0021-7557/11/87-06/551
Jornal de Pediatria

Pneumonia mortality in children aged 4 years and younger

Dear Editor,

In its March/April issue, Jornal de Pediatria published a study on the analysis of the temporal trend of pneumonia mortality in Brazilian children aged 4 years and younger. This study was conducted from 1991 to 2007 in the whole country including its five regions.[1] The objective of the present letter is to point out some issues regarding this study. The authors reported that the study design was analytical retrospective, however we consider this is an ecological study because the data being compared were collected following a temporal order at different locations. The authors used secondary data collected from the database available at the website of the IT Department of Brazilian Public Health System (DATASUS). A sample size calculation was not performed because the temporal series is considered to be a sample of the stochastic process since it represents one among all possible paths found in the graph of the historic series.[2]

The dependent variable was the pneumonia mortality rate (number of deaths from pneumonia/population) multiplied by 1,000 for the age group under 1 year old and by 10,000 in the age group from 1 to 4 years. It is important to stress that to calculate the mortality rate among individuals under 1 year old, the denominator should be the number of live births,[3,4] and the authors wrongly calculated the mortality rate using the population in this age group as the denominator. In order to investigate the trend reduction, that authors calculated the relative reduction in the pneumonia mortality rate (the mortality rate in 2007 minus the mortality rate in 1991, divided by the mortality rate in 1991 multiplied by 100). Simple linear regression was used to perform the statistical analysis; the regression coefficient showed the mean annual change in the pneumonia mortality rate. However, we did not identify in the article the other higher order models tested by the authors, even though we were able to identify in the graphs the points where the series could be divided and a second order function could be used.

The authors did not report if they made a dispersion diagram between the mortality rates and time to investigate the type of relation between these variables. They also did not mention any of these two methods for trend analysis: adjustment of a polynomial function of time (polynomial regression models) and analysis of the behavior of the series around a point, estimating the trend at that point (self-regression models).[2] We believe that the authors analyzed the trend using the adjustment of the polynomial function based on the fact that they used the whole period of the series.

The reduction in the rates was compared between the whole country and the five regions, with higher mortality rates in the South and Southeast. These regions had the highest rates in the beginning of the period; however, it is important to highlight that the authors did not analyzed the quality of the records related to mortality data between the regions.[4]

The authors did not show either the equations of the models (or $\beta 0$) or the coefficient of determination (r^2), which could provide a clearer understanding of the explanatory capacity of the models tested.[2,5] In spite of providing the confidence intervals of $\beta 1$, the authors did not analyze the significance of the models. $\beta 0$ would offer the mean annual rates in each region and in the whole country.

And finally, the authors also did not mention removal of white noise (series smoothing). The advantage of developing a historic series using a central year would be to be able to make comparisons between different places. There is no report on the centralization of the variable period (a central period would avoid serial correlation – colinearity – between the regression terms: seasonality removal).

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http://dx.doi.org/10.2223/JPED.2159

No conflicts of interest declared concerning the publication of this letter.

Authors' reply

We would like to thank the reader for her comments and interest in our study. Next, we provide the answers regarding the main issues pointed out in her letter to the editor:

1. Study design: we agree with the reader's recommendation about the study design, that is, our study should be considered an ecological study using temporal series and based on secondary data.[1]

2. Calculation of the pneumonia mortality rate: we are aware of the fact that the denominator used to calculate the infant mortality rate should be the number of live births.[2] However, the dependent variable of our study was the pneumonia mortality rate of children 4 years old or younger. This population was divided into two age groups: < 1 year and 1-4 years. The use of the same type of denominator (population) for calculation of the mortality rate makes it easier to compare two age groups. Conversely, the type of denominator for the calculation of the pneumonia mortality rate in children younger than 1 year old should not have a significant impact on the results of temporal trend because the population was used as the denominator in the whole period of the study.

3. Statistical analysis method: we were advised by two epidemiologists and both of them considered that the simple linear regression test was appropriate for the analysis of the temporal trend of the pneumonia mortality rates. The quality of the adjustment of the models was also demonstrated by the coefficient of determination (r^2) and significance of the models (Table 1).

We would like to add the following information on the statistical analysis procedures of our study: we performed the statistical modeling considering the pneumonia mortality rates as dependent variables (Y) and the years as independent variables (X); we chose to use the variable in a centralized manner (X-1999) to avoid self-correlation between the terms of the equation;[3,4] the estimated model was $Y = \beta0 + \beta1 (X-1999)$, where Y = pneumonia mortality rate, β0 = mean rate in the period, β1 = mean annual change of the rate, and X = year.

Table 1 - Results of the analysis of the trend of pneumonia mortality rates in children 4 years old and younger in Brazil and its geographical regions from 1991 to 2007

Regions	ß0	ß1	p (model)	r^2
South				
< 1 year old	1.08	-0.14	< 0.0001	0.93
1-4 years	0.83	-0.07	< 0.0001	0.84
Southeast				
< 1 year old	1.45	-0.18	< 0.0001	0.92
1-4 years	1.12	-0.09	< 0.0001	0.83
Central West				
< 1 year old	1.04	-0.09	< 0.0001	0.87
1-4 years	0.97	-0.04	0.0001	0.67
Northeast				
< 1 year old	1.09	-0.07	< 0.0001	0.79
1-4 years	1.16	-0.05	< 0.0001	0.84
North				
< 1 year old	1.15	-0.04	0.0002	0.61
1-4 years	1.28	-0.03	0.0001	0.66
Brazil				
< 1 year old	1.23	-0.12	< 0.0001	0.91
1-4 years	1.10	-0.07	< 0.0001	0.93

ß0 = mean rate in the period; ß1 = mean annual change in the rate; r^2 = coefficient of determination.

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http://dx.doi.org/10.2223/JPED.2160

No conflicts of interest declared concerning the publication of this letter.