



## Letter to the Editor

**El Niño Southern Oscillation and tuberculosis: Is there an association?\***

Sir,

It is known that factors such as overcrowding and malnutrition have an important impact in the epidemiology of tuberculosis (TB), especially in developing countries such as Peru [1]. There have been also some studies demonstrating the association between climatic factors and the seasonal variability of TB [2–4], however, in Peru, as well in Latin America, there is a lack of studies on this topic [5].

A climate phenomena such as El Niño Southern Oscillation (ENSO) affects climatic variables, promoting of the transmission of infectious diseases in Peru and other countries of the region, particularly vector-borne diseases [6]. Therefore, we assessed if there is an association between ENSO phenomena and the incidence of TB in a large hospital in Lima, Peru, over a 4-year period.

We performed an ecological analysis in which the relationship between the number of monthly cases of TB and climatic variables from the National Oceanographic and Atmospheric Agency (NOAA) was assessed. ENSO was measured by the Oceanic Niño Index (ONI), which is the monthly average of climatic anomalies in the sea surface temperature, expressed in °C, in the El Niño 3.4 region [5°N–5°S, 120°–170°W]. Non-linear regression models were run for these variables. Stata 14<sup>®</sup> licensed for UTP was used, significance level  $p < 0.05$ .

A total of 2162 cases were diagnosed during the study period (36/month), 56.5% of which corresponded to pulmonary tubercu-

losis. In the simple nonlinear regressions, significant associations were observed between ONI ( $r^2 = 0.9495$ ;  $p < 0.0001$ ) and TB incidence. Furthermore, a greater number of cases of TB were evidenced when the ONI index had values below 0.5 °C (La Niña's phenomenon).

Additionally, the association between pulmonary TB (TBP)  $r^2 = 0.9081$  ( $p < 0.0001$ ) and extrapulmonary TB (TBEP)  $r^2 = 0.9250$  ( $p < 0.0001$ ) with ONI was very significant (Fig. 1). The inversely proportional relation for the case of the TBP with the ONI could be due to its aerial transmission, which makes it more susceptible to the influence of the climate. Although there is a high incidence of TB worldwide, we have not found previous studies associating ENSO with the incidence of TB (Fig. 1).

The findings of this preliminary study show the impact of climate change on the epidemiology of TB, which could contribute to the execution of preventive actions, control and seasonal diagnosis of TB [7,8]. It is required the execution of additional studies for the confirmation and validation of these results [7,8].

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**Competing interests**

None declared.

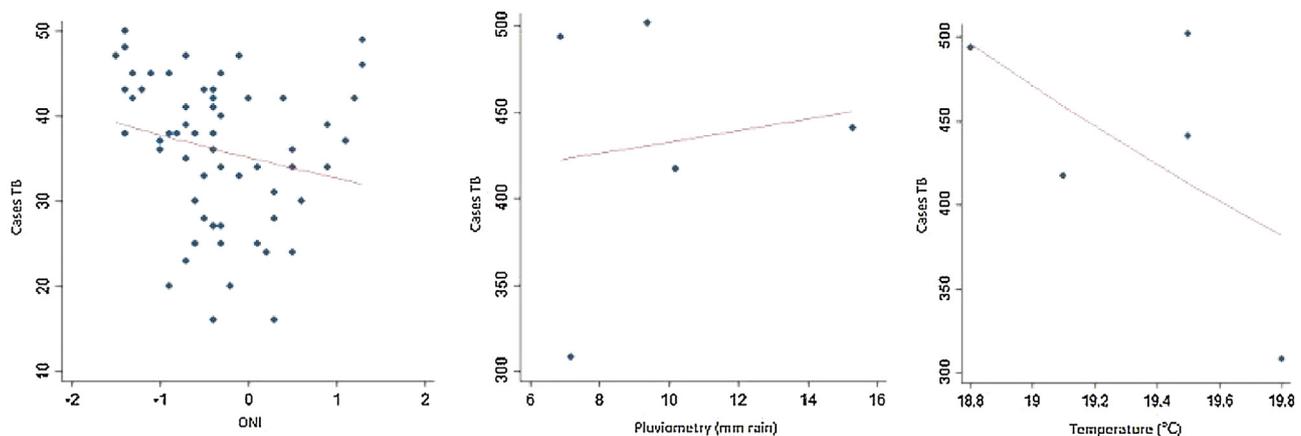


Fig. 1. Non-linear regression between ONI (left), pluviometry (center), temperature (right) and total cases of TB, 2008–2012.

\* This study was previously presented in part at the XXXI National Scientific Congress of Medical Students Scientific Societies of Peru (CCN SOCIMEP), Ica, Peru, August 1–5, 2017 (Oral presentation-P25).

**Ethical approval**

Not required.

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