# **Original Research Article**

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# Trends of admission and deaths of burn patients (2000 to 2016) in a tertiary care hospital of Maharashtra: a time series analysis

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#### **ABSTRACT**

**Background:** The World Health Organization projects that by 2020, injuries will surpass infectious diseases as the leading cause of death worldwide. Therefore we conducted the present study with objective to identify trends of admissions and deaths of burn patients and to forecast the number of cases of admission and deaths in a tertiary care hospital, Maharashtra by using time series analysis.

**Methods:** The present retrospective study was conducted at a tertiary care hospital of Maharashtra in the month of September 2017. Month wise admissions (7674 patients) and deaths (2865) of burn patients in last seventeen years (2000 to 2016) were used for this purpose. Data was analyzed by using SPSS version 16.

**Results:** There was increasing trend of admissions of burn patients in December to January. Increase in the deaths was also observed in the months of February and March by simple seasonal model of Expert Modeler in SPPS. This predicted 30-44 admissions and 9-13 deaths of burn patients in the year of 2019.

**Conclusions:** The trends and forecasting of admissions and deaths of burn patients will be useful for hospital administrators for management of cases.

Keywords: Trends, Admission, Deaths, Time series analysis, Burn patients

# INTRODUCTION

Every year an estimated 1,80,000 deaths are caused by burns, the vast majority occur in low and middle income countries. In India, over 10,00,000 people suffers from moderate or severe burns every year. Burns being the second largest injuries in India after road traffic accidents affecting the majority i.e., 70% from the age group of 15 to 40 years and most of these belong to poor socioeconomic status; half of them succumb to the injuries. Burns are among the leading causes of disability-adjusted life-years (DALYs) lost in low- and middle-income countries. About 50% of deaths due to burn are contributed by south Asian region. The economic impact of burns also include loss of wages and the costs relating to deformities, in terms of emotional

trauma and loss of skills.<sup>4</sup> Goswami et al observed 40.8% mortality rate due to burns in 5 years.<sup>5</sup> The World Health Organization projected that by 2020, injuries will surpass infectious diseases as the leading cause of death worldwide.<sup>6</sup>Therefore the present study was carried out with objective to identify trends of admissions and deaths of burn patients and to forecast the number of admissions and deaths due to it in a tertiary care hospital of Maharashtra by using time series analysis.

## **METHODS**

# Study design

This retrospective study was conducted in the month of September 2017.

### Study setting

Medical record section of Dr. Shankarrao Chavan Government Medical College and Hospital, Nanded.

# Sample size and study population

All the admissions and deaths during 2000 to 2016 due to burns i.e., 7674 and 2865 respectively in the burn ward of Dr. Shankarrao Chavan Government Medical College and Hospital, Nanded.

# Ethical approval

The study was approved by Institutional Ethics Committee.

#### Data collection

The month wise data were collected directly in the excel sheet for admissions and deaths. There was no missing data found in the medical record section regarding our objective.

# Statistical analysis

Data were entered in Microsoft excel sheet and analyzed by statistical software SPSS 16 Version for sequence charts, model fitting procedure. The model fitting procedure was done by expert modeler for best fit model of time series analysis.

#### **RESULTS**

The present study showed 7674 admissions and 2865 deaths due to burns during January 2000 to December 2016 in the Medical College Hospital. The sequence

charts of admission and deaths of burn patients were plotted which showed increasing trend of admissions of burn patients in December to January. There was also increasing trend of deaths in the month of February to March pattern in both sequence charts (Table 1) (Figure 1 and 2).

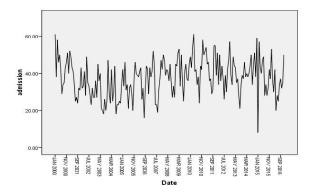


Figure 1: Sequence chart of admissions of burn patients.

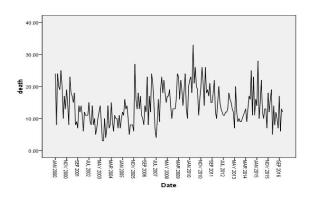


Figure 2: Sequence chart of deaths of burn patients.

Table 1: Baseline data of year wise frequency of admission and deaths of burn patients.

Sl. No.	Year	No. of admissions	No. of deaths
1.	2000	533	214
2.	2001	441	163
3.	2002	388	126
4.	2003	361	98
5.	2004	341	111
6.	2005	404	138
7.	2006	421	163
8.	2007	441	176
9.	2008	467	189
10.	2009	495	220
11.	2010	530	255
12.	2011	529	218
13.	2012	494	162
14.	2013	440	142
15.	2014	522	177
16.	2015	445	174
17.	2016	422	139
Total		7674	2865

The simple seasonal model as best fit model was selected automatically by SPSS version 16 software which used expert modeler for admissions and deaths of burn patients. Ljung box Q statistics was not statistically significant as the P value for admission was 0.108 and for death was 0.281. So model was found to fit for the prediction (Table 3, Figure 3 (A, B)).

The additional goodness of fit measures were also calculated (Table 2). The stationary R-squared was 0.773

(range 0.766-0.780) while R-squared was 0.352 (range 0.314–0.390). Root mean square error (RSME) was 6.210 with standard error of 2.26. Mean Absolute percentage error (MAPE) and Maximum Absolute percentage error (MaxAPE) were 24.93 and 371.74 respectively. The normalized Bayesian Information Criterion (Normalized BIC) was found to be 3.64.

This model predicted 30-44 admissions and 9-13 deaths of burn patients in the year of 2019.

Table 2: Model fit statistics for simple seasonal model.

Fit Statistic	Mean	SE	Minimum	Maximum
Stationary R-squared	0.773	0.010	0.766	0.780
R-squared	0.352	0.054	0.314	0.390
RMSE	6.210	2.260	4.612	7.808
MAPE	24.931	7.591	19.563	30.299
MaxAPE	371.738	171.518	250.457	493.020
MAE	4.792	1.827	3.500	6.083
MaxAE	27.923	16.290	16.404	39.442
Normalized BIC	3.636	0.744	3.110	4.162

RMSE: Root mean square error; MAPE: Mean Absolute percentage error; MaxAPE: Maximum Absolute percentage error; MAE: Mean Absolute error; MaxAE: Maximum Absolute error; BIC: Bayesian Information Criterion.

Table 3: SPSS output for admission and death Model of burn patients.

Model	Number of	Model fit statistics Ljung-box Q		Number of audious		
Model	predictors	Stationary R-squared	Statistics	DF	Sig.	Number of outliers
Admission-model	0	0.780	23.229	16	0.108	0
Death-model	0	0.766	18.768	16	0.281	0

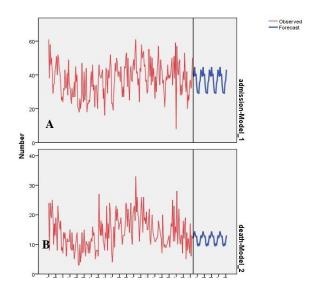


Figure 3 (A and B): Simple seasonal model for admissions and deaths of burn patients.

### **DISCUSSION**

The present study was planned to identify trends of admissions and deaths of burn patients and to forecast the number of cases of admission and deaths of burn patients.

Literature showed that no similar study was published. The sequence charts of burn patients (2000 to 2016) showed increasing trend of admissions during December to January that reflected in the trend of deaths during February to March. On the contrary a 10 year study from Mexico by Miguel Angel Ibarra Estrada<sup>7</sup> observed decreasing trend in the mortality rates through these years. Krishnamurthy et al<sup>8</sup> also observed decrease in mortality rate from 8.74% in 2011 to 3.84% in 2015 but there was increase in the admission during the same period. There was progressive decline in the mortality due to burn by 5.25% from 2000 to 2009 in a study by Navarrete and Rodriguez<sup>9</sup>. The increasing trend in the present study may be due to India being one of the most populous country with absence of organized burn care primary and secondary health care level<sup>1</sup>. The sequence charts also showed the periodic fluctuations during certain period. So the simple seasonal model was found to be appropriate. Significant seasonal variation was also observed by Dokteret et al showing highest admission rates in summer season. 10 The value for stationary R squared was 0.773, closer to 1 that explaining the simple seasonal model as more appropriate. The remaining other goodness of fit measures supports for the best fit model. The predictions of admission and deaths of burn patients were also appropriate estimates by our study.

The factorial analysis of burnt patients with more parameters can have scope for research in future. This study can be useful for the hospital administrators for planning purpose.

#### Limitations

As the present study was a record based hospital study, we could not get the data regarding few variables.

#### **CONCLUSION**

The trends and forecasting of admissions and deaths of burn patients may be useful for hospital administrators for management of burn patients.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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