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## The Influence of the Deteriorations in Living Environments on the Health of Disaster Victims Following a Natural Disaster

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### Abstract

Relief housings are used to quickly provide disaster victims with a temporary living place whenever there is a natural disaster. However, few previous studies on the influences of the deterioration in living environments on the health of the disaster victims in relief housings might be identified. Therefore, a study on the influence of the deteriorations in living environments on the health of disaster victims following a severe natural disaster has been carried out and the study results are reported in this paper. Field tests on the thermal environment inside relief housings and questionnaire survey on the health of disaster victims in relief housings in Wenchuan earthquake disaster settlement area were performed. The study found that the thermal environment in relief housings was very poor in summer days, and that the deteriorations in the living environment had significantly negative impacts on the disaster victims' mental state, sleep duration, appetite, and body weight. It also found that frequency of sickness, especially cold and heatstroke increased after moving into the relief housings. In addition, the number of doctor visitings by disaster victims in tents and in prefabricated houses increased by 55.4% and 44.4%, respectively. The study results revealed that it is of great urgency to improve the living environments in relief housings following a natural disaster for the better health of disaster victims.

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## 1. Introduction

"5.12" Wenchuan earthquake in Sichuan, China in 2008 caused 5.36 million houses to collapse and 21.43 million to damage. As a result, more than 13 million disaster victims were relocated [1]. In order to meet the housing requirements for the victims as soon as possible, relief housings including temporary tents and prefabricated houses were quickly built up. This provided the disaster victims with transitional residences before finding their permanent housings [2]. Because of the severe damage caused by the earthquake, finding the permanent housings through quick reconstruction was hardly possible. Disaster victims had to live in relief housings for as long as up to two years before the completion of reconstruction [3]. However, the impacts of the deteriorations in living environments on disaster victims' health are often ignored, as the focus following a natural disaster has been usually to get the victims settled with temporary housings as soon as possible, without looking at anything beyond this focus. More than 10 million disaster victims in Wenchuan earthquake disaster settlement area had to live in these temporary relief housings. Therefore, first-hand data and study samples can be obtained and collected to understand the living environment in the relief housings following a natural disaster and its impacts on the health of disaster victims.

Temporary relief housings constructed using light-weighted materials have poor thermal performance and are vulnerable to extreme weather. Previous studies [4, 5] have suggested that thermal environment inside temporary housings may be much worse than that outside, with higher indoor air temperature in hot days and lower indoor air temperature in cold days than that in ordinary residential buildings. Therefore, although relief housings can be used to provide disaster victims with a temporary living place on short term basis, it is very important to study the thermal environment inside relief housings, because it may seriously impact disaster victims' mental and physical health. Consequently, how to maintain a suitable indoor environment is very important for temporary housings when used in hot seasons in hot/warm regions. Zaki et al. [6, 7] conducted experimental studies inside a tent with a canopied east-facing attic-type roof. The results showed that this simple arrangement reduced daily heat gain by 46-49% for days with clear sky. In addition, the heat transfer coefficient for a tent with an inclined fabric top was 2 to 3 times larger than that with smooth metal plate top. Hu [8] carried out a comparative study on tents with and without drenching water, and found that the use of drenching water on outside surfaces obviously improved the internal thermal environment of the tents. Yang [9] studied the thermal performance of green heat reflective coatings used for army tents. After using the coatings, the surface temperature and indoor air temperature of the tents could be effectively decreased.

Although the thermal environment inside temporary housings has gradually been studied, most of the reported studies were mainly on how to improve the thermal environment inside temporary housings. Few studies have focused on the impact of the deteriorations in living environment on the health of disaster victims following a natural disaster [10, 11]. Therefore, the objective of the study reported in this paper is to investigate the influence of the deteriorations in living environment on the mental and physical health of the victims living in relief housings after Wenchuan earthquake.

## 2. Methods

Both the field test and questionnaire survey methods were adopted. The thermal environment in relief housings in Wenchuan earthquake disaster area were firstly studied. This was followed by administrating a questionnaire survey to find out the level of influence of the deteriorations in living environment on disaster victims' health.

### 2.1. Field test

During initial site visits, it was found that the indoor thermal environment inside relief tents and prefabricated houses was far away from satisfaction. Most disaster victims living there complained that the thermal environments inside these tents/prefabricated houses were unbearable, significantly affecting their health. Thus, a tent in the resettlement area in Mianzhu City was chosen as a study tent. The following parameters, indoor and outdoor air

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