

TIME SERIES ANALYSIS APPLIED ON EXPOSURE TO COLD AND DAILY HOSPITAL ADMISSIONS IN PORTUGAL

* João Vasconcelos^{1,2,3}, Elisabete Freire², Ricardo Almendra^{2,3}, Paula Santana³

¹ Escola Superior de Turismo e Tecnologia do Mar, Instituto Politécnico de Leiria, PT * j.vasconcelos@ipleiria.pt

² Centro de Investigação em Arquitectura e Design, Faculdade de Arquitectura da Univ. Técnica de Lisboa, PT

³ Centro de Estudos em Geografia e Ordenamento do Território, Univ. de Coimbra, PT



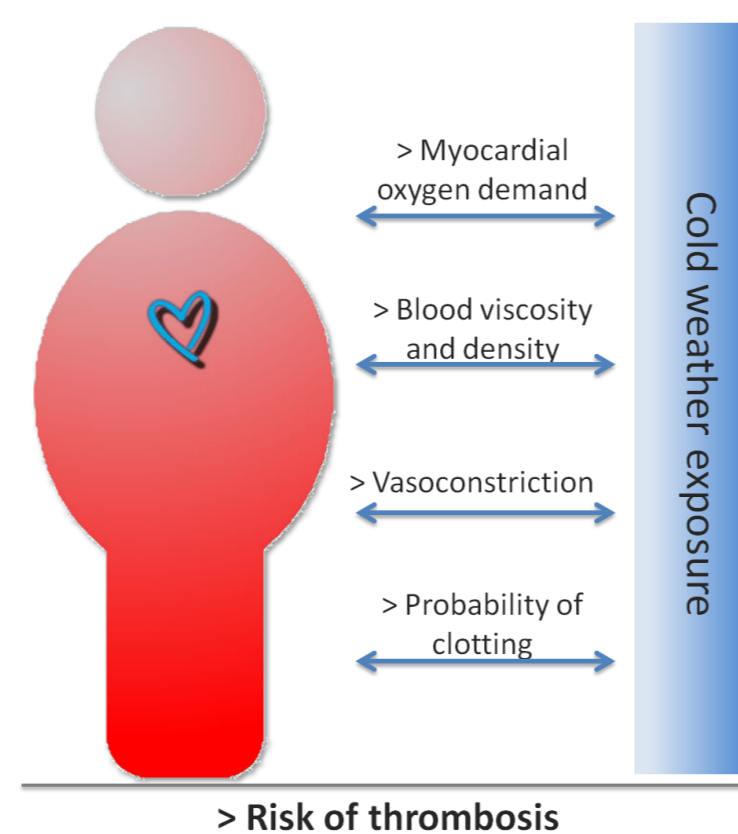
Introduction

The impact of the exposure to cold weather on human health is very often underestimated. Excess winter mortality is commonly assumed as a natural pattern of seasonality and very rarely as a public health issue.

As a consequence only few countries have designed health policies to reduce this environmental determinant for health, and very few studies try to quantify the effect of cold on mortality or morbidity.

Nevertheless, literature has provided evidences that exposure to cold weather can be associated to a higher probability of thrombosis and, therefore, with an increase of cardiovascular diseases.

Portugal is one of the countries where this relationship is yet to be assessed; thus, the main goal of this study is to identify the contribution of cold conditions to cardiovascular diseases, within Portugal.

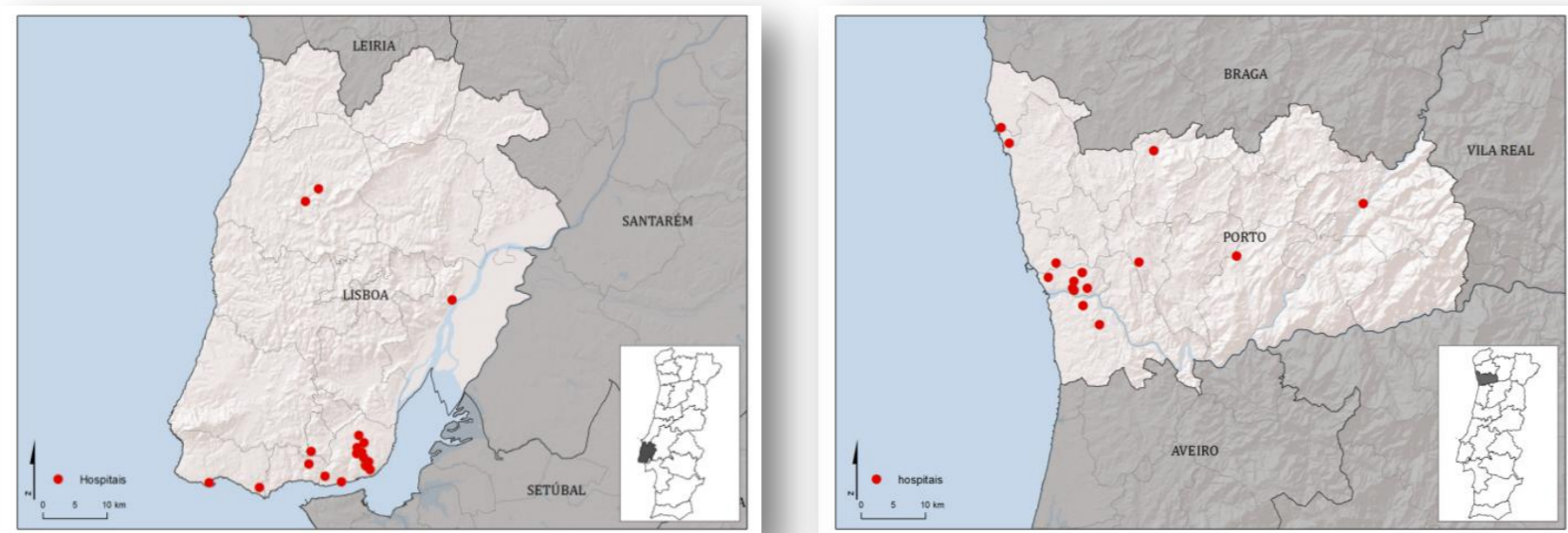


Methodology

In order, to estimate the influence of the thermal comfort (*Physiologic Equivalent Temperature*) on daily hospitalizations for acute myocardial infarction (ICD 9 – 410), from 2003 to 2007, generalized additive *Poisson* regression models (GAM) were used.

$$g(y_i) = \beta_0 + f_1(x_{1i}) + f_2(x_{2i}) + \dots + f_n(x_n) + \varepsilon_i$$

The models were applied to Lisbon and Oporto districts, and it was estimated the impact of cold for the whole adult population and later for the elderly.



All models were adjusted to time variables such as *day of week* (DOW), *holidays* and *trend*, and also to other environmental confounders, such as *influenza* and *air pollution*. Additionally, it was also calculated the lag effect between exposure and morbidity. The impact of cold was expressed as risk ratios (RR).

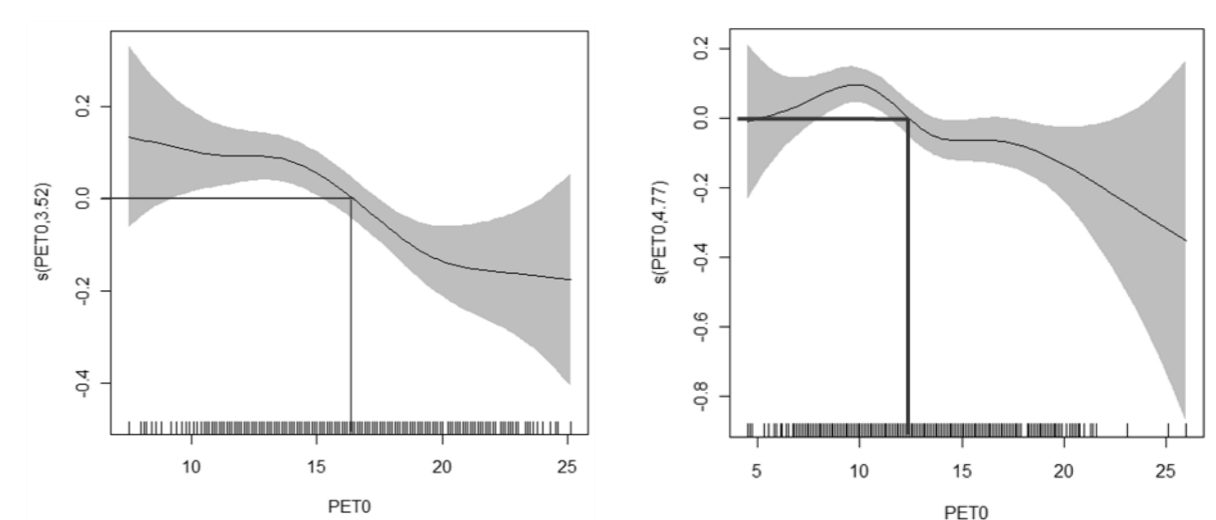
Results

During the 5 years studied, 6503 patients were hospitalized due to an acute myocardial infarction, in Lisbon, and 5059, in Oporto, representing a daily average of almost 9 and 7 hospitalizations, respectively.

	Lisbon				Oporto			
	Average	CI 95%	STDVP	Sum	Average	CI 95%	STDVP	Sum
All	8,68	(8,46 - 8,90)	3,05	6 503	6,69	(6,50 - 6,89)	2,73	5059
>65	5,59	(5,42 - 5,75)	2,32	4 184	4,03	(3,88 - 4,18)	2,13	3045

The main results of the modelling revealed an increase up to 2,2% (95%CI=0,9%;3,3%) of daily hospital admissions, in winter, per degree fall in PET, in Lisbon.

RR	Lisbon		Oporto	
	Total pop. > 65	> 65	Total pop. > 65	> 65
	2,20%	1,30%	1,70%	1,60%
	(0,9%;3,3%)	(0,9%;2,1%)	(0,9%;2,5%)	(0,9%;2,6%)



All the models tested included significantly *Trend*, *DOW*, and *influenza*.

The increase in daily hospitalizations was greater, in both cities, for the entire population than for only the elderly.

The contribution of thermal comfort on daily hospitalizations was more evident after 3 to 4 days of the exposure to cold.

Conclusion

This is the first quantification of cold weather on acute myocardial infarctions, in Portugal; it highlights the negative impact of cold weather on human health.

We believe that cold should be recognized as an environmental determinant for health and that urban planning and health policies should act together in order to reduce exposure to cold, in particular, by the implementation of better housing.

This study may contribute to trigger the discussion on the vulnerability to meteorological aspects that so often are neglected, in Portugal; as well as, to include the health issues upon urban planning policies.

Acknowledgments

This study was undertaken within the research project CLIMAHABS (PTDC/AUR-AQI/115688/2009), which is funded by the National Foundation for Science and Technology www.fa.utl.pt/~climahabs

