

The association between noise, work stress and coping with sleep quality among cable manufacturing workers

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Abstract

Poor sleep quality has been found previously to cause various negative outcome among workers. There are many factors which may influence sleep quality which include noise and work stress. This is the first study aims to explore the association between three factors; noise, work stress and coping strategies and sleep quality among manufacturing workers. This study employed cross-sectional study design involving 140 cable manufacturing workers who were recruited via simple random sampling. The Malay-version Stress Overload Scale (SOS) was used to measure stress overload. Coping strategies was assessed via Coping Strategy Indicator (CSI) and sleep quality was estimated by using Pittsburgh Sleep Quality Index (PSQI). All respondents were male and most of them were Malay, married and working as machine operator. Results showed that at least 50% of the subject were exposed to the noise level of more than 86.83 dB (A). Majority of respondents (89.3%) had poor sleep quality and experienced low level of stress (77.9%). Higher level of all components of work stress ($r = 0.18-0.22$) and higher level of being avoidance as a coping strategy ($r = 0.26$) were found to be significantly correlated with poorer sleep quality. However, noise was not found to be a significant factor of sleep quality. The present findings suggested that work stress and coping were the dominant determinants for sleep quality which helps in prioritizing intervention strategies to improve sleep quality among respondents.

Keywords: Noise, Work Stress, Coping, Sleep Quality, Manufacturing Workers

Introduction

A normal adult spends between six to eight hours a day, or about one-third of their lifetime sleeping. Sleeping is a normal physiological process of human being and poor sleep quality will reduce human alertness, impairs judgment, and affect emotion. Sleep quality include the number of arousal, sleep duration and latency, and the depth and restfulness of sleep (Buysse et. al., 1989). Sleep disturbances has been found previously to be related to several physiological and psychological detrimental effects including work accidents (Gaultney & Collins-McNeil, 2009). Based on 23 observational studies, Uehli, et al. (2014), concluded that approximately

13% of work accident could be attributed to sleep problems. Manufacturing workers are more related to the occupational/industrial noise as they are exposed to the noise from the machine at the workplace. Industrial noise is characterized with high frequency noise (Reinhold, Kalle, & Paju, 2014). This noise was found previously to be associated with sleep disturbance among them (Mokhtar et al., 2007; Gitanjali & Ananth, 2003). Fouladi et al. (2012) suggested that workers exposed to high level of noise experienced more psychological stress. Psychological stress was found significant in disturbing sleep quality which is most probably due to the increased production of stress-hormone (Kim et al., 2011). However, individual psychological



stress can be influenced by individual coping strategies. Coping strategies are usually divided into three distinct categories which were problem solving, social support and avoidance (Amirkhan, 1990). Coping is recognized as a significant moderator for work stress among people in several countries (Bhagat, 2010).

Materials and Method

This research employed a cross-sectional study design from September 2014 to June 2015 at a cable manufacturing factory in Selangor, Malaysia. This factory primarily involved in the manufacturing and supply of various power cables. Hundred-forty production workers were recruited via simple random sampling by table of random numbers based on the name list of workers that was obtained from the administration section of the company.

Noise area monitoring

A walkthrough survey was conducted to identify the noisy area. The noise measurement was conducted at the area where respondents exposed to the noise through the walkthrough survey. The reading was taken three times at three different points surrounding each machine by using the sound level meter.

Socio-demographic, work stress and coping and sleep disturbances

Socio-demographic data was determined by using self-administered questionnaire together with three other standardized questionnaires. The Stress Overload Scale (SOS) was used to measure stress overload for the past one week. Stress overload is described as arising when demands overwhelm resources. SOS contains 30-items with two domain which were personal vulnerability and event load (Amirkhan, 2012). The responses are in a form of Likert Scale from 'not at all = 1' to 'a lot = 5'. From the previous study, the internal consistency of the SOS was excellent ($\alpha > .94$) (Amirkhan, 2012).

The Coping Strategy Indicator (CSI) (Amirkhan, 1990) was used to assess three groups of coping strategies; problem solving, seeking support, and avoidance. Each component was graded from 1(Not at All) to 3 (A lot)

The Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) was used to determine the respondent's sleep quality over the previous month. The PSQI

consists of 19 questions with seven components; subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication and daytime dysfunction. It has good internal consistency and reliability coefficient ($\alpha = 0.83$) These 7 component scores was sum up to produce Global PSQI (range between 0-21). Poor sleep quality was determined when score equal or greater than 5 (Buysse et al., 1989)

Results

Hundred and forty workers agreed to participate in the study thus contributed to 100% of the response rate. All of them was male with an average age of 32.81 years. Most of them was Malay and married. See Table 1. The average years of job tenure was 7.85 ± 6.7 . Based on the walkthrough survey, majority of them was exposed to noise but they were wearing earplugs as protective mechanism. All participants worked 8 hours a day with rotating shiftwork.

Table 1: Socio-demographic and work characteristics of study participants

Variables	Mean \pm SD/min-max	f (%)
Gender		
Male		140(100%)
Age(years)	32.81 \pm 7.92/21-57	
Marital status		
Single		54(38.6%)
Married		86(61.4%)
Race		
Malay		139(99.3%)
Chinese		1(0.7%)
Job position		
Machine operator		109(77.9%)
Technician		31(22.1%)
Employment(years)	7.85 \pm 6.70/1-33	
Noise Exposure		
Yes		128(91.4%)
No		12(8.6%)
PPE compliance		
Yes		113(80.7%)
No		27(19.3%)

Noise level

The average noise level was 87.2 ± 0.25 dB(A). The maximum noise level was 96.46 dB(A) at aluminum plant and the lowest was 83 dB(A) at jacketing area. The median value was 86.83 dB(A), indicating that at



least 50% of the subject were exposed to the noise level of more than 86.83 dB(A).

Prevalence of work stress and sleep quality Results indicated that majority of participants (89.3%) had poor sleep and experienced low level of stress (77.9%). See Table 2.

Table 2: Prevalence of work stress and sleep disturbances

Variables	Mean±SD/min-max	f (%)
Sleep Disturbances	7.62±2.67/2-14	
Poor sleep (>5)		125(89.3%)
Good sleep (<5)		15(10.7%)
Stress level	62.89±16.48/29-120)	
Low stress		109(77.9)
High stress		31(22.1)

Correlation between noise, work stress and coping with sleep quality

Correlation analyses were conducted between socio-demographic and work characteristics, work stress, coping strategies and noise with sleep disturbances. Higher level of all components of work stress ($r = 0.18-0.22$) and higher level of being avoidant ($r = 0.26$) significantly correlated with poorer sleep quality. Correlation test was also done between noise levels and stress but was not significant. See Table 3.

Table 3: Correlation between work stress and coping with sleep disturbances

Variables	Total PSQI score	
	r value	p-value
Work Stress		
Personal Vulnerability	0.21	0.01*
Event Load	0.18	0.03*
Total stress	0.22	0.01*
Coping Strategies		
Problem solving	0.004	0.96
Social support	0.044	0.61
Avoidance	0.26	0.002*

Discussion

The workers were exposed to continuous noise that was emitted from the machine at the production area. The work unit under aluminum plant was identified as a high continuous noise exposure as machines in that plant needs more energy powered to melting and moulding the raw aluminums into cable wire. Noise from other nearby machines and building structure

with poor absorbing material may contribute to the increase noise reading. The prevalence of poor sleep quality found in this study was 89.3% which was higher than the previous study done among Malaysian workers in aluminum company (71.3%) (Nuaim, et al., 2015). Lower prevalence was also recorded in a previous study among manufacturing workers in the USA (Luckhaupt et al., 2010) and Taiwan (Chou & Hsieh, 2010). Comparison of the results are difficult to be made because there are many factors that can cause poor sleep quality including noise and stress which were not measured in these two previous studies. The prevalence of work stress among respondents were 22.1%. This result is similar with that from previous study shown among Malaysian polymer workers (25.3%) (Nada et al., 2012). Similar findings were found among Korean workers (Kim et al., 2011). In the present study, noise was not significant in predicting sleep quality which support findings of previous study in Brazil (Rios & da Silva, 2005) but in contrary to the previous findings among Malaysian industrial workers (Mokhtar et al., 2007). The workers were exposed to the noise during work every day, and most probably they were already adapted to the noise exposure which no longer affect their sleep. Instead, findings of the present study suggested that work stress and avoidance coping was significant in predicting sleep quality among respondents. The prevalence of stress level among the respondents in this study was 22.1%. The mechanism of how stress affect sleep was not fully established. According to Fouladi et al. (2012), work stress increase cortisol level that consequently disturb sleep.

Conclusion

Majority of respondents had poor quality sleep which were significantly predicted by work stress and coping strategies and not by occupational noise exposure. Findings of the present study assist in prioritizing prevention mechanism to improve sleep quality among respondents.

References

- Amirkhan JH, 1990. A factor analytically derived measure of coping: The Coping Strategy Indicator. *J Pers Soc Psychol.* 59(5): 1066–1074.



- Amirkhan JH, 2012. Stress overload: A new approach to the assessment of stress. *Am J Community Psychol.* 49(1-2): 55-71.
- Bhagat RS, Krishnan B, Nelson TA, Moustafa Leonard K, Ford Jr DL, & Billing TK, 2010. Organizational stress, psychological strain, and work outcomes in six national contexts: a closer look at the moderating influences of coping styles and decision latitude. *Cross Cult Manag.* 17(1): 10-29.
- Buyse DJ, Reynolds CF, Monk TH, Berman SR, & Kupfer DJ, 1989. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 28(2): 193-213.
- Luckhaupt SE, Tak S, & Calvert GM, 2010. The prevalence of short sleep duration by industry and occupation in the National Health Interview Survey. *Sleep.* 33(2): 149-159.
- Chou AW, & Hsieh CL, 2010. The impact of Shift Work Implementation on sleeping quality and job performance: A case study of semi-conductor manufacturing company. In *Computers and Industrial Engineering (CIE), 2010 40th International Conference on* (pp. 1-6). IEEE.
- Fouladi DB, Nassiri P, Monazzam EM, Farahani S, Hassanzadeh G, & Hoseini M, 2012. Industrial noise exposure and salivary cortisol in blue collar industrial workers. *Noise and Health.* 14(59): 184-189.
- Gaultney J & Collins-McNeil J, 2009. Lack of Sleep in the Workplace: What the Psychologist-Manager Should Know About Sleep. *The Psychologist-Manager Journal.* 12(2): 132-148.
- Gitanjali B, & Ananth R, 2003. Effect of acute exposure to loud occupational noise during daytime on the nocturnal sleep architecture, heart rate, and cortisol secretion in healthy volunteers. *J Occup Health.* 45(3): 146-152.
- Kim HC, Kim BK, Min KB, Min JY, Hwang SH, & Park SG, 2011. Association between job stress and insomnia in Korean workers. *J Occup Health.* 53(3): 164-174.
- Mokhtar MO, Kamaruddin S, Khan ZA, Mallick Z, 2007. A study on the effects of noise on industrial workers in Malaysia. *J. Tech.* 46: 17-30.
- Nada I, Anita AR, Eqbal ZS, Wilson CVS, Afzan ZZ, Rahmah AS, & Atikah CH, 2012. A study of organizational factors in occupational stress problems among workers in a polymer manufacturing factory. In *Network of Ergonomics Societies Conference (SEANES), 2012 Southeast Asian* (pp. 1-5). IEEE.
- Nuaim R, Irniza R, Sharifah Norkhadijah SI, Emilia ZA, 2015. The Relationship between Noise with Stress and Sleep Disturbances among Manufacturing Workers. *Asia Pacific Environmental and Occupational Health Journal.* 1(1): 9-14.
- Reinhold K, Kalle S, & Paju J, 2014. Exposure to high or low frequency noise at workplaces: differences between assessment, health complaints and implementation of adequate personal protective equipment. *Agronomy Research.* 12(3): 895-906.
- Rios AL, & da Silva GA, 2005. Sleep quality in noise exposed Brazilian workers. *Noise and Health.* 7(29): 1-6.
- Uehli K, Mehta AJ, Miedinger D, Hug K, Schindler C, Holsboer-Trachsler E, & Künzli N, 2014. Sleep problems and work injuries: A systematic review and meta-analysis. *Sleep Med Rev.* 18(1): 61-73.

