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The association of weather on pediatric emergency department visits in Changwon, Korea (2005–2014)

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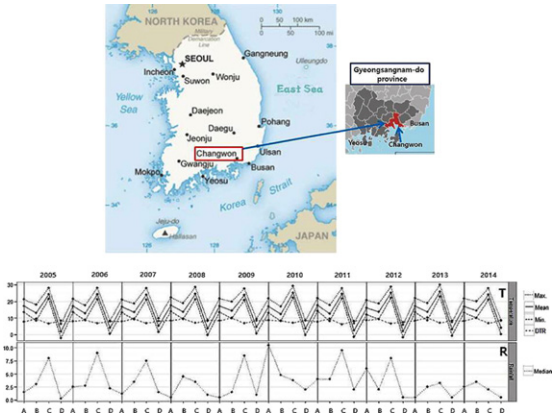
HIGHLIGHTS

- Weather and pediatric emergency department (ED) visits are associated.
- The volume of ED visits decreased on days of rain or snow.
- The volume of ED visits were increased 2 days after rainy or snowy days.
- The volume of ED visits increased 1.013 times for every 1 °C increase in DTR.

GRAPHICAL ABSTRACT



Changwon (population 1,075,168 in 2014) in Gyeongsangnam-do province is located on the southeast coast of the Republic of Korea (36°13'N, 128°40'E), and therefore is characterized by a more oceanic climate. Abbreviation: A, spring; B, summer; C, fall; D, winter; DTR, diurnal temperature range; Max, maximum; Min, minimum; T, Annual temperatures (°C); R, Median rainfalls (mm).

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ABSTRACT

Background: It is widely believed that patients are less likely to visit hospitals during bad weather. We hypothesized that weather and emergency department (ED) visits are associated. Thus, we investigated the association between pediatric ED visits and weather, and sought to determine whether admissions to the ED are affected by meteorological factors.

Methods: We retrospectively analyzed all 87,242 emergency visits to Samsung Changwon Hospital by pediatric patients under 19 years of age from January 2005 to December 2014. ED visits were categorized by disease. We used Poisson regression and generalized linear model to examine the relationships between current weather and ED visits. Additionally a distributed lag non-linear model was used to investigate the effect of weather on ED visits.

Results: During this 10-year study period, the average temperature and diurnal temperature range (DTR) were 14.7 °C and 8.2 °C, respectively. There were 1,145 days of rain or snow (31.4%) during the 3,652-day study period. The volume of ED visits decreased on days of rain or snow. Additionally ED visits increased 2 days after rainy or snowy days. The volume of ED visits increased 1.013 times with every 1 °C increase in DTR. The volume of ED

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visits by patients with trauma, digestive diseases, and respiratory diseases increased when DTR was over 10 °C. As rainfall increased to over 25 mm, the ward admission rate (23.8%, $p = 0.018$) of ED patients increased significantly.

Conclusion: The volume of ED visits decreased on days of rain or snow and the ED visits were increased 2 days after rainy or snowy days. The volume of ED visits increased for every 1 °C increase in DTR.

1. Introduction

The health of human populations is influenced by changes in weather. Rising temperatures have increased the risk of heat-related illness, and local changes in temperature and rainfall have altered the distribution of some water-borne illnesses (Lin et al., 2013; Ma et al., 2015; Woodward et al., 2014). Previous studies by emergency medical health care providers indicated that there are significantly fewer visits during severe weather conditions than favorable weather conditions (Attia and Edward, 1998; Christoffel, 1985), while other reports noted increases in emergency department (ED) visits during inclement weather conditions (Perry et al., 2011; Sun et al., 2009). Some studies have been conducted on the Korean population to assess the impacts of temperature on health. There were study that both high and low temperatures were associated with the risk of hospitalization (Ha et al., 2011; Kim et al., 2006; Lim et al., 2013; Son et al., 2014).

Children are particularly vulnerable to both the direct and indirect effects of climate change (American Academy of Pediatrics Committee on Environmental and Shea, 2007). Climate can influence child health, as seen in the physical and psychological sequelae of weather disasters, heat stress, and respiratory diseases related to poor air quality (Ahdoot et al., 2015). Although some studies have addressed the impact of weather on health, most of these studies did not focus on pediatric patients.

In this study, we explored the association between pediatric ED visits and weather, and sought to determine whether admissions to the ED are affected by meteorological factors in Changwon, Korea.

2. Materials and methods

2.1. Data collection

The Republic of Korea is located in the middle latitudes of the northern hemisphere, on the east coast of Eurasia and adjacent to the western Pacific. Therefore, it exhibits complex climate characteristics with both continental and oceanic features. The city of Changwon in Gyeongsannam-do province is located on the southeast coast of the Republic of Korea (36°13'N, 128°40'E) (Fig. 1), and therefore is characterized by a more oceanic climate. Summers are hot, and occasionally heavy rainstorms occur between June and August during the rainy period caused by East Asian monsoons, locally referred to as "Jang-ma." Winter is cold but snow is rare in Changwon.

Daily meteorological data for this region were obtained from the Korea Metrological Administration (KMA) website (www.kma.go.kr) for the study period. The variable included daily mean temperature

Fig. 1. The location of Changwon in Korea.