

# Whether Increases in Ambulance Transports is Stratified by Heat Stroke in Fukushima Prefecture, Japan in 2011?

Nobuyuki Miyatake<sup>1</sup>, Noriko Sakano<sup>1</sup>, Shoko Murakami<sup>1</sup>, Tomohiro Hirao<sup>2</sup>

<sup>1</sup>Department of Hygiene, Faculty of Medicine, Kagawa University, Miki, Kagawa, Japan; <sup>2</sup>Department of Public Health, Faculty of Medicine, Kagawa University, Miki, Kagawa, Japan  
Email: miyarin@med.kagawa-u.ac.jp

Received July 23<sup>rd</sup>, 2011; revised August 27<sup>th</sup>, 2011; accepted September 29<sup>th</sup>, 2011.

## ABSTRACT

We investigated the link between heat stroke and high air temperature from July to September in 2010 in Fukushima prefecture, Japan. Daily data of ambulance transports stratified by heat stroke and the highest air temperature were obtained. Heat stroke was significantly correlated with the highest temperature. The 9.0 magnitude earthquake and following tsunami on March 11, 2011, destroyed many cities in the northwestern part of Japan. Taken together, heat stroke may dramatically increase in Fukushima prefecture, Japan in 2011.

**Keywords:** Heat Stroke, Fukushima, High Air Temperature, Fukushima Daiichi

## 1. Introduction

Global warming has become public health challenge and heat stroke is also considered to be a serious problem [1]. We have previously showed that ambulance transports stratified by heat stroke was also associated with higher air temperature in all 47 prefectures in Japan by ecological study [2]. We found that one degree °C increase in mean of the highest air temperatures in Japan corresponded to a 0.122 times per ten thousand person increase in ambulance transports by heat stroke in Japan [2].

The 9.0 magnitude earthquake and following tsunami on March 11, 2011, destroyed many cities in the northwestern part of Japan. In addition, the Fukushima Daiichi nuclear power plant by the Tokyo Electric Power Company in Fukushima prefecture disabled their control systems. Therefore, about 4 thousand people are refugees now in Fukushima prefecture, Japan and electric power shortage is estimated in this summer. To show this, we evaluated and estimated the relationship between ambulance transports stratified by heat stroke and high air temperature in Fukushima prefecture (about 2 million people), Japan.

## 2. Methods

Daily incidence data of ambulance transports stratified

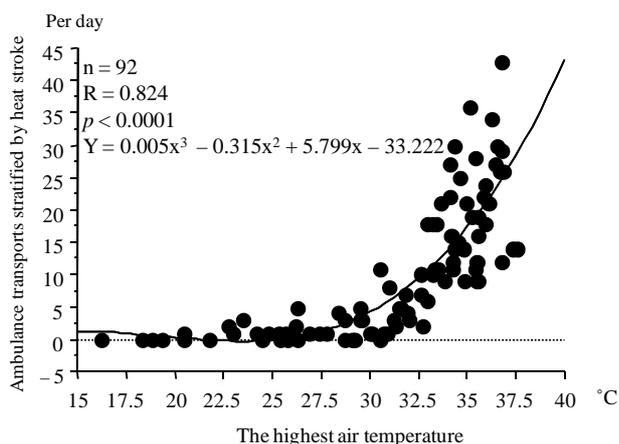
by heat stroke from July to September in 2010 in Fukushima prefecture, Japan was directory obtained from Fire and Disaster Management Agency, Japan [3]. Daily meteorological parameters *i.e.* the highest air temperature in Fukushima, prefecture, Japan for the required periods were obtained from Japan Meteorological Agency. The observation spots (Fukushima city) were located at the central in the area [4].

## 3. Results

A total of 947 ambulance transports stratified by heat stroke was observed. We evaluated the relationship between ambulance transports stratified by heat stroke and the highest air temperature by using polynomial regression analysis. Ambulance transports stratified by heat stroke were significantly correlated with the highest temperature in Fukushima prefecture, Japan [(Ambulance transports stratified by heat stroke) = 0.005 (the highest air temperature)<sup>3</sup> - 0.315 (the highest air temperature)<sup>2</sup> + 5.799(the highest air temperature) - 33.222;  $r = 0.824$ ,  $p < 0.0001$ ] (**Figure 1**).

## 4. Discussion

Form our study, by using our formula of polynomial regression line, we can estimate the number of ambulance transports stratified by heat stroke. However, many fac-



**Figure 1. The relationship between ambulance transports stratified by heat stroke and the highest air temperature by using polynomial correlation analysis from July to September in 2010 in Fukushima prefecture, Japan.**

tors are modifiable for heat stroke in this summer. Air-conditioning may be not available due to the destruction of the nuclear power plant and many people are refugees now in Fukushima prefecture, Japan. Therefore, ambulance transports by heat stroke may increase. It is reasonable that we need to deal with high air temperatures in summer in Fukushima prefecture, Japan *i.e.* individual

copied with high air temperatures, innovation of the thermal energy metabolism in cities and preparation of ambulance transports system.

### 5. Acknowledgements

This research was supported in part by Research Grants from FUKUTAKE Science & Culture Foundation, Japan. There is no conflict of interests.

### REFERENCES

- [1] M. Lye and A. Kamal, "Effects of a Heatwave on Mortality-Rates in Elderly Inpatients," *Lancet*, Vol. 1, No. 8010, March 1977, pp. 529-531.
- [2] N. Miyatake, N. Sakano and S. Murakami, "The Relation between Ambulance Transports Stratified by Heat Stroke and Air Temperature in all 47 Prefectures of Japan in August 2009: Ecological Study," *Environmental Health and Preventive Medicine*, in press.
- [3] Fire and Disaster Management Agency, Japan, in Japanese, 2011. [http://jsem.umin.ac.jp/pdf/heat\\_qqhansouteikyoku.pdf#search=](http://jsem.umin.ac.jp/pdf/heat_qqhansouteikyoku.pdf#search=)
- [4] Japan Meteorological Agency, in Japanese, 2011. [http://www.data.jma.go.jp/obd/stats/etrn/index.php?prec\\_no=36&prec\\_ch=%95%9F%93%87%8C%A7&block\\_no=47595&block\\_ch=%95%9F%93%87&year=&month=&day=&view=](http://www.data.jma.go.jp/obd/stats/etrn/index.php?prec_no=36&prec_ch=%95%9F%93%87%8C%A7&block_no=47595&block_ch=%95%9F%93%87&year=&month=&day=&view=)