Modeling and Forecasting of COPD Admissions in Portuguese Hospitals: a Box–Jenkins Methodology in Medical Research.

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PURPOSE

Many scientific applications generate data in the form of a time series. This is also the case in the health sector where hospital admissions (HA) data, resulting from the monitoring of hospital services, can help predict the number of hospitalizations, thereby offering an advantage for the planning of health service delivery requirements. Forecasts of daily hospital presentations were generated for the public hospitals in Portuguese Metropolitan Areas (PMAs).

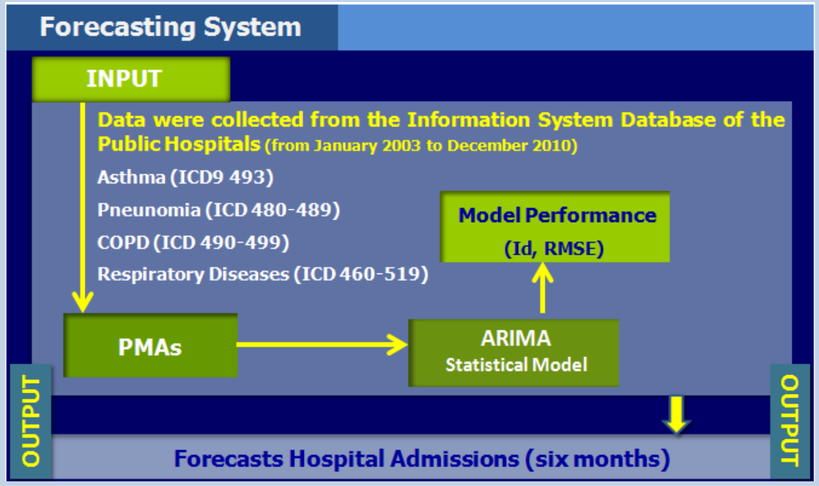
The main purpose of this work is to evaluate and test the quality of a criterion developed to predict the number of hospitalizations in the PMAs of Lisbon and Porto.

METHODS

1. Methodology for making the model

➢Method of this study is conducted by time series analysis, one of these methods called **ARIMA model** (Jenkins, 1994).

➢Data were used to develop a forecasting model for the following 6 consecutive months and were processed for validation.



2. Statistical methodology for predicted

To introduce objectivity in the numerical error analysis, the performance should be judged by certain statistical evaluation indices (recommended by Willmott, 1981, 1985). Thus, two indicators are used in researching the predictive skill of the models developed in the present study.

- Index of Agreement (Id)

$$Id = 1 - \frac{\sum_{i=1}^{n}(P_i - O_i)^2}{\sum_{i=1}^{n}\left(\left|P_i - \bar{O}\right| + \left|O_i - \bar{O}\right|\right)^2}$$

- Root Mean Squared Error (RMSE)

$$RMSE = \left[\frac{1}{N}\sum_{i=1}^{N}\phi_i'^2\right]^{1/2};\ \phi_i' = \phi_f - \phi_{obs}$$

Where, ϕ_f and ϕ_{obs} are the predicted and observed values, respectively.

RESULTS

This study suggests that hospital admissions in PMAs can be predicted using these models (ARIMA), which were the most appropriate for forecasting the DNP.

The table 1 presents the summary of the model evaluation statistics for the various models at all the HA in PMAs. The Id for the forecast of the various models from 0,8896 to 0,9446, which is a very good forecast. Thus, most of the models are able to explain equal to or more than 83,3% of the potential for error, i.e., at least 83,3% of the predictions are error free.

Table 1: Model evaluation statistics.

Lisbon Metropolitan Area				
Diseases	**Model**	**R^2**	**Id**	**RMSE**
Asthma	(0,0,0)(0,1,1)	0,9082	0,8930	0,1846
Pneunomia	(1,1,0)(2,1,1)	0,9400	0,9061	0,2867
COPD	(1,2,1)(1,1,0)	0,9160	0,8420	0,3258
Respiratory Diseases	(2,1,1)(1,1,1)	0,8330	0,9401	0,2013
Porto Metropolitan Area				
Diseases	**Model**	**R^2**	**Id**	**RMSE**
Asthma	(1,0,1)(1,2,1)	0,8870	0,9060	0,3477
Pneunomia	(2,1,0)(1,1,1)	0,9270	0,8896	0,1138
COPD	(2,1,0)(1,2,1)	0,9000	0,9524	0,2890
Respiratory Diseases	(1,0,1)(2,1,1)	0,9120	0,9446	0,1004

CONCLUSIONS

❖ The results obtained in the study reveal that linear stochastic models such as ARIMA models provide a useful quantitative description of Hospital Admissions.

❖The Time Series Analysis are an analytic tool in the studies about epidemiology and in the resources of the health institutions in Portugal.

❖The implementation of a forecasting service for use by general practitioners in the Portuguese Metropolitan Areas may help reduce hospital admissions and associated costs.

References

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