Indian Journal of Medical Sciences
(INCORPORATING THE MEDICAL BULLETIN)
VOLUME 59 SEPTEMBER 2005 NUMBER 9
ORIGINAL CONTRIBUTIONS

OCCUPATIONAL INJURIES: IS JOB SECURITY A FACTOR?

ASIM SAHA[1], P.K.KULKARNI[2], R.CHAUDHURI[3], H. SAIYED[4]

ABSTRACT

CONTEXT : Although a large number of contributing factors of occupational injury causation are explored meticulously to explain the phenomenon of higher occupational injury occurrence in some subjects, it has remained a matter of controversy. AIMS : In this study, an effort is made to explore whether job security has any contribution in explaining higher susceptibility of some workers. SETTINGS AND DESIGN : This was a retrospective occupational injury record study conducted in an industry of eastern India. MATERIALS AND METHODS : Along with the study of injury records of 5 years, an interview was also conducted involving 726 workers (including permanent and temporary workers both) of the factory. STATISTICAL ANALYSIS USED : Comp arison was made between permanent and temporary workers by using the Mann–Whitney U-test and the chi-square test. A theoretical model of Poisson's distribution was used to compare between expected and real occurrence. RESULTS : Although two worker groups were very similar in relation to age, level of education, habits, and nature of work, accident frequency and severity rates were found to be significantly higher in temporary workers. CONCLUSIONS : This study concluded that the higher accident risk of the temporary workers might have been due to the less effective experience as well as due to lack of job security inherent in such workers.

KEY WORDS : Job security; occupational injuries; repetitive injury.

[1]Senior Research Officer, [2]Deputy Director, [3]Professor, All India Institute of Hygiene and Public Health, 110, Chittaranjan Avenue, Kolkata, India.[4]Director, National Institute of Occupational Health, Ahmedabad 380016, Gujarat, India.

Correspondence
Dr. Asim Saha,
Senior Research Officer (Medical), National Institute of Occupational Health, Meghani Nagar, Ahmedabad-380 016, Gujarat, India. E-Mail: asimsaha2311@yahoo.co.in

INTRODUCTION

A variety of factors are found to be responsible, either directly or indirectly when a large number of contributing factors of occupational injury causation are explored and their role is measured meticulously to impart scientific support to the fact of higher

occupational injury occurrence in some subjects. Work conditions,[1] age,[2] educational status and safety training,[3] experience,[4] smoking,[5] alcohol,[6] psychosocial factors,[7] shift of work,[8] speed of work[9] are all designated as responsible factors. Some epidemiological investigations have highlighted the role of job security in causation of occupational injuries.[10],[11] These studies have shown that the temporary workers are more vulnerable to occupational injuries than permanent workers. Such studies being only a few, some workers have already mentioned the need of more research in relation to occupational injuries in temporary workers.[11]

In this study, an effort is made to explore whether in a given cohort some workers are more susceptible to occupational injuries than others and if so whether job security is a contributing factor to injury risk.

SUBJECTS AND METHODS

This present study is a retrospective occupational injury record study of 5-year duration involving the workers of a chemical industry. Along with this record study, to collect the personal details of the workers, an interview was also conducted with the workers who have worked in the factory in the study period of 5 years (January 1996–December 2000). Prior informed consent was taken from the participants and necessary ethical clearance from the institutional ethical committee was also obtained for this study. Thus, data in relation to age, sex, job, level of education, experience, habits of smoking and alcohol, etc. were collected. A total of 307 permanent and 419 temporary workers were interviewed. Nine permanent and 29 temporary workers, who have worked during the study period could not be interviewed due to nonavailability. But, accident-related data were collected in relation to all 316 permanent and 448 temporary workers. Chi-square test was done on the data regarding the personal characteristics of the workers in order to examine the comparability between temporary and permanent workers.

Occupational injury registers, pay rolls, productivity registers were examined for the study period of 5 years to collect data in relation to number of accidents, number of employees, amount of lost man-days and amount of working man-hours. Frequency rate and severity rate were calculated as per the standard statistical procedure.[12] Ninety-five percent confidence intervals were calculated for each calculation of frequency rate and severity rate for comparison between the two kinds of workers.[13] Frequency rate was calculated as number of accidents per million working man-hours and severity rate was calculated as number of lost man-days per thousand working man-hours.

Mean number of occupational injuries/person was calculated for both permanent and temporary workers. This calculation was done for all workers, workers with one or more accidents and workers with two or more accidents.

In this study, only reportable injuries (time loss occupational injuries) have been taken into consideration to take care of the factor of nonreporting. Such an occupational injury is compulsorily reported by the concerned worker

because of the fact that reporting ensures his earning of compensation towards loss of wages from the social security scheme (Employees State Insurance Scheme). In this factory, the temporary workers had a peculiar characteristic. Although temporary, they were working for several years (except for a minor percentage of migrant workers) in the same factory. The factory had ceased to recruit permanent employees for long years (except for highly skilled technical persons). This industry manufacturing fertilizer was an industry of semi seasonal nature. Work demand being much more for 7–8 months in a year the temporary workers were employed mostly in that time. The temporary workers also (getting opportunity of regular employment for 7–8 months every year) were working in the same factory for years. No system of shifting from temporary to permanent status was existent in this factory.

Statistical analysis

Comparison was made between permanent and temporary workers by using the Mann–Whitney *U*-test (normality assumption being violated). Proportion of workers (permanent and temporary both) involved in one or more and two or more occupational injuries were calculated and comparison of permanent and temporary workers in this respect was made by using the chi-square test. A theoretical model of Poisson's distribution was fitted to the occupational injury occurrence data of permanent and temporary workers to calculate the expected occurrences and a comparison between the expected and actual occurrence was made by using the chi-square test of goodness of fit. Poisson 's probability of committing 'χ' number of 'accidents' by a worker is given by $P(\chi) = e^{-\mu} \times \mu^{\chi}/\chi$ for $\chi = 0, 1, 2, 3,\ldots$ and μ is the mean estimated from the data. The expected frequency of number of workers committing 'χ' 'accidents' is given by 'N' $P(\chi)$, where 'N' is total number of workers.

RESULTS

Mean age of the two worker groups were 35.3 years for permanent workers and 35.9 years for temporary workers. One hundred and sixty-nine (55.1%) permanent workers and 222 (53.0%) temporary workers were in the age group of less than 35 years. Fifty-three (17.3%) permanent workers were illiterate, while 32 (10.4%) were higher secondary or above level educated. The numbers were 80 (19.1%) and 33 (7.8%), respectively, in case of temporary workers. Two hundred and fifty (81.4%) permanent workers and 330 (78.7%) temporary workers had experience of 5 years or more in the same factory. Two hundred and nine (68.1%) permanent workers and 293 (69.9%) temporary workers were tobacco users (either smoking or chewing). Majority of both kinds of workers were involved in production division [One hundred twenty-three (40.1%) permanent and 171 (40.8%) temporary workers]. Others were engaged in different other sections (maintenance, packing, loading, etc.) [Table 1]. All the employees of this factory were males. No female worker was employed in this factory. Application of chi-square test showed that there was no significant difference in the personal characteristics of the two worker groups.

Frequency rate (for a period of 5 years) for

Table 1: Personal characteristics of the workers

Personal characteristics	*Category*	*Permanent Workers (%)*	*Temporary Workers (%)*	*Significance*
		N = 307	**N - 419**	
Age (years)	<35	169 (55.1)	222 (53.0)	NS
	35–55	120 (39.1)	162 (38.7)	
	< 55	18 (5.9)	35 (8.3)	
Educational status	Illiterate	53 (17.3)	80 (19.1)	NS
	Up to secondary level	222 (72.3)	306 (73.0)	
	Above secondary level	32 (10.4)	33 (7.8)	
Habit of tobacco use	Tobacco user	209 (68.1)	293 (69.9)	NS
	Nonuser	98 (31.9)	126 (30.1)	
Experience (years)	<5	57 (18.6)	89 (21.2)	NS
	³5	250 (81.4)	330 (78.7)	
Nature of work	Production	123 (40.1)	171 (40.8)	NS
	Others	184 (59.9)	248 (59.2)	

temporary workers was found to be 277 (95% CI = 258–297). For permanent workers it was 41 (95% CI = 34–48). Severity rate for temporary workers for the same period was 5.33 (95% CI = 5.24–5.41). For permanent workers it was 0.72 (95% CI = 0.69–0.75). Relative risk calculated on the basis of frequency rate was 6.7 (95% CI = 5.6–8.0) and on the basis of severity rate was 7.43 (95% CI = 7.12–7.75) [Table 2]. Mean number of injuries/person was significantly higher ($P < 0.001$) in temporary workers in comparison of permanent workers when compared in relation to all workers, workers with one or more occupational injuries and workers with two or more occupational injuries. One or more occupational injuries were found with 238 (53.1%) of temporary workers and 113 (35.8%) of permanent workers ($P < 0.001$), whereas two or more occupational injuries were met with by 213 (47.5%) temporary workers and 25 (7.9%) permanent workers ($P < 0.001$) [Table 3].

Repetitive occupational injury occurrence was found in a section of temporary workers. One hundred and eighty (40.18%) temporary workers met with three or more injuries, 107 (23.88%) met with four or more and 26 (5.80%) contacted five or more injuries in the period of 5 years. Comparison of observed and expected (Poisson's probability distribution) injury occurrences showed that though the injury occurrences in case of permanent

Table 2: Frequency rate and Severity rate of Permanent and Temporary workers

Status of employment	*Man hours worked*	*Man days lost*	*No. of injuries*	*Frequency rate*	*Relative risk*	*Severity rate*	*Relative risk*
Permanent	3391264	2432	140	41(34-48)	6.7(5.6-8.0)	0.72(0.69-0.74)	7.4(7.1-7.7)
Temporary	2797128	14901	776	277(258-297)		5.33(5.24-5.41)	

Table 3: Comparison of permanent and temporary workers in relation to repetition of occupational injuries

	Number of workers		*Mean number of injuries/ person ± SD*		
Category	*Permanent*	*Temporary*	*Permanent*	*Temporary*	*Significance*
All workers	316	448	0.44 ± 0.66	1.73 ± 1.87	*P* < 0.001
Workers with one or more injuries	113	238	1.24 ± 0.47	3.26 ± 1.27	*P* < 0.001
Workers with two or more injuries	*25*	*213*	*2.08 ± 0.28*	*3.53 ± 1.07*	P < *0.001*

Table 4: Comparison of observed and expected (Poisson probability distribution) occupational injury occurrences.

No.of injuries	*Permanent workers*		*Temporary workers*	
	Observed	*Expected*	*Observed*	*Expected*
0	203	203.515	210	79.423
1	88	89.546	25	137.402
2	23	19.700	33	118.853
3	2	2.889	73	68.538
4	0	0.317	81	29.642
5	0	0.027	21	10.256
6	0	0.002	1	2.957
7	0	0.000	2	0.730
8	0	0.000	1	0.158
9	0	0.000	1	0.030
Significance of test of goodness of fit	NS		P<0.001	

workers followed the Poisson's probability distribution, the same occurrences in case of temporary workers did not follow the same distribution [Table 4].

DISCUSSION

Frequency and severity rates have been significantly higher in the temporary workers, which reflect higher risk of occupational injury in the temporary workers. Significantly higher ($P < 0.001$) mean number of injuries/person in temporary workers and significantly higher percentage of temporary workers' involvement in two or more occupational injuries also depicts the higher risk of injuries in temporary workers. Calculated relative risks on the basis of frequency and severity rates are also significant. This finding of higher injury risk of the temporary workers is similar to the experience of earlier published reports.[10],[11] The two types of workers had similar trend in age distribution, habit of tobacco use, educational status, experience, and job. Even then distinct difference of injury status is observed between the two worker groups. This may be attributed to the temporary status of the working group having significantly more number of injuries. Lack of job security may have played a role in such workers. Other factors frequently associated with temporary workers (more risky job given to them, no choice of shifting to safer job even after an injury, less effective experience) might have contributed to such increased occurrence of injuries in temporary workers. The factory where this study was undertaken had no established safety training system. Only way for gaining knowledge of safety was on the job experience. In this respect, the permanent workers may have been in a better position than the temporary workers because of the fact that the temporary workers do not get chance to work always in the year like the permanent workers. Accordingly, effective experience may have been less in the temporary workers.

Occupational injury data of permanent workers followed the Poisson's probability distribution but in case of temporary workers it did not follow such distribution. The number of workers committing three or more accidents is clearly in excess of the expected numbers. This also is an indirect evidence of the fact that occupational injuries have taken place in excess in case of temporary workers.

Although very few studies are carried out till date to make a comparative analysis of temporary and permanent workers, there are studies that have reported about the significant contribution of different factors (usually associated with nonpermanent workers) in the causation of occupational injuries. Lack of job training,[14] job characteristics like job

dissatisfaction,[15] work environmental condition[16] (in many occasions temporary workers have to face relatively more adverse environmental conditions) and sleep deprivation[17] (many times nonpermanent workers are engaged in other part time activities) are such factors that are found to be responsible for occupational injuries in these studies.

This study has made an attempt to highlight the fact that temporary nature of employment has got some adverse effects so far as the causation of occupational injuries are concerned. To take care of completeness of injury data only reportable injuries are analyzed in this study so that the factor of nonreporting can be eliminated. Even then this study has suffered from some limitations. Workers could not be followed for the entire period like a classical retrospective cohort study. A multivariate analysis involving the possible contributing factors like age, duration of employment, etc., could have thrown more light on this issue.

However, this study has not only concluded that the temporary workers have a different profile of occupational injuries but also it has stressed the need of further exploration of the role of job security (psychological effect) in the causation of occupational injuries in temporary workers taking care of the confounding effect of other characteristics of temporary workerhood.

REFERENCES

1. Melamed S, Yekutieli D, Froom P, Kristal-Boneh E, Ribak J. Adverse work and environmental conditions predict occupational injuries: The Israeli cardiovascular occupational risk factors determination in Israel (CORDIS) study. Am J Epidemiol 1999;150:18-26.
2. Cloutier E, The effect of age on safety and work practices among domestic trash collectors in Quebec. Safety Science 1994;17:291-308.
3. Wong TW. Occupational injuries among construction workers in Hong Kong. Occup Med 1994;44:247-52.
4. Salminen ST. Epidemiological analysis of serious occupational accidents in southern Finland. Scand J Soc Med 1994;22:225-7.
5. Ryan J, Zwerling C, Orav EJ. Occupational risks associated with cigarette smoking: A prospective study. Am J Publ Health 1992;82:29-32.
6. Wells S, Macdonald S. The relationship between alcohol consumption patterns and car, work, sports and home accidents for different age groups. Accid Anal Prev 1999;31:663-5.
7. Niedhammer I, Bugel I, Goldberg M, Leclerc A, Gueguen A. Psychosocial factors at work and sickness absence in the Gazel cohort: a prospective study. Occupational and Environmental Medicine 1998;55:735-41.
8. Smith L, Folkard S, Poole CJ. Increased injuries on night shift. Lancet 1994;344:1137-9.
9. Harrell WA. Perceived risk of occupational injury: control over pace of work and blue-collar versus white-collar work. Percept Mot Skills 1990 ; 70 : 1351-9.
10. Sampaio RF, Martin M, Artazcoz L, Moncada S. Occupational accidents in Barcelona (Spain), from 1992 to 1993. Rev Saude Publica 1998 ; 32 : 345-51.
11. Morris JA. Injury experience of temporary workers in a manufacturing setting: Factors that increase vulnerability. AAOHN J 1999;47:470-8.
12. Brancoli M. Accident Statistics. In: International Labour Office, ed. Encyclopaedia of Occupational Health and Safety. Vol. 1, 3rd Edition.

Geneva:ILO, 1983;32-35.
13. Ahlbom Anders, Norell Staffan. Introduction to Modern Epidemiology. 2nd Edition. USA: Epidemiology Resources Inc,1990;70.
14. Sarmiento-Salinas R, Lopez-Rojas P, Marin-Cotonieto IA, Godinez-Rocha A, Haro-Garcia L, Salinas-Tovar S. Risk factors associated with work-related accidents in the construction industry in the Valley of Mexico. Gac Med Mex 2004;140:593-7.
15. Dembe AE, Erickson JB, Delbos R. Predictors of work-related injuries and illnesses: national survey findings. J Occup Environ Hyg 2004;1:542-50.
16. Leclercq S, Thouy S. Systemic analysis of so-called 'accidents on the level' in a multi trade company. Ergonomics 2004;47:1282-300.
17. Spengler SE, Browning SR, Reed DB. Sleep deprivation and injuries in part-time Kentucky farmers: impact of self reported sleep habits and sleep problems on injury risk. AAOHN J 2004;52:373-82.