

Conference Paper

Effects of Shift Work on Chronic Fatigue Symptoms among Automotive Part Workers

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Abstract

Shift work is associated with negative effects on sleep and performance as well as with chronic fatigue. The goal of this cross-sectional study was to explore chronic fatigue symptoms among automotive part workers. Chronic fatigue symptoms were measured using the Piper Fatigue Scale (PFS) questionnaire. Fatigue measurement results showed that about 50.7% of die-casting part shift workers had symptoms of mild fatigue, and 49.3% had symptoms of severe fatigue. The risk factors significantly related to fatigue symptoms include job design, overtime, physical workload, commute time, and health status. This study shows that shift work might affect fatigue symptoms among manufacturing workers. It seems necessary to implement ergonomic continuous improvement programs for more appropriate shift work as well as reducing working hours.

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1. INTRODUCTION

Fatigue is a feeling that arises naturally; it can involve lethargy, loss of control, and the inability to interact with others and can ultimately lead to complaints of stress and depression [8]. Definitions of fatigue show varying degrees of each type of symptom, but all can result in a loss of efficiency and a reduction in work capacity and endurance. Fatigue in the workplace can be caused by a combination of interrelated factors, including physical, environmental, and mental burdens. Factors causing fatigue can be either work-related or not related to work.

Research in Australia shows that as much as 93% of accidents among heavy equipment operators at a coal open-cut mine stemmed from work-related fatigue [2] According to Duncan research, as much as 16.5% of nurses identified fatigue as a reason for failure in drug delivery [1] and according to the US National Transportation

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Safety Board, 57% of all accidents in 2000 were due to fatigue [2]. In general, this fatigue occurred among shift workers with excessive workloads.

Shift work is a method of work organization wherein each worker in a group performing the same operation works on different schedules, or shifts, so the group can operate longer than the weekly number of hours specified for a single worker. In shift work conditions, workers are forced to change their typical waking cycles according to the activity, and their rest periods are also changed.

PT TD Automotive Compressor Indonesia (TACI) is one of the industries that apply shift work to support their operations. One part of the work is the die casting unit. Based on an initial survey, die cast operators are one group of workers at risk of fatigue. Therefore, it was necessary to do an in-depth study on the conditions and factors associated with the level of fatigue occurring in the production department of PT TACI, particularly die casting.

2. METHODS

This study was conducted in May and June 2016, using a cross-sectional design. The population of workers making die casting parts included a sample of 63 shift workers from PT TACI. The data in this study were obtained from a questionnaire adapted from the Piper Fatigue Scale (PFS) to measure subjective fatigue. The questionnaire contains questions used to determine the factors that cause fatigue as part of workers' complaints. In determining the categorization of fatigue, the codes used on the Piper Fatigue Scale (PFS) include 1–3 mild categories, 4–6 moderate categories, and 7–10 severe categories [4].

3. RESULTS

Fatigue measurement results indicated that 35 (50.7%) of the 69 die casting part shift workers had complaints of fatigue in the mild category, and 34 (49.3%) had complaints of fatigue in the severe category. The die casting operators' work-related risk factors are listed in Table 1, which includes data regarding shift work, rest periods, working time, design work, overtime, additional work, physical load, mental load, and environmental load.

The die casting operators' non-work-related risk factors are listed in Table 2, which includes data regarding age, time of travel, health, community social activities, and relationships with family.

Based on the results of the bivariate analysis, there are only five variables associated with complaints of fatigue: work design ($p = 0.030$), overtime ($p = 0.028$), physical load ($p = 0.036$), time ($p = 0.001$), and the level of health ($p = 0.016$) (Table 3).

4. DISCUSSION

4.1. Subjective Fatigue of Die Casting Workers PT TACI

Fatigue involves a decrease in work capacity and endurance of work, marked by fatigue, lethargy, and fatigue sensations. In this study, the circumstances experienced by the studied shift workers involving both physical and mental fatigue were measured using the Piper Fatigue Scale (PFS). This study measured 69 respondents (die casting operators at PT TACI) to assess complaints of fatigue. The results showed that among these 69 workers, 34 (49.3%) experienced a severe fatigue condition, while 35 others (50.7%) experienced a relatively light state of exhaustion.

TABLE 1: Work-related Risk Factors of Die Casting Operators.

Risk factor	Categories	N	%
Work shift	Morning	28	40.6
	Night	41	59.4
Rest time	Enough	4	5.8
	Not enough	65	94.2
Work time	≤ 8 hours	3	4.3
	> 8 hours	66	95.7
Work design	Monotonous	51	73.9
	Dynamic	18	26.1
Work overtime	Yes	60	87.0
	No	9	13.0
Work other	Yes	2	2.9
	No	67	97.1
Physical load	Yes	20	29.0
	No	49	71.0
Mental load	Yes	14	20.3
	No	55	79.7
Environmental load	Yes	17	24.6
	No	52	75.4

It is important to monitor and manage the risks that fatigue poses to the safety of work. A comprehensive method for managing the risk of job burnout is to use a fatigue risk management system (FRMS), a system specifically designed to combat

TABLE 2: Non-work-related Risk Factors of Die Casting Operators.

Risk factor	Categories	N	%
Age	≤25 years	54	78.3
	>25 years	15	21.7
Commuting time	≥60 minutes	56	81.2
	<60 minutes	13	18.8
Health status	Healthy	37	53.6
	Unhealthy	32	46.4
Community social activities and relationships with family	Yes	42	60.9
	No	27	39.1

the risks associated with fatigue. The first FRMS model was proposed by Dawson and McCulloch in 2005. This type of system includes a series of layers of defense that can be established at four points in combination with the potential trajectory. At each point, the potential for fatigue-related accidents can be identified and prevented [6] Fatigue cannot be eliminated, but risk factors associated with fatigue can be managed through collaboration between the company and workers [6].

A worker's physical load has a significant relationship with fatigue, according to research as described in Haghghi (2015), showing that physical burden is one of the causes of fatigue. Physical load can include such things as the use of force, awkward postures, static loads, and repetitive movements. From the results of the research conducted on the die casting unit of PT TACI, overall, physical load factors potentially affecting job performance and causing respondents to make complaints of fatigue involved the use of excessive force in carrying out the work.

Overtime occurs when time at work exceeds the normal working time. Based on our results, the respondents often work beyond normal working hours. Within a week, some respondents worked overtime more than four times a week, for an overtime duration of three hours per day. This was limited due to rules that state that overtime work can be done at most for three hours a day.

An analysis of the relationship between overtime and complaints of fatigue showed a significant association between overtime and symptoms of fatigue. The results also showed that workers who worked overtime experienced 9.778 times the number of complaints of fatigue compared to workers who did not work overtime. Working more than the standard 35 to 40 hours a week may cause more tired workers and will result in extended injuries and illness related to shift work [3].

TABLE 3: Bivariate Analysis.

Variable	OR (95% CI)	P Value	Corelation
<i>Work Shift</i>	0.825 (0.315-2.161)	0.808	None
Rest Time	0.304 (0.030-3.077)	0.356	None
Work Time	0.471 (0.041-5.445)	0.614	None
Work Design	0.269 (0.083-0.870)	.,030	correlated
Over time	9.778 (1.150-83.120)	0.028	correlated
Additional work	1.030 (0.062-17.163)	1.000	None
Physical Load	3.383 (1.111-10.299)	0.036	correlated
Mental Load	1.487 (0.455-4.857)	0.561	None
Environmental Load	1.215 (0.406-3.638)	0.785	None
Age	0.575 (0.180-1.839)	0.394	None
Time of travel	17.217 (2.091-141.775)	0.001	correlated
Health status	3.524 (1.305-9.522)	0.016	correlated
community social activities, and relationships with family.	0.661 (0.250-1.747)	0.465	None

Based on the study results, work design could be divided into two categories: monotonous and dynamic. A static or monotonous job requires workers to maintain a certain posture or position for an extended period of time. In contrast, an effective job involves a lot of movement in its processes [5].

In this study, the design of work has a significant relationship with complaints of fatigue; this is in line with the research on the effects of monotonous work on fatigue. Monotonous work has an indirect effect on employment through job stress fatigue; it increases work stress, which in turn affects fatigue. Monotonous work that does not vary will also lead to saturation that could potentially cause fatigue. Monotonous work can lead to boredom, which can result in reduced attention, perception, and cognition and can reduce the activity and performance of the workforce. This situation involves decreases in alertness, sluggishness/an impression of laziness, and discomfort, with a strong desire to get out of the monotonous environment [7].

5. CONCLUSION

The fatigue measurement results indicated that 35 people (50.7%) among the 69 die casting part shift workers complained of fatigue in the mild fatigue category, while 34 (49.3%) had complaints of fatigue in the severe fatigue category. Work-related variable risk factors shown by this study to have a significant relationship with complaints of fatigue include the design of the work, overtime, and physical burden. Non-work-related variable risk factors shown to have a significant relationship with complaints of fatigue included travel time and health levels.

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