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Short-term impacts of air temperature on hospitalizations for mental disorders in Lisbon

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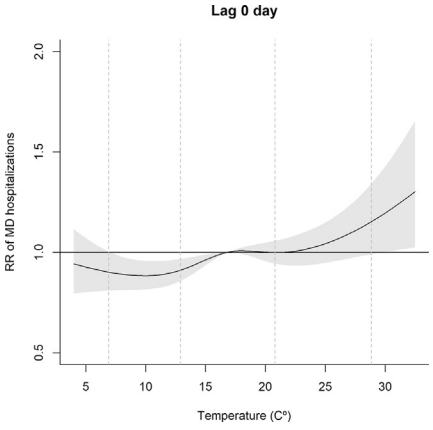
HIGHLIGHTS

- Hospital admissions by mental disorders increase significantly with high temperatures.
- Hospital admissions by mental disorders tend to decrease with low temperatures.
- Women with mental disorders are more vulnerable than men to high temperatures.
- Strengthen preventive measures following extreme high temperatures alerts

GRAPHICAL ABSTRACT



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ABSTRACT

Background: Individuals with mental disorders are often susceptible to the effects of extreme ambient temperatures. The aim of this study is to assess the short-term impacts of daily mean temperature on hospitalizations for mental disorders in the Lisbon Metropolitan Area, Portugal.
Methods: To assess the short-term impacts of daily mean temperature on hospitalizations for mental disorders (2008–2014), a quasi-Poisson generalized additive model combined with a distributed lag non-linear model was applied. The model was adjusted for day of the week, air pollution, relative humidity, time and seasonality.
Results: The number of hospital admissions for mental disorder during the study period was 30,139. Hospital admissions increase significantly with high temperatures on day of exposure, at lag 0–1 and at lag 0–2. Women are more vulnerable than men, and there was no difference between the age groups studied.
Conclusions: The exposure to high temperatures should be considered a significant risk factor for mental disorders; therefore, patient management services may need to be strengthened when extreme high temperature alerts are given.

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1. Introduction

The effect of ambient temperature on human health is well known, with several studies providing evidence supporting the association between temperatures and several diseases (Ballester, 2003). These studies usually show an increasing trend for morbidity and mortality as the temperature deviates from the optimum temperature value (Curriero et al., 2002; Gasparrini et al., 2015). The magnitude of the morbidity and mortality increase changes significantly between diseases and regions, depending on environmental, socioeconomic and biological factors (Almendra et al., 2017; Bunker et al., 2016; Iñiguez et al., 2010).

When comparing to other diseases (*e.g.* cerebrovascular, cardiovascular, respiratory), the effects of temperature on mental health are not often studied (Bunker et al., 2016), probably due to the complexity of interactions between all the environmental and non-environmental determinants that may interfere with mental health and wellbeing. A common misbelief persists that mental illness is associated instead with winter weather conditions (Rau, 2004) when, in fact, the number of hospital admissions for mental diseases tends to increase with higher temperatures (Peng et al., 2017; Vida et al., 2012).

Individuals with mental illness are more vulnerable to the effects of extreme temperature due to the disruption of normal thermoregulation functions from the use of psychotropic medication, psychiatric illness, and due to behavioral issues (Hansen et al., 2008; Wang et al., 2014). Studies from Sulman (Sulman et al., 1978, 1970) have suggested that the increased vulnerability associated with heat may be attributed to atmospheric electrical changes, in particular, air ion concentrations and the ion polarity ratio, which interfere with the serotonin system.

Several other environmental factors such as air pollution and pollen concentration may play an important role in the development of mental disorders. Shin et al. (2018) identified a positive association between high concentrations of air pollutants (PM10, NO2, and CO) and the prevalence of high stress, depressiveness, diagnosis of depression, and suicide ideation. Allergic symptoms due to pollen concentration was found to be associated with aggravation of anxiety symptoms (Postolache et al., 2008), with the worsening of depression In patients with bipolar disorders (Manalai et al., 2012) or suicide behavior (Besancenot et al., 2011).

In 2014, Portugal ranked second amongst the European Union countries with highest percentage of people reporting depressive symptoms (Eurostat, 2018) and third with respect to higher prevalence of chronic depression (OECD, 2017). Despite the significant extent of Mental Disorders (MD) and their social and economic consequences, the role of ambient temperature in mental health is still to be addressed. It is believed that a better understanding of the relationship between temperature and mental illness may contribute to better response care and preparedness of the medical system. Thus, this study aims to assess the short-term impacts of daily mean temperature on hospitalizations for MD in the Lisbon (Portugal) Metropolitan Area (henceforth referred to as Lisbon).

2. Data and methods

2.1. Location

The Lisbon Metropolitan Area is an administrative region organized into 18 municipalities distributed along the north and south shores of the Tagus River (Fig. 1). Lisbon has the largest population concentration in Portugal, and nearly 96% of the population live in predominantly urban areas. According to the Statistics Portugal (2017), 2,821,349 inhabitants lived in Lisbon in 2016, and the percentage of women was slightly higher than men, corresponding to 53% and 47%, respectively. About 23% of women and 19% of men were over age 65 in 2016.

Lisbon is characterized by a typical Mediterranean climate with mild and wet winters and dry and warm summers (Csa according to the Köppen-Geiger classification). Annual medium air temperature for the period of 1971–2000 reached an average of 15.2 °C and minimum air temperature of 10.0 °C: Warm periods in Lisbon occur during the

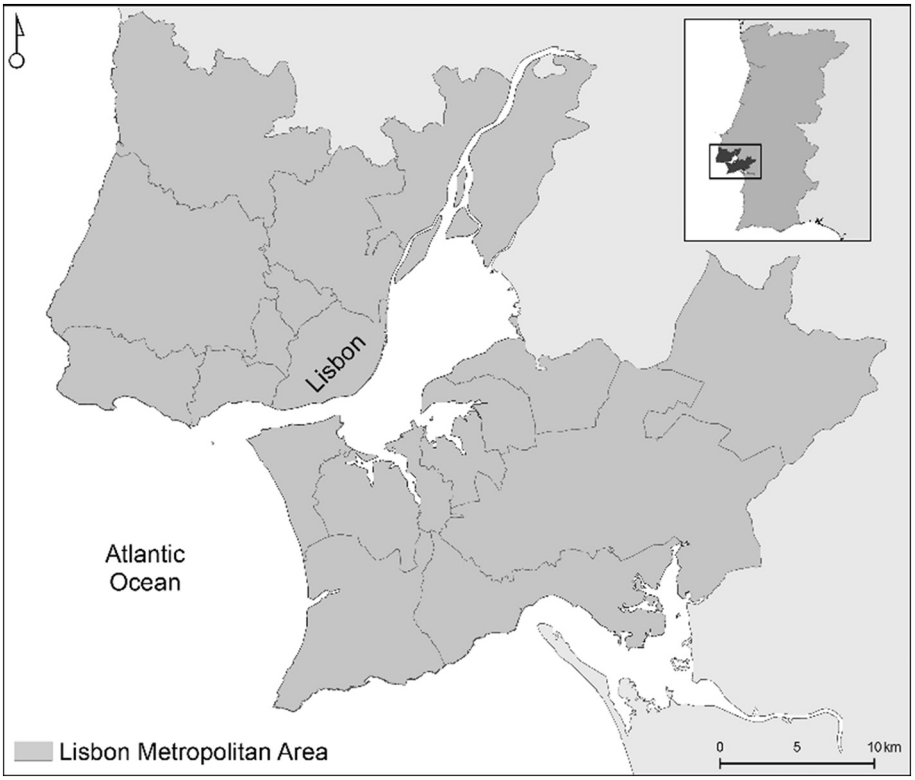

Fig. 1. Location of the study area.