atreya found out, farmers are less careful about the exposure to pesticide, which have led to different health conditions. So, people should be made aware about the safe and proper use of pesticide. Specially, women should be educated more as Atreya found a lower level of knowledge about pesticides among women than men.

Joshi et al [8] and Pradhan A's [13] works also highlighted different health problems among workers in small scale industries like carpet factories, construction works, etc, which are more manual. Usually, people with low level of education are engaged in such works as they don't demand much of technical skills. These workers have the least knowledge about occupational safety measures and health effects, while at the same time, they have to work in some of the most hazardous environments. So, they are disadvantaged from both the ends and thus, suffer the most.

About the major health issues among laborers, Joshi et al,[8] Pradhan A,[13] Joshi et al [14] had similar results, which include musculoskeletal problems, respiratory tract infections and abdominal problems. Such problems are to be expected considering the hard and manual job they have to do and lack of hygiene at the work place, which was also pointed out in another study by Joshi et al.[18] Although that was a study about child workers, it provided general information on working conditions in different work sectors, similar to those in the studies of Joshi et al,[8] Pradhan A,[13] and Joshi et al.[14] Specifically, Murthy et al[16] provided a picture of working condition in brick kilns where higher SO_2 levels and thermal stress were found. He also argued for better working condition and upgrading the technologies, which is a good way of controlling the hazards and minimizing the health effects.

Likewise, in the hospital based case control study, Joshi et al convincingly pointed to the relation of occupational exposure to lung cancer. Exposure prone occupations like agriculture, construction of buildings, construction of roads and bridges, manufacturing, and transport were categorized as exposed occupations.[9] The odds for lung cancer in those occupations was high also after adjusting for smoking habits. Thus, workers at such places should be made aware about the risks and be taught about proper safety and precaution measures.

Many studies focused on manual and highly physical works, but, there were some which studied work environment among hospital workers. It is definitely surprising, when Gurubacharya et al's results showed that 40% of the participants (nurses and paramedical staffs) didn't have HBsAg vaccination ever and 34% of the respondents had no idea of Universal Precaution Guidelines. This was also supported by the findings of Shrestha et al, who found that 1.4% of health workers had HBsAg, and 20.9% of non-professional staff, 19.2% of nurses, 5.6% of laboratory workers and 3.1% of doctors had evidence of past or present HBV infection.

Hospitals and hospital workers are supposed to be the ones at high risk of transmission of contagious diseases like Hepatitis. 40% of the respondents not being vaccinated against Hepatits B indicates huge carelessness among the respondents as well as the hospital. The hospital should make it mandatory that their staffs are properly vaccinated and protected against such diseases.

As for the severity of injuries and hazards at work places, Pun K pointed out that approximately 20000 workers meet workplace accidents each year which lead to about 200 lives lost in Nepal. This is a very high figure which requires serious attention from the relevant authorities, employers, labor unions and the employees themselves.

Conclusions

There are few scientific studies conducted so far in Occupational Safety and Health in Nepal. Summing up the limited literature available, it is found that the overall status of occupational safety and health in Nepal is not satisfactory. Most of the work places, especially the ones requiring more physical work and labor, do not possess proper safety and preventive measures, likewise, the workers do not have proper understanding of exposure to hazards and measures to minimize them. Thus, in such conditions, there should be immediate and strong interventions at all levels including the government, employers and the employees.

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