A Study of Occupational Characteristics and their Association with Cardiovascular Disease among Industrial Workers in Eastern Nepal

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ABSTRACT

Background

An understanding of occupational characteristics of a worker is essential to establish policies, legislation in order to protect the health of the worker. The concept of Occupational Safety and Health is in initial stage in our country. Work-related cardiovascular disease (CVD) is caused by occupational factors that increase the oxygen requirements of the heart or decrease the capacity of the heart to use oxygen. It can be very difficult to link a specific work-related exposure to the development of cardiovascular disease in an individual person. This is because of issues of latency, multiple possible risk factors, lack of specific work-related features and various factors that influence diagnosis.

Objective

To study occupational characteristics and their association with cardiovascular disease among relatively young male industrial workers between 20-59 years of age in Sunsari-Morang industrial corridor of Eastern Nepal.

Method

A cross sectional study was conducted among men between 20 -59 years of age in two randomly selected industries in the Sunsari-Morang corridor of Eastern Nepal from July 2012 to July 2013. The data was collected using a pre-tested semi-structured questionnaire. Systematic random sampling was done to select the required number of samples. Chi-square and Fisher Exact tests were used. Crude and adjusted analyses were done.

Result

Majority (85%) were day shift workers. About 40% of the workers worked for 70-80hrs/week. Most of them have stress sometimes at work. Noise was experienced by 40.9% of the workers. Earplug was used by only 5% of the workers. Hypertriglyceridaemia was seen in 49.3% of the workers. Long working hours, not using earplug and financial stress were seen to be associated with cardiovascular disease on bi-variate analysis. However, only earplug was significant in multivariate analysis.

Conclusion

Risk of cardiovascular disease was seen more among those who worked for more hours; those who did not use earplug and those who had financial stress. The results need further exploration to establish a causal association between occupational characteristics of the workers and cardiovascular disease in industrial set-up of eastern Nepal.

KEY WORDS

Cardiovascular disease, Industrial workers, Occupational characteristics

INTRODUCTION

Industry refers to a group of productive organizations that produce or supply goods, services and are also the sources of income, or extraction of natural resources. It indicates the way in which human effort is being harnessed as a force for the commercial production of goods and services.[1]

Occupational safety and health primarily deals with prevention of hazards at workplace in order to maintain health and safety for all levels of workers. Various hazards at the workplace puts the workers at risk for injuries, cancers, diseases of different systems including communicable and non-communicable diseases.[2]

One component that the efficiency and productivity at any workplace depends on is the safety at work. Identification of hazards and applying measures to increase safety at workplace is the key to a successful occupational health program. This is often ignored and the labo workforce are always at risk, especially in low and middle income countries.[3]

Cardiovascular disease (CVD) are the number one killer disease of the world globally. More people die annually from CVD than from any other cause. There are various occupational factors that had shown to have strong predisposition to CVD. There are strong scientific evidence with four particular chemicals carbon disulphide, carbon monoxide, methylene chloride and nitro-glycerine. Additionally, environmental tobacco smoke, psychosocial factors, low job control, noise and shift work have shown to have positive association. The evidence is less strong against carbon monoxide, methylene chloride, nitro-glycerine, other chemicals, long working hours, electromagnetic fields, temperature extremes, diesel exhaust, other particulates, organic combustion products, manual work or strenuous occupations, sedentary work, and certain specific occupation.[4]

CVD is usually identified because the person experiences an acute coronary event, but there are many factors that can influence when a person experiences such an event. This means occupational exposures may contribute to a person developing CVD while the person could have a heart attack at home. Conversely, a person might have a heart attack at work because of CVD that developed due to non-work exposures.[4] We aim to assess the various occupational factors and its association with CVD among male industrial workers 20-59 years of age in the Sunsari-Morang corridor of Eastern Nepal. Male workers were chosen as the incidence of CVD is lower in women before the menopause compared to men.

METHODS

A Cross sectional study was conducted among men age 20-59 years in two industries in Sunsari-Morang Corridor of Eastern Nepal from July 2012 to July 2013. According to the

study done by Kaur et al. in India the least prevalent risk factor of CVD was Diabetes which was 16.3%.[5]

Prevalence (p) = 16.3%

Compliment of prevalence (q) = 100-16.3= 83.7%

Permissible Error (PE) at 20%, L =20% of 16.3= 3.26

Sample size (n) = $(Z_{1-\alpha})$ 2X pq/L2

= (1.96)2X 16.3 X 83.7/ (3.26)2

= 493.30 (494)5

Two Medium and Large industries were selected randomly from the industrial cue-sheet provided by Morang Merchant Association, Biratnagar, Nepal. List of workers in these two industries was obtained. Systematic random sampling was done to select the required number of sample size.

The data was collected using a pre-tested semi-structured questionnaire. Questions were adopted from Hunter's textbooks of occupational health.[6] The questionnaire was used to elicit information from each study participant for occupational characteristics such as duty shift, duration of work, working environmental condition, earplug used and history of stress of the workers.

Dust was defined as particles in the atmosphere that comes from various sources such as soil, dust lifted by weather and pollution. Heat was the state of body perceived as having or generating a relatively high degree of warmth. Noise is a sound particularly loud one that disturbs people or makes it difficult to hear. Chemicals are the substance that has constant chemical composition. Acid fumes are the emission of vapour or gas while making wires. Stress was defined as feeling irritable or feeling with anxiety at home, work or if financial stress.

Cardiovascular positive cases was defined asthose cases which have been diagnosed on the basis of documentation, evidence of treatment of cardiovascular disease, positive rose angina and the Minnesota coding system.[7]

Data was analysedusing Statistical Package for Social Sciences (SPSS) Version 17. The significance of proportion was used by examining Chi-square test and Fisher Exact test. The probability of significance was set at 5% level of significance and 95% confidence interval. Crude and adjusted Odd's ratio was calculated.

This study was conducted after obtaining ethical clearance from Institutional Ethical Review Board of BP Koirala Institue of Health Sciences, Dharan, Nepal. Approval for conducting the study was obtained both from the management and the employee representative. Informed consent from the study participants was taken.

RESULTS

We conducted face to face interview of 494 workers. The mean age of the participants was 33.56±8.75 years with

minimum age of 20 and maximum year of 55 years. About 40.7% of the workers were in 20-29 years age group.

The overall prevalence of CVD was found to be 13.8%. About 33.6% had hypertension (HTN). Total of 4.1% were diabetic as per the fasting blood sugar (FBS) and 30.5% had impaired fasting blood sugar. Dyslipidaemia was seen in 84.5% of the workers.

Majority of the workers (85.8%) were day shift workers. Almost half of the workers (43.3%) worked for about 70-80 hours/week. Majority of the workers (40.9%) experienced noise in their working environment.

Table 1. Occupational characteristics of the industrial workers (n=494)

Occupational Characteristics	Frequency	Percentage
Duty Shift		
Morning (7am-2pm)	50	10.1
Evening (2pm-7pm)	20	4.0
Day (9am-4pm)	424	85.8
Duration of work/week		
40-50 hours	139	28.1
50-60 hours	79	16
60-70 hours	48	9.7
70-80 hours	207	41.9
80-90 hours	21	4.3
Working environmental condition		
Dust	86	17.4
Heat	40	8.1
Noise	202	40.9
Chemicals	40	8.1
Acid fumes	126	25.5
Total	**494**	**100**

About 78% of the workers didn't use earplug. On asking the reason for not using earplug majority of them (44%) stated unavailability of earplugs whereas 22.8% said they were habitual to noise.
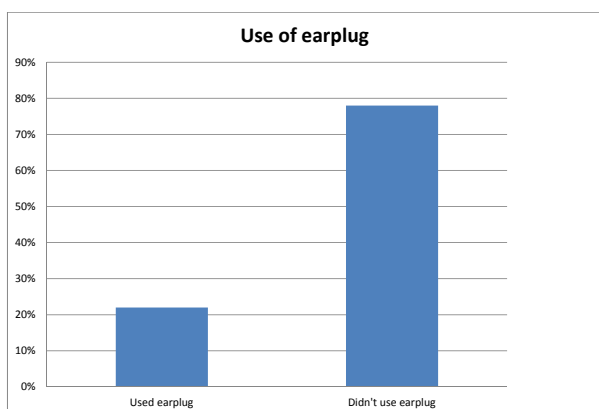

Figure 1. Use of earplug by the workers (n=494)

Stress was defined as feeling irritable or filled with anxiety at home, work or financial stress. Those who have 0 episode in a month was defined as having never stressed, those having <5 episode in a month was defined as having stress sometimes and those have >5 episode in a week was defined as having always stressed.

Regarding the stress history 84.2% suffered from stress sometimes at work, 78.7% suffered from stress sometimes at home and 73.1% suffered from stress due to financial reason.

Table 2. Stress History of the workers (n=494)

Stress type	Frequency	Percentage
Stress at work		
Never	51	10.3
Sometimes	416	84.2
Always	27	5.5
Stress at home		
Never	88	17.8
Sometimes	389	78.7
Always	17	3.4
Financial stress		
Never	61	12.3
Sometimes	361	73.1
Always	72	14.6
Total	**494**	**100**

Regardingthe bio-chemical parameter about 49.3% of the workers had hypertriglyceridemia, 44.1% had hypercholesterolemia and 65.8% has decreased HDL.

Table 3. Lipid Profile parameter of industrial workers (n=406)

Characterisitics	Percentage
Hypertriglyceridemia	49.3
Hypercholesterolemia	44.1
Decreased HDL	65.8

Those working for ≥50 hours had more chances of developing CVD compared to those who worked for <50 hours (OR=1.98, CI=1.02 to 3.83)

It was seen that those who didn't earplug were more likely to develop CVD compared to those who used earplug (OR=2.30, CI= 1.06 to 4.97)

Workers who reported to be always in financial stress were more likely to develop CVD(OR= 2.83, CI=1.03 to 7.72)

Those variables which may confound the result of occupational characteristics of the workers were entered in the logistic regression model. Cardiovascular positive cases were given 0 and negative were given 1. Variable

entered in the logistic regression model were HTN, DM, tobacco product user, those with family history of HTN, obesity, use of earplug, shift duty and working hours. On Logistic regression model through enter method we found that those who did not use earplug were 2.54 times more likely to develop cardiovascular disease compared to those who did not use earplug which was found to be statistically significant. (AOR= 2.54, CI 1.01-6.38)

Table 4. Association between occupational characteristics and cardiovascular disease (n=494):

Variable	Cardiovascular disease			0dd's Ratio	Confidence Interval
	Positive	Negative	Total		
Working hours					
< 50 hours	12(8.6)	127(91.4)	139(100)	1.00	1.02-3.83
≥ 50 hours	56(15.8)	299(84.2)	355(100)	1.98	
Earplug used					
Yes	08(7.4)	100(92.6)	108(100)	1.00	1.06-4.97
No	60(15.5)	326(84.5)	386(100)	2.30	
Financial Stress					
Never	06(9.8)	55(90.2)	61(100)	1.00	-----
Sometimes	45(12.5)	316(87.5)	361(100)	1.30	0.53-3.26
Always	17(23.6)	55(76.4)	72(100)	2.83	1.03-7.72

DISCUSSION

Our study aimed to identify the occupational characteristics of industrial workers and its association with CVD among male population in eastern Nepal. All of the workers interviewed were morning, day or evening shift workers. In a study done by Karlsson et al. there was a significant association between shift works and lipid disturbances.[8] A high proportion of shift workers than day workers had high TG level (≥1.7 mmol/l) and low level of HDL cholesterol (<0.9 mmol/l). High levels of triglycerides were also significantly associated with shift work (OR: 1.40, 95% CI: 1.08-1.83).[8] In our study around 50% of the shift workers had hyper-triglyceridaemia. Majority of them were working population in these industries and were labour class people. Besides working as an industrial workers majority of them cultivated their own land with rice crops. Consumption of carbohydrate diet especially rice has been their routine practice with consumption twice to thrice per day. These all factors probably led to hypertriglyceridemia seen in almost 50% of our working population.

Almost 50% of the workers in our study worked for 70-80 hours/week. Beside their normal duty most of the workers did overtime work. Those working for more than ≥50 hours/week had significant odds (OR=1.98, CI-1.02-3.83) of developing CVD compared to those worked ≤50 hours/week. In a study done by Charles et al. long work hours (≥50 hrs/week) may be related to CVD through insufficient hours of sleep and the impact of sleep deprivation on CVD risk factors which was similar to our working condition.

Long work hours may also lead to poor lifestyle behaviors, such as insufficient leisure-time physical activity and consumption of less healthy foods, which are also linked to systemic inflammation.[9]

In our study about (40.9%) of the workers were exposed to noise in the working environment. Noise exposure occurs during various industrial activities in textile and wire industry. Noise are excessively produced during loom (a hand-operated or power-driven apparatus for weaving fabrics, containing harnesses, lay, reed, shuttles, treadles etc.) in textile industry and operation of power plant and galvanizing iron and steel in wire industry. Kempen et al. suggested that occupational noise exposure is associated with blood pressure changes and ischemic heart disease risk.[10] The estimated relative risks per 5 dB(A) noise increase is of 1.14 (1.01-1.29).[10] In a study done by Gan et al. compared with the participants who were not exposed, subjects chronically exposed to occupational noise had a 2-3 fold increased prevalence of angina pectoris, myocardial infarction, coronary heart disease and isolated HTN.[11] Since in our worksite the workers were directly or indirectly exposed to noise at various level of work they may have high risk for the development of HTN and subsequently CVD. Although the exact quantification of noise was not made this could be potential area of further research.

About 84.2%, 78.7% and 73.1% had stress sometimes at work, home and financial respectively. However it was only significant for financial stress (OR=2.83, CI-1.03-7.72). Majority of the workers do overtime work (70-80 hrs/week) and were thus exposed to high level of work stress. Additionally most of them were labour class people and worked on daily wages. They had to run the family through the daily wages amount of Rs. 333 which is insufficient. Hence they are always at risk of financial stress. Kivimaki et al. states that employees with high job strain, had twice more cardiovascular mortality risk compared with their colleagues with low job strain. High job strain was associated with increased total serum cholesterol at the 5 year follow up.[12] Additionally, study done by Gallo et al. over the 10 year study frame showed 13.5% of the sample experienced involuntary job loss.[13] After controlling for established predictors of outcomes, the displaced workers had more than two-fold increase in the risk of subsequent myocardial infarction (MI), hazard ratio (HR) = 2.48 and stroke HR = 2.43 relative to working persons. The job loss caused financial deprivation and substantial health consequences.[13]

Our study failed to include night shift workers, thus our finding was limited to workers in morning, evening and day shift. Quantitative assessment of noise could not be done.

CONCLUSION

Risk of cardiovascular disease was seen more among those who worked for more hours; those who did not use

earplug and those who had financial stress. The results need further exploration to establish a causal association between occupational characteristics of the workers and CVD in industrial set-up of eastern Nepal. Although this seems to be a small occupational health study but it adds on occupational risk factor prevalent in the industrial set-up and thus focus the attention of researcher to conduct more studies.

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