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LETTER TO THE EDITOR

Diurnal temperature range may be the risk factor for respiratory tract infections among the elderly in Guangzhou, China

Tiegang Li · Zhicong Yang · Ming Wang

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Dear Editor,
We read the paper by Lim et al. (2012) with great interest because it highlighted the very important issue that deaths among the elderly are associated with diurnal temperature range (DTR)—a meteorological term defined as the difference between daily maximum and minimum temperature within 1 day—in six Korean cities. Respiratory tract infection (RTI) is the most common acute disease reported for the elderly, leading to considerable fatality (Mourtzoukou and Falagas 2007) and ranking first among causes of disability adjusted life-years (DALYs) lost in developing countries (WHO 2009). However, no survey has yet been published demonstrating the relationship between DTR and RTI among the elderly. In an attempt to fill this gap, we would like to share our findings from a recent investigation in Guangzhou—the largest trading city in southern China.

We collected daily emergency-room visits aged ≥65 years for RTI between 1 January 2010 and 31 December 2012 from the first affiliated hospital, Sun yat-sen University, one of the largest medical establishments located in the center of Guangzhou. RTI was described in our analysis as a diagnosis of common cold, pharyngitis, laryngitis, croup, viral otitis, sinusitis, acute bronchitis, viral exacerbations in chronic bronchitis, bronchiolitis, and/or community-acquired pneumonia. Simultaneous meteorological data were obtained from the Guangzhou Meteorological Bureau.

A negative binomial model was used to identify the relationship between DTR and RTI. On examination of the lag effects of DTR on RTI, we developed two different lag structures: single-day lag from days 0 to 5 and multi-day average starting from lag 0 (up to 5). For example, lag 02 stands for the 3-day moving average of current and previous day values. To quantify the effects of DTR, we computed the influences $(e^{\beta}-1)*100$, which virtually correspond to percent increase. A sensitivity analysis was conducted to validate the DTR effects, including possible confounding factors in studying association between DTR and adverse health outcomes, e.g., daily air pollution data (PM_{10}, SO_2, and NO_2), in the model using data from 2010 and 2012. These analyses were carried out using SAS (V.8.01, SAS Institute, Cary, NC). P values <0.05 were considered statistically significant.

From 1 January 2010, to 31 December 2012, a total of 8,237 emergency-room visits aged ≥65 years for RTI were recorded in first affiliated hospital, Sun yat-sen University. On average, there were approximately eight visits for RTI per day. The average daily mean temperature and DTR were 21.89 °C and 7.73 °C, respectively. Table 1 showed results from the single-day lag (L0–L5) and the cumulative exposure models (L02 and L05) for the percentage increase in emergency-room visits for RTI per 1 °C-increase in DTR after adjusting for mean temperature, day of the week, and seasonal and long-term trends. The effects of DTR on RTI are statistically significant for single-day lag (L1 and L2) and multi-day lag (L02 and L05). For instance, a 1 °C increase in 1-day lagged (L1) and 2-day lagged (L2) DTR corresponded to 0.92 % (95 % CI,0.77 % to 1.35 %) and 1.56 % (95 % CI,1.46 % to 2.13 %) increase in the number of daily emergency-room visits aged ≥65 years for RTI, respectively. Likewise, a 1 °C increase in 3-day moving average (L02) and 6-day moving average (L05) corresponded to an increase in the number of visits by 2.07 %(95 % CI,1.67 % to 2.33 %) and 0.76 %(95 % CI,0.57 % to 0.89 %), respectively. We conducted a sensitivity analysis to compare the DTR effects with or without PM_{10}, SO_2, and NO_2 in the model from 2010 to 2012. There were no substantial differences among the models.

To the best of authors' knowledge, this is the first study to assess the relationship between DTR and RTI targeting the

T. Li (✉) · Z. Yang · M. Wang
Guangzhou Center for Disease Control and Prevention, Guangzhou, Guangdong Province 510440, China
e-mail: tiegang1977@126.com

Table 1 Estimated percent increase in the number of daily emergency-room visits aged ≥65 years for respiratory tract infection (RTI) per 1 °C increase in diurnal temperature range (DTR). *CI* Confidence interval

Lag(L)	*P*	$(e^B-1)*100$ = percent increase	95 % CI for percent increase (%)	
			Lower boundary	Upper boundary
L0	0.21	0.60	−0.21	0.97
L1	0.02*	0.92	0.77	1.35
L2	0.01*	1.56	1.46	2.13
L3	0.08	0.49	−0.19	0.64
L4	0.25	−0.39	−0.53	0.21
L5	0.34	−0.57	−0.69	0.33
L02	0.00*	2.07	1.67	2.33
L05	0.01*	0.76	0.57	0.89

*$P<0.05$

elderly. Unlike the method reported by Lim et al. (2012), our current study applied negative binomial models to quantifying the estimated effects of DTR on RTI. We found DTR to be positively associated with the risk for outpatient visits aged ≥65 years for RTI. Although the underlying mechanism is still unclear, previous studies have shown that sudden temperature change may increase respiratory workload and induce the onset of a respiratory event (Imai et al. 1998). Similarly, DTR has been identified as an independent risk factor for coronary heart disease (Cao et al. 2009), stroke (Chen et al. 2007; Shinkawa et al. 1990; Kyobutungi et al. 2005), and chronic obstructive pulmonary disease (Song et al. 2008). Tam et al. (2009) also found that DTR was associated with daily cardiovascular diseases among the elderly.

Taken together, we report that DTR is a risk factor for RTI among the elderly. Our findings may provide a possible explanation for, and strength the evidence of, Lim et al.'s (2012) finding.

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