



The effect of organizational and individual factors on health and safety practices: results from a cross-sectional study among manufacturing industrial workers

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Abstract

Background Manufacturing industries are one of the leading industries, where a large work force is employed and most accidents occurred. Unsafe safety practices are the primary cause for most workplace injuries and illnesses. However, in Ethiopia there is inadequate, limited, and narrow research attention with regard to the health and safety practices among manufacturing industrial workers. Therefore, this study was carried out to investigate the effect of organizational and individual factors on health and safety practices.

Methods An institution-based cross-sectional study was conducted from March to April 2017. A stratified sampling technique was used to select 403 study participants from within the manufacturing industries. In addition to a structured questionnaire, an observational checklist was used to assess the working conditions. Bivariate and multivariable binary logistic regression analyses were performed using SPSS version 20. Significance level was obtained at 95% CI and p value ≤ 0.05 . Odds ratio was used to determine the strength of association.

Result The overall percentage of good health and safety practices among workers in manufacturing industries was 57.5% (95% CI: 52.4, 62). Work experience > 5 years (AOR = 2.76, 95% CI: 1.44, 5.29) and a level of education of diploma and above (AOR = 6.49, 95% CI: 1.31, 31.86) were important predictors of good health and safety practices. Moreover, working hours ≤ 48 h per week (AOR = 1.71, 95% CI: 1.05, 2.78), safety training (AOR = 3.95, 95% CI: 2.20, 7.12), and management support (AOR = 1.88, 95% CI: 1.13, 3.15) were significantly associated organizational factors for good health and safety practices.

Conclusion This study highlights the need for ongoing health and safety training, management commitment to health and safety of employees, and provision of appropriate personal protective equipment to enhance health and safety practices of workers.

Keywords Health and safety · Safety practice · Bahir Dar · Ethiopia

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Background

Safety practices are the rules, regulations, procedures, and activities implemented or followed by the workers of an organization to maintain their safety (Subramaniam et al. 2014). Unsafe safety practices are the primary cause for most workplace injuries and illnesses. According to the Heinrich accident causation theory, poor safety practices account for 88% of accidents (UAW International Union 2001). Other studies conducted across various countries have reported unsafe safety practices accounting for 80–95% (UAW International Union 2001) and 80% (Subramaniam et al. 2014) of accident causation.

Globally, 2.3 million workers die every year from occupational accidents and work-related diseases. In addition, many millions of workers suffer non-fatal injuries and illnesses, and 3 billion workers (over 85%) are working without any access to occupational safety and health services (Yiha and Kumie 2010; Safety 2014).

A qualitative study conducted in Malaysia on the level of awareness with regard to behavioral-based safety in manufacturing industry showed that the knowledge level among respondents were higher than the levels of understanding and practices. Although workers have a high level of knowledge, workers practice less what is understood and known (Osman et al. 2015); a study in Korean manufacturing industries has also reported that managers and workers showed high level of safety awareness (Baek et al. 2008). Other studies reporting the level of safety practices found levels of 58.2% (Azadeh and Mohammad Fam 2009), 29% (Truong et al. 2009), 55.29% (Rodrigues and Kiran 2013), 21% (Khosro and Nafees 2015), 31.5% (Haldiya et al. 2005), and 86% (Adebola 2014). A study done in Ethiopia reported that the prevalence of workers using personal protective equipment (PPE) was 54.2% (Tetemke et al. 2014).

Promoting good occupational safety practices of workers in manufacturing industry leads to numerous advantages, such as lower costs, improvements in productivity by protection of business from interruption, and increases in organizational capability. Many factors can be associated with good safety practices. Level of education and work experience have been reported as important factors in improving the level of safety practice (Garcia et al. 2004; Baek et al. 2008; Azadeh and Mohammad Fam 2009; Ayim Gyekye and Salminen 2010; Milijic et al. 2013; Tetemke et al. 2014). Other studies have shown that the level of safety practice is influenced by management support on safety issues and by safety training of workers (Oliver et al. 2002; Seo 2005; Lingard and Blismas 2006; Milijic et al. 2013; Oswald et al. 2013). Literature has revealed that non-availability of PPE and inadequate training were the major factors leading to poor health and safety practices in developing countries, including Ethiopia (Yiha and Kumie 2010; Tetemke et al. 2014).

Studies by Nuwayhid (2004) and Milijic et al. (2013) showed that issues of health and safety practices in many countries including Ethiopia were mostly neglected and still not well known and understood.

Therefore, this study aimed to investigate the effect of individual and organizational factors on health and safety practices among large-scale manufacturing industrial workers in Bahir Dar City, Northwest Ethiopia.

Methods

Study design, setting, and study participants

An institution-based cross-sectional study was conducted from March to April 2017. The study was conducted among nine manufacturing industries found in Bahir Dar City, Northwest Ethiopia. The industries engaged in different economic activities; these included textile, pipe, leather, tanning, agro-processing, and bottling activities. These industries employed more than 5000 employees.

All workers employed in the manufacturing processes of large-scale manufacturing industry in Bahir Dar City were included in this study. A stratified sampling technique was used to select the 403 study participants among nine manufacturing industries. Workers were stratified based on the type of industries. Sample size was calculated using a single population proportion formula. The number of sample points was determined by using a proportional allocation formula for each stratum. Then, the required sample sizes were selected by using a simple random sampling technique from each stratum. This study targeted all workers who were engaged in the production processes of large-scale manufacturing industries.

Data collection procedure and tools

Quantitative data was collected through a face-to-face interview data-collection technique. Work-place observation was also performed by using a structured observational checklist.

The questionnaire was originally prepared in English, and was then translated to the local language Amharic and back to English by another translator to check the consistency of message in the questions. The translation was then reviewed by professional experts. Before starting the actual data collection, 10% of the questionnaires were pre-tested in order to check the validity and consistency of the Amharic-translated version of the questionnaire.

The structured questionnaire was developed from different literature sources aimed at assessing workers health and safety practices. Eighteen questions were used to assess workers health and safety practices. The questionnaire also includes socio-demographic and behavioral characteristics of workers, and work environment issues that affect the health and safety practices of workers.

Six Bachelor of Science graduate occupational health and safety data collectors with three supervisors were assigned for data collection. Training was given to data collectors and supervisors for 2 days on procedures, techniques, and ways of collecting the data.

Operational definitions

Safety practices in this study were defined as rules, procedures, and activities implemented or followed by workers to maintain their safety.

Good health and safety practices Workers health and safety practices were measured by 18 questions; a respondent percentage score of correct answers > 60% was considered as indicating good health and safety practices, and a score of ≤ 60% was considered as indicating poor health and safety practices (Adebola 2014).

Composite level scores were computed by summation of the items within the composite scales and dividing by the number of items. Negatively worded items were reversed when computing percent positive response.

Good management support From six questions, participant percentage score of > 60% was considered as indicating there is good management support.

Data management and analysis

Quantitative data was checked, edited, coded, and entered to Epi-info version 7.00, and exported to SPSS version 20.0 for further analysis.

A chi-square test was performed to see the association of different factors with good health and safety practices. A binary logistic regression model was fitted to identify factors associated with health and safety practices. Good health and safety practice was regressed against demographic, socio-economic, behavioral, and work environment factors. Before fitting the binary logistic regression model, first the goodness of model fit test was checked and assumption was satisfied.

Bivariate binary logistic regression analysis was performed, and variables with *p* value < 0.20 were exported to multivariable binary logistic regression analysis. The stepwise selection method was used in multivariable analysis for selection of variables. Significance level was obtained at 95% CI and *p* value ≤ 0.05. Adjusted odds ratio was used to determine the strength of association.

Results

Of the total of 403 questionnaires, 395 were completed and valid questionnaires were considered for the analysis, which gives a response rate of 98%.

Socio-demographic and behavioral characteristics of the respondents

From the total respondents, 212 (53.7%) were males. The mean age with standard deviation of the study participants was 28.5 ± 7.2 years, and the age of the respondents ranged from 18 to 58 years. Among the study participants, 386 (97.7%) of them were permanently employed, and less than half (166; 42%) of the respondents were married. More than three-quarters (299; 75.7%) of the respondents had ≤ 5 years of experience. The results on educational status of the respondents revealed that a large proportion (283; 71.6%) had completed education to diploma and above level.

Of the total of 395 study participants, 107 (27.1%) of the respondents drank alcohol [of these a high proportion, 98 (91.6%) drank only occasionally] and only nine (2.3%) of the respondents were khat chewers (see Table 1).

Work environment factors

Among the study participants, most (242; 61.3%) of the respondents worked ≤ 48 h per week. With regard to health and

Table 1 Distribution of socio-demographic characteristics of respondents in manufacturing industries in Bahir Dar City, Northwest Ethiopia (*n* = 395)

Variables	Frequency (<i>n</i>)	Percent (%)
Sex		
Male	212	53.7
Female	183	46.3
Age		
18–29	286	72.4
30–44	83	21
≥ 45	26	6.6
Level of education		
≤ Grade 8	12	3.1
Grades 9–12	100	25.3
Diploma and above	283	71.6
Marital status		
Single	220	55.7
Married	166	42
Others (widowed, divorced)	9	2.3
Employment pattern		
Temporary	5	1.3
Permanent	386	97.7
Others	4	1
Experience in the factories		
≤ 5 years	299	75.7
> 5 years	96	24.3
Alcohol drinking		
Yes	107	27.1
No	288	72.9
Khat chewing		
Yes	9	2.3
No	386	97.7

Table 2 Work-environment factors which affect safety practices of workers in manufacturing industries in Bahir Dar City, Northwest Ethiopia ($n = 395$)

Variables	Frequency (n)	Percent (%)
Working hours per week		
≤ 48	242	61.3
> 48	153	38.7
Provision of PPE		
Yes	316	80
No	79	20
Safety training		
Yes	122	31
No	273	69
Management support		
Good	152	38.5
Poor	243	61.5

safety training, more than half of respondents (273; 69%) had not received any health and safety training, and 243 (61.3%) of the study participants responded that there was poor management support. More than three-quarters (316; 80%) of the participants responded that there was provision of PPE (see Table 2).

Health and safety practices

A good level of health and safety practice among manufacturing industries workers in Bahir Dar City was achieved by 57.5% (95% CI: 52.4, 62).

The majority (292; 74%) of the respondents were using at least one type of PPE, and more than three-quarters of respondents (321; 82.3%) and 329 (83.3%) respectively kept their working station clean and followed the stated working procedures. A large proportion (246; 62.3%) of respondents were aware of the hazards related to their specific job, while 170 (43%) of the study participants did not know and implement hazard prevention and controlling methods.

Table 3 Health and safety practices among manufacturing industries in Bahir Dar City, Northwest Ethiopia ($n = 395$)

Types of industries	Health and safety practice		P value
	Poor (%)	Good (%)	
Textile factories	98 (44.9%)	120 (55.1%)	0.099
Leather factories	16 (35.5%)	29 (64.5%)	
Agro-processing industries	19 (44.2%)	24 (55.8%)	
Pipe factories	23 (52.3%)	21 (47.7%)	
Plastic carrier bag factories	12 (26.7%)	33 (73.3%)	

Comparative results on health and safety practices across manufacturing industries

The manufacturing industries workers in this study did not show significant differences in their health and safety practice score (P value > 0.05) (see Table 3) across the different industry types.

Factors associated with good health and safety practices

Multivariable logistic regression showed that level of education, work experience, alcohol drinking, provisions of PPE, working hours, health and safety training, and management support had statically significant associations with health and safety practices at P value ≤ 0.05, while marital status, employment pattern, and khat chewing had no significant associations with health and safety practices (see Table 4).

Discussion

The result of this study revealed that the level of good health and safety practices among manufacturing industrial workers in Bahir Dar city was 57.5% (95% CI: 52.4, 62). This result showed that the manufacturing industrial workers in Bahir Dar city had a moderate level of good safety practice and need to improve. Poor health and safety practice might be attributed to low political, economic, and social commitments. Other possible reasons are due to poor record keeping, weak law enforcement by the government, and low awareness level among employers. This result is comparable with the studies which reported 55.29% in India (Rodrigues and Kiran 2013) and 58.2% in Iran (Azadeh and Mohammad Fam 2009). This similarity might be due to the similarities in employee's demographic characteristics and occupational health and safety infrastructures.

However, the overall proportion of good health and safety practice is lower than the 86% reported by a study in Nigeria (Adebola 2014). This difference might be due to differences in social and political will, as this is the most common challenge to employee health and safety practices. Other possible reasons might be difference in educational level of participants, access to health and safety education, and effectiveness of regulatory bodies.

This study showed that level of education, work experience, safety training, availability of personal protective equipment, working hours, management support, and drinking alcohol were the determinant factors that significantly associated with health and safety practices.

Level of education had a statistically significant association with health and safety practices. Employees with an educational level of diploma and above had 6.49 times higher odds

Table 4 Multi variable analysis of factors associated with health and safety practices in manufacturing industrial workers in Bahir Dar City, Northwest Ethiopia (*n* = 395)

Variables	Health and safety practices		COR (95%CI)	AOR (95%CI)
	Poor: <i>n</i> (%)	Good: <i>n</i> (%)		
Sex				
Male	103 (26.1)	109 (27.6)	1.00	1.00
Female	65 (16.5)	118 (29.9)	1.72 (1.14, 2.57) *	1.61 (0.98, 2.64)
Age				
14–29	134 (34)	152 (38.5)	1.00	1.00
30–44	28 (7)	55 (13.9)	1.73 (1.04, 2.87) *	1.17 (0.37, 3.75)
> 45	6 (1.5)	20 (5.1)	2.94 (1.15, 7.53) *	1.53 (0.44, 5.36)
Marital status				
Single	92 (23.3)	128(32.4)	1.00	
Married	71 (18)	95(24.1)	0.96 (0.64, 1.44)	
Others (widowed, divorced)	5 (1.3)	4(1)	0.58 (0.15, 2.20)	
Education level				
≤ Grade 8	9 (2.2)	3 (.76)	1.00	
Grades 9–12	54 (13.7)	46 (11.6)	2.56 (0.65, 10.00)	2.05 (0.41, 10.41)
Diploma and above	105 (26.6)	178 (45.1)	5.09 (1.35, 19.21) *	6.49 (1.31, 31.86) **
Employment pattern				
Temporary	1(0.25)	4(1)	1.00	
Permanent	165 (41.8)	221 (55.9)	0.34 (0.04, 3.02)	
Others	2 (0.51)	2 (0.51)	0.25 (0.01, 4.72)	
Experience				
≤ 5 years	146(37)	153(38.7)	1.00	1.00
> 5 years	22 (5.5)	74 (18.7)	3.21(1.89, 5.44) *	2.76(1.44, 5.29) **
Working hours per week				
≤ 48 h	116 (29.4)	126 (31.9)	1.79 (1.18, 2.72) *	1.71 (1.05, 2.78) **
> 48 h	52 (13.1)	101 (25.6)	1.00	1.00
Alcohol drinking				
No	109 (27.6)	179 (43.3)	2.02 (1.29, 3.16) *	2.40 (1.41, 4.06) ***
Yes	59 (14.9)	48 (12.2)	1.00	1.00
Khat chewing				
No	166 (42)	220 (55.7)	1.08 (0.29, 4.10)	
Yes	2 (0.51)	7 (1.8)	1.00	
PPE provide				
No	54 (13.8)	30 (7.6)	1.00	1.00
Yes	114 (28.7)	197 (49.9)	3.11 (1.88, 5.14) *	2.22 (1.23, 4.00) **
Safety training				
No	147 (37.2)	126 (31.9)	1.00	1.00
Yes	21 (5.3)	101 (25.6)	5.61 (3.31, 9.50) *	3.95 (2.20, 7.12) ***
Management support				
No	128 (32.4)	115 (29.1)	1.00	1.00
Yes	40 (10.1)	112 (28.4)	3.12 (2.00, 4.84) *	1.88 (1.13, 3.15) **

1:00 = reference, * = variable *P* value < 0.2, ** = *p* value < 0.05, *** = *p* value ≤ 0.001

of being likely to practice good health and safety than respondents who were at primary level of education (AOR = 6.49, 95% CI: 1.31, 31.86). This finding was consistent with studies done in Iran (Azadeh and Mohammad Fam 2009) and Nigeria (Adebola 2014). This might be due to the fact that education contributes to human development skills such as problem-solving ability, personal control, cognitive skills, and access to resources. This might have a profound impact on the health and safety practices of workers.

Work experience was positively associated with good health and safety practices, and workers with > 5 years of work experience had almost 3 times higher odds of showing good health and safety practices than their counterparts who had ≤ 5 years of work experience [AOR = 2.76, 95%CI: 1.44, 5.29]. This result is in line with studies conducted in Iran (Azadeh and Mohammad Fam 2009) and Serbia (Milijic

et al. 2013) which found that workers experience had a significant association with health and safety practices. This might be explained by the concept of job-relevant knowledge gained over time. The more experienced workers had more constructive perspectives regarding safety practices than their inexperienced counterparts. Other possible reasons might be that as they work an increasing number of years, they become familiar with and aware of hazards related to their specific job.

In this study, provision of safety training had a positive influence on health and safety practices. Workers who received health and safety training had 4 times higher odds of adapting good health and safety practices when compared to workers who had not had safety training (AOR = 3.95, 95%CI: 2.20, 7.12). This finding is consistent with studies conducted at the Tendaho agricultural development facility (Yiha and Kumie 2010) and Adwa textile factory (Tetemke

et al. 2014). Other studies carried out in Serbia (Milijic et al. 2013) and Korea (Baek et al. 2008) also revealed that provision of safety training for workers was positively associated with good health and safety practices. This might be because safety training is an important component in increasing workers' understanding about workplace hazards, safety and health programs, and methods of controlling those hazards. This indeed provides workers with the knowledge and skills needed to work safely and avoid creating hazards.

Provision of PPE had a statistically significant association with good health and safety practices. Studies conducted in Ethiopia (Tetemke et al. 2014) and India (Rodrigues and Kiran 2013) reported that provision of personal protective equipment was an important factor which influenced workers' health and safety practices. This might be an indication that provision of personal protective equipment shows management commitment to health and safety.

Health and safety practices of workers were positively influenced by a high level of management support. Workers who perceive there was management support were almost twice more likely to practice good health and safety in the workplace than those who did not receive such support (AOR = 1.88, 95% CI: 1.13, 3.15). This is consistent with the study done in Australia which reported that high levels of management support on safety had a significant association with good health and safety practices (Lingard and Blismas 2006). Another study done in Spain showed that providing comfortable working tools and environment, conducting periodic follow-up and hazard identification, and making decisions on safety issues at an organization level can enhance workers' safety performance (Oliver et al. 2002). This might be an indication that management support for safety practice exist shows their commitment to the health and safety of employees, and places responsibility on employees to take reasonable steps to ensure both their own health and safety and also that of their co-workers.

Working ≤ 48 h per week had a positive association with workers' good safety practices. Workers who works ≤ 48 working hours per week were more likely to exhibit good safety practices than workers who worked more than 48 h (AOR = 1.71, 95% CI: 1.05, 2.78). This is supported by a study conducted in Addis Ababa, Ethiopia metal manufacturing industries, which revealed that working for hours greater than the cutoff point (48 h) per week (ILO 1919) was associated with the increased rate of work related injuries (Habtu et al. 2014). This might be due to the fact that working long hours could be associated with fatigue and a reduction in mental and physical functioning, impairment of concentration, an increase in risk-taking behavior, and irritability which might increase poor safety practices by employees.

Workers who did not drink alcohol were more likely to have good health and safety practices than workers who did drink alcohol (AOR = 2.40, 95% CI: 1.41, 4.06). This finding

is supported by studies carried out in Ethiopia (Kifle et al. 2014) and the UK (Oswald et al. 2013) which reported that alcohol drinking was the behavior having most influence on workers' safety performance. This might be because drinking alcohol at work jeopardizes both efficiency and safety by increasing the likelihood of mistakes, errors of judgment, and accident proneness.

Since we assessed level of safety practice based on workers' opinion, the possibility of under- or over-reporting cannot be ruled out. But through observation and honestly explaining the objectives and significance of the study, we tried to minimize the effect.

Conclusion

The overall proportion of good health and safety practices among manufacturing industrial workers was moderate.

Education and work experience are important individual factors that were significantly associated with good health and safety practices. Furthermore, working hours, availability of PPE, safety training, and management support had a significant positive association with health and safety practices of workers.

Management commitment to health and safety of employees, ongoing safety training for workers, and provision of appropriate personal protective equipment can enhance health and safety practices of workers.

Authors' contributions GAT contributed to the study design, data collection, data analysis, interpretations of the results, and manuscript write-up. SDW and GKB contributed to the study design, data analysis, interpretations of the results, and manuscript write-up and review. All authors read and approved the final manuscript.

Availability of data and materials All data generated or analyzed during this study are included in this article. The data that support the findings of this study are also available from the corresponding and primary authors upon reasonable request.

Compliance with ethical standards

Ethics approval and consent to participate Ethical clearance was obtained from Ethical Review Committee of Institute of Public Health, College of Medicine and Health Sciences, University of Gondar. Permission letter was also obtained from each manufacturing industry manager. Those workers in the manufacturing industries in Bahir dar city, who were selected to participate, were informed about the purpose of the study, the importance of their participation and withdraw at any time.

Informed consent Informed consent was obtained from all individual participants included in the study prior to quantitative data collection.

Consent for publication Privacy and confidentiality of information given by each respondent was kept properly and personal identifiers were removed.

Conflict of interest The authors declare that they have no conflict of interest.

Abbreviations AOR, Adjusted odds ratio; CI, Confidence interval; PPE, Personal protective equipment

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