



Surveying and Impact Path of Noise on the Worker's Unsafe Behavior in Prefabricated Construction

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Abstract. The prefabricated construction industry, while promising in its prospects, introduces fresh safety challenges. Noise, as one of the important influencing factors affecting prefabricated construction workers, has an unavoidable impact on construction workers' unsafe behavior. This study explores these unsafe behaviors by constructing models, hypothesizing on the probable causes, and validating them via questionnaires. Accumulated data is cross-tabulated and combined with a theoretical model. Results conclude that the occurrence of psychological discomfort under the noise of the construction of prefabricated buildings has an impact on the efficiency of the work (distraction failure) and physiological discomfort has an impact on decision-making failures (unsafe decision-making) in each case.

Keywords: Prefabricated Construction; Unsafe Behavior

1 Introduction

In recent years, under the support of national industrial policy and the boost of the market environment, the prefabricated construction industry will usher in the golden period of development. As summarized by the survey, the reasons for unsafe behaviors of prefabricated construction workers can be divided into the following points: 1) Lack of safety knowledge; 2) Inadequate construction management; 3) Unsafe working environment. There are various unsafe factors in the construction site, which can easily lead to accidents if corresponding protective measures and safety facilities are not taken. Construction noise, as an important source of pollution in the construction site environment, has the characteristics of high intensity, high sound level, long interference time, strong penetration, etc., which has a potential impact on the unsafe behavior of workers. However, most of the companies do not recognize and pay no attention to how much harm prolonged exposure to high noise levels can cause to construction workers [1].

According to current research, in physiological aspects, when workers are exposed to a certain intensity of productive noise, it will damage their auditory system and non-auditory system functions, which are mostly reversible and physiological changes at the beginning, but irreversible and pathologic changes can occur when they are exposed to strong noise for a long period [2]. Intermittent noise reduces attention and short-term

memory, and building construction noise tends to produce different degrees of annoyance, making it difficult for employees to concentrate on their work, which leads to a series of unsafe behaviors [3]. Long-term occupational noise can damage the cardiovascular system of workers [4]. In addition, there is a correlation between damage to the auditory system and cumulative noise exposure [5].

However, there is no systematic research on the connection between the factors of noise on the psychological, physiological, and unsafe behavior of prefabricated construction workers. Therefore, this paper takes the unsafe behavior of prefabricated construction workers as the core research problem, focuses on the effects of noise on the physiological and psychological aspects of prefabricated construction workers' unsafe behavior, and explores the connection between each factor through the method of cross-analysis.

2 Theoretical modeling of the noise affecting the unsafe behavior

The negative effects of noise on prefabricated construction workers can be categorized into psychological and physical health. The model of noise impact on unsafe worker behavior in prefabricated construction workers is constructed, shown in Fig. 1.

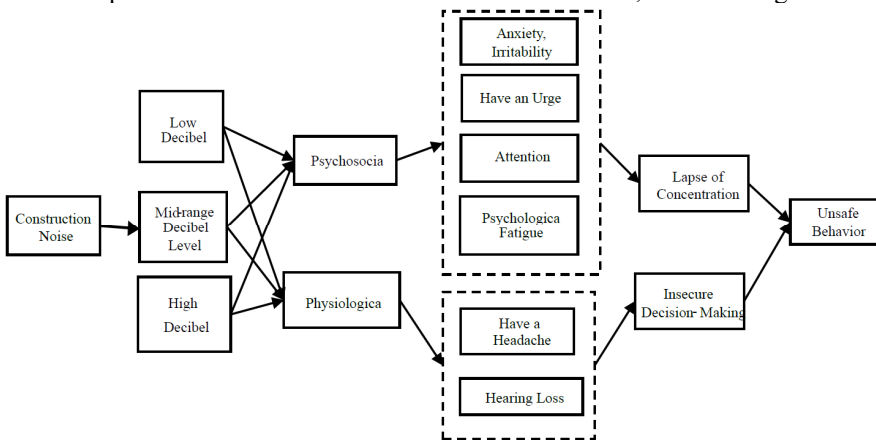


Fig. 1. Model of noise impact on unsafe worker behavior in prefabricated construction.

H1: Noise has a direct impact on the workers' mental health.

Different types of noise, such as the operation of machinery and equipment, metal banging, and blasting, can cause different psychological responses. 1) Noise can cause stress, tension, and irritability in workers, increasing the risk of anxiety occurring. It can increase the likelihood of making impulsive and irrational decisions. 2) Noise may cause workers to have particularly strong feelings, weak rational control, lose supervise, and cause impulsive psychological phenomena, which can lead to actively engaging in unsafe impulsive behaviors. 3) Noise can lead to a decrease in workers' attention span.

High-intensity noise can cause distraction and confusion among workers, making it difficult for them to concentrate on work tasks. 4) Noise can cause psychological fatigue among workers. When workers are performing complex or highly concentration-requiring tasks, noise interferes with their thought processes and affects the accurate response of the nerve centers of the brain, making them susceptible to psychological fatigue and leading to errors and mistakes. Workers may ignore safety regulations or operating procedures, thereby increasing the risk of unsafe behavior [6].

H2: Noise can hurt workers' physical health.

Prolonged exposure to high-decibel noise can lead to physical discomforts such as headaches and hearing loss. 1) Headaches may affect workers' ability to concentrate and think, making them more susceptible to distraction and mistakes. 2) Hearing loss can reduce workers' ability to perceive their environment, making it difficult to accurately access and analyze information, and thus make unsafe decisions. When confronted with complex or emergencies, workers may suffer health problems such as hearing damage and headaches due to prolonged noise exposure. It affects the brain's ability to process information and make decisions, making workers unable to accurately recognize and assess hazards, and make unsafe decisions [7].

3 Path analysis of noise affecting the unsafe behavior

The influence path of unsafe behaviors under the influence of multiple variables in the noise environment is verified using the cross-analysis method. The results can provide support for the development of unsafe behavior management strategies for construction workers.

3.1 Data collection

A total of 233 valid questionnaires are collected, and the data structure is shown in Table 1.

Table 1. Data structure.

Questionnaire content	number of people	percentage
working status	Construction staff	68.24%
	Non-construction staff	32%
working hours	Less than 4 hours	24.03%
	4-8 hours	48.93%
	More than 8 hours	27.04%
noise level	Noise is small and negligible	15.45%
	Moderate to negligible noise	24.46%
	Moderate noise, not negligible	62.66%
	The noise is too loud to be ignored	38.20%

3.2 Results

According to the theoretical model in Fig. 1, cross-tabulation analysis is used to analyze the interrelationships among the relevant variables of psychological, physiological, distracted error, and unsafe decision-making.

Scholars have conducted relevant theoretical analysis on selecting and determining the physiological parameters (heart rate and blood pressure), psychological parameters (annoyance) and behavioral ability indicators (reaction time and number of errors) of construction workers in the noise environment [1], which showed that construction noise had an impact on the psychology and physiology of construction workers. However, the explanation cannot be carried out for the specific correlation between construction noise, construction workers' psychological parameters, construction workers' physiological parameters and unsafe behavior. This study conducted a cross-tabulation analysis to intuitively reveal its impact relationship of noise affecting the unsafe behavior.

(1) The chi-square tests.

The asymptotic sig value of psychological discomfort and decision-making failure (unsafe decision-making) and physiological discomfort and work efficiency (distraction failure) is much larger than 0.05, and it is not possible to reject the original hypothesis, then there is no significant correlation between the two variables mentioned above, which is by the constructed theoretical path model. Therefore, the following analysis is carried out to analyze the effect of psychological discomfort on work efficiency (distraction failure) and the effect of physiological discomfort on decision-making failure (unsafe decision-making) under the noise environment of prefabricated building construction.

(2) Impact of psychological discomfort on work efficiency.

The relevant data obtained from the questionnaire are cross-analyzed by the Spss, and as shown in Fig. 2. 52.6% of the respondents who thought that the noise of prefabricated building construction would cause psychological discomfort strongly agreed that its psychological impact would have an impact on work efficiency. 75.2% of the respondents agreed that its psychological impact would have an impact on work efficiency, which is the most significant situation. This shows that there is a correlation between psychological discomfort and work efficiency (distraction) under noise environment, which proves that the impact path of psychological discomfort on distraction under noise environment in the theoretical model in Fig. 1 is established.

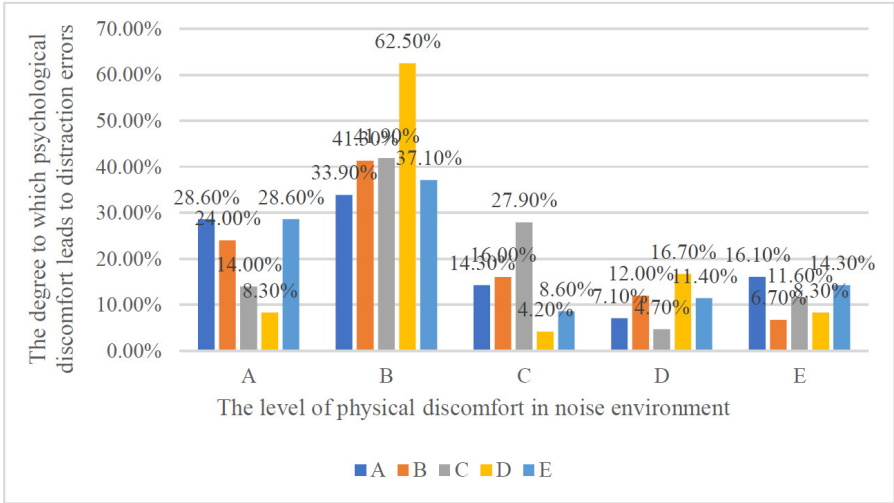


Fig. 2. The effect of psychological discomfort on work efficiency under noise.

(3) Impact of physiological discomfort on decision-making failures.

Cross-tabulation analysis by Spss yielded Fig. 3., 52.4% of the respondents believed that their physiological discomfort in the prefabricated noise environment and strongly agreed that it would result in poor decision-making. 68.2% of the respondents strongly agreed. This indicates that physiological discomfort under noise affects decision-making errors (unsafe decision-making). It is proved that the path of physiological discomfort in a noisy environment → unsafe decision-making in the theoretical model path in Fig. 1 is valid.

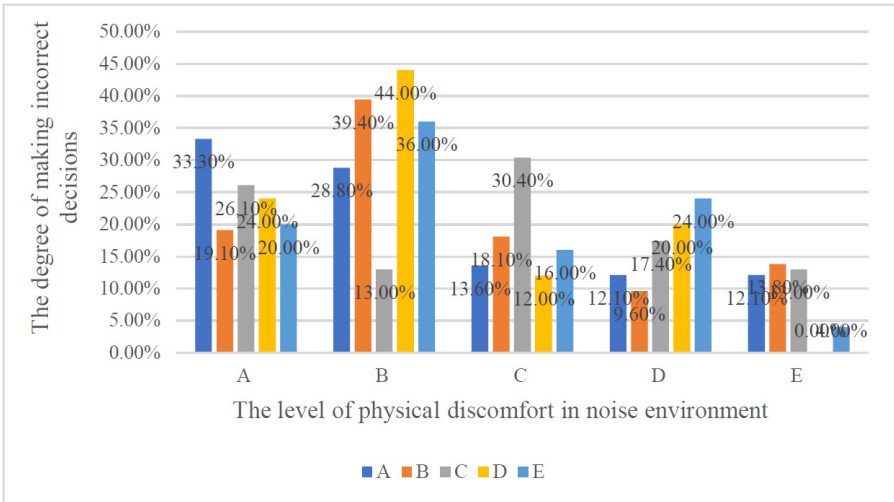


Fig. 3. Impact of physiological discomfort on decision-making failures under noise

As shown in Fig. 3, it can be concluded that the occurrence of psychological discomfort under prefabricated building construction noise has an effect on work efficiency (distraction failure) and physiological discomfort has an effect on decision-making failure (unsafe decision-making) in a relative way each.

4 Conclusion

Through literature references, model building, and questionnaires, the path of noise influence on the unsafe behavior of prefabricated construction workers was identified.

(1) A theoretical model was constructed.

(2) Different levels of noise have certain psychological and physiological effects, causing anxiety, irritability, impulsivity, reduced concentration, mental fatigue, headaches, and hearing loss among prefabricated construction workers, which can lead to distraction errors unsafe decision-making, and unsafe behaviors.

(3) Recommendations about control measures. According to the data results the following recommendations are given: ① Provide appropriate personal protective equipment, such as earplugs or ear muffs, to minimize noise damage to hearing. ② Reduce the impact of noise on the psychological and physiological health of workers by adjusting the working environment, such as soundproofing measures and rationalizing working hours. ③ Strengthen workers' safety training and raise their awareness of noise and other potential hazards to enhance their safety awareness and coping ability.

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