

Effects of heatwaves on hospital admissions for cardiovascular and respiratory diseases in Southern Vietnam, 2010-2018



Nguyen Thi Trang Nhung¹, Le Tu Hoang¹, Tran Thi Tuyet Hanh¹, Nguyen Xuan Truong², Luu Quoc Toan¹, Hoong Van Nhat², Nguyen Anh Son², Nguyen Duc Thanh², Nguyen Huu Quyen³, Ha Van Nhu¹
¹ Hanoi University of Public Health, Hanoi, Vietnam
² Ministry of Health, Hanoi, Vietnam
³ Institute of Hydrology and Meteorology Science and Climate Change, Hanoi, Vietnam

INTRODUCTION

- Cardiovascular diseases (CVD) were ranked as the greatest single contributor to the overall disease burden in the world. In 2017, it contributed to 17.79 million CVD deaths globally and 201.14 thousand deaths in Vietnam (IHME 2020)
- Extreme ambient temperature, related to global climate change, is an essential environmental hazard associated with an overall mortality of respiratory diseases and CVD (Breitner et al. 2014; Zhang et al. 2014)
- Heatwave is a significant public health hazard (Ye et al. 2012) and can lead to adverse health impacts within 24-48 hours of a temperature increase (Elliot et al. 2014)
- The number of 'hot' days are projected to have an upward trend, with the largest increases likely in Vietnam (Thuc et al. 2016).
- Heatwaves in this analysis were defined as periods of at least three consecutive days when the maximum temperature exceeded the 90th percentile. This definition has been used by previous studies in Vietnam (Phung et al. 2017a) and China (Yang et al. 2019; Zhang et al. 2019)

METHODOLOGY

Study area and population

- Ninh Thuan is a coastal area of South-Central Vietnam (3,355 km² & 607,000 inhabitants, 2017)
- Ca Mau located in Southern Vietnam, belongs to the Mekong Delta region (5,221.2 km² & 1,226,300 inhabitants, 2017)

Data source

- Daily hospital admissions were obtained from provincial hospitals from 1 January 2010 to 31 December 2017 in Ninh Thuan and 31 May 2013 to 31 July 2018 in Ca Mau.
- Individual data were collected including residential locations of the patients, age (or year of birth), gender, primary and discharge diagnoses (coded in International Classification of Diseases version 10 - ICD10), and admission and discharge dates.
- Patients with ICD codes J00-J99, excluding J60-J70 (lung diseases due to external agents and J92 (pleural plague), were coded as hospital admissions for respiratory diseases.
- Patients with ICD10 codes from I00-I99, excluding I00-I02 (acute rheumatic fever) and I05-I09 (chronic rheumatic heart diseases), were coded as hospital admissions for CVDs
- The meteorological data were provided by the corresponding provincial hydrometeorological stations in Ninh Thuan and Ca Mau provinces.

Data analysis

- Generalized additive quasi-Poisson log-linear models were used, controlling for long-term trends and seasonality.
- To investigate the delayed effects, the associations between heatwaves and hospital admissions for lag 0-lag 4 were reported
- All statistical analyses were conducted using R (version 1.2.5019, <http://www.r-project.org>), using the "mgcv", "spline" and "gam" packages.

RESULTS

Table 1: Hospital admission for respiratory and cardiovascular diseases in Ninh Thuan and Ca Mau in total and by age group

	Entire time*						During heatwave occur					
	Total of cases	Mean	SD	p ²⁵	p ⁵⁰	p ⁷⁵	Total of cases	Mean	SD	p ²⁵	p ⁵⁰	p ⁷⁵
Ninh Thuan (1 February 2010- 31 December 2017)												
Respiratory diseases (ICD10: J00-J99, exclude J60-J70)												
All	17988	6.2	3.4	4	6	8	1369	6.3	3.3	4	6	8
6-60	5827	2.0	2.0	1	2	3	473	2.2	2.0	1	2	3
>60	6844	2.3	1.9	1	2	3	543	2.5	1.9	1	2	3
Ca Mau (31 May 2013- 31 July 2018)												
Respiratory diseases (ICD10: J00-J99, exclude J60-J70)												
All	13203	7.0	4.2	4	7	10	838	5.9	4.2	3	6	9
6-60	4480	2.4	2.1	1	2	4	287	2.0	1.9	0	2	3
>60	8722	4.6	3.0	3	4	6	551	3.9	2.9	2	4	6
Cardiovascular diseases (ICD 10: I00- I99, exclude I00-I02 and I05-I09)												
All	29056	15.4	7.2	12	16	20	1785	12.7	7.7	9	14	18
6-60	7204	3.8	2.5	2	4	6	447	3.2	2.3	1	3	5
>60	21851	11.6	5.7	9	12	15	1338	9.5	6.0	6	10	13

Percent change of hospital admissions for cardiovascular diseases, all ages, Ca mau, 2013-2018

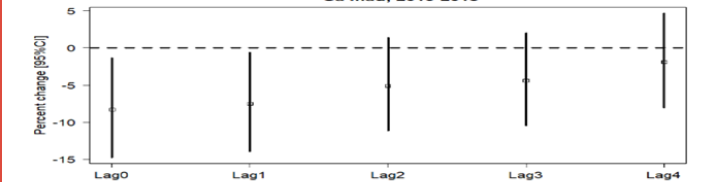


Figure 1: The lag distribution of the associations between heatwave and hospital admissions for cardiovascular diseases in Ca Mau

Percent change of hospital admissions for respiratory diseases, all ages, Ninh Thuan, 2010-2017

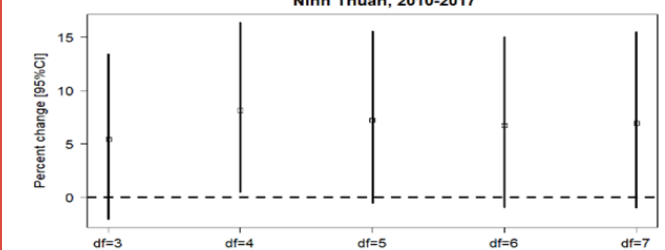


Figure 2: Estimated percentage change of hospital admission for respiratory in Ninh Thuan at lag 2 with different degrees of freedom (knots) per year

Table 2: Associations between heatwaves and hospital admissions for cardiovascular and respiratory diseases in Ninh Thuan and Ca Mau, 2010-2018 at lag 2

	Percentage change (%)				P-value
	ER(%)	95% CI*			
		Lower	Upper		
Ninh Thuan					
Respiratory diseases					
All ages	8.31	0.64	16.55	0.033*	
6-60	0.70	-11.53	14.63	0.916	
60+	2.45	-8.01	14.10	0.660	
Ca Mau					
Respiratory diseases					
All ages	0.53	-8.78	10.78	0.916	
6-60	-3.04	-17.60	14.11	0.710	
60+	2.41	-8.68	14.85	0.683	
Cardiovascular diseases					
All ages	-5.11	-11.18	1.37	0.120	
6-60	1.61	-9.94	14.65	0.795	
60+	-7.28	-13.97	-0.08	0.048*	

Percent change of hospital admissions for respiratory diseases, all ages, Ca mau, 2013-2018

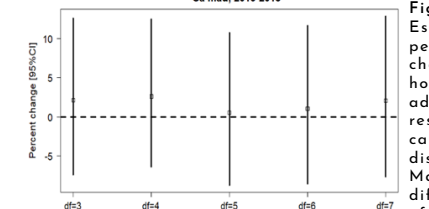


Figure 3: Estimated percentage change of hospital admission for respiratory and cardiovascular diseases in Ca Mau at lag 2 with different degrees of freedom

Percent change of hospital admissions for cardiovascular diseases, all ages, (knots) per year included in the cubic thin plate spline function used to capture time trends and seasonal variations

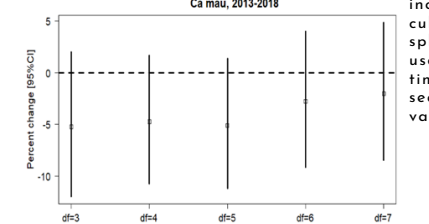


Figure 3: Estimated percentage change of hospital admission for respiratory and cardiovascular diseases in Ca Mau at lag 2 with different degrees of freedom

OBJECTIVE

To investigate the association between heatwaves and hospitalization due to respiratory diseases and CVDs in two provinces, Ninh Thuan in Central Vietnam and Ca Mau in Southern Vietnam using time-series analysis

CONCLUSION

- Associations between hospital admissions for RDs and heatwaves in Ninh Thuan were observed at lag 2, with excess risk (ER = 8.31%, 95% CI:0.64%-16.55%).
- The heatwave was negatively associated with CVDs in Ca Mau, which was determined amongst the elderly (age above 60), ER = -7.28%, 95%CI: -13.97% - -0.08%.
- Heatwaves can be considered as a risk of hospital admission for RDs in Vietnam. Further studies are needed to assert the link between heatwaves and CVDs to identify recommendations to mitigate the negative health impacts of heatwaves.

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