

FIVE YEARS PERFORMANCE EVALUATION OF PULMONOLOGY UNIT AND DISEASE PATTERN OF ADMITTED PATIENTS

Hussain Ahmad*, Afaq Rahim*, Mukhtiar Zaman*

* Pulmonology Unit, Khyber Teaching Hospital, Peshawar - Pakistan

Address for correspondence:

Hussain Ahmad

Pulmonology Unit, Khyber Teaching Hospital, Peshawar - Pakistan

E-mail:

dr.hussainahmad79@yahoo.com

ABSTRACT

Objectives: To determine the frequency and seasonal variations of respiratory diseases in hospitalized patients. To evaluate five years performance of Pulmonology unit, at a tertiary care hospital.

Methodology: We conducted a five years (2011-2015) retrospective, descriptive study at Pulmonology ward KTH, by retrieving data from ward admission registers, excluding patients with pulmonary tuberculosis admitted in isolation rooms. Patient's age, gender, diagnosis, outcome of discharge and length of hospital stay were analyzed via SPSS-16. Performance of the unit was assessed by calculating bed occupancy rate (BOR), bed turnover rates (BTR) and average length of stay (ALOS) according to Pabon Lassographical model.

Results: We enrolled a total of 6771 patients with mean age of 52 (± 19) years, among these females constituted 53%. The top 10 diagnoses in order of decreasing frequency included COPD (31%), post TB lung fibrosis (17%), pleural effusion (15%), asthma (7.3%), pneumothorax (3.98%), bronchiectasis (3.96%), ILD (3.56%), pneumonia (3%), empyema (1.64%), and bronchogenic carcinoma (0.89%). Admissions during winter months outnumbered the summers significantly by 27 % ($p < 0.01$). Hospital performance parameters (BOR 84%, BTR 58/year, ALOS 5.2 (± 3.41)) of all the years from 2011-2015 constantly fell in the efficient zone (3) of Pabon Lasso model.

Conclusions: Obstructive airway diseases (COPD, asthma), post TB lung fibrosis, pleural diseases (pleural effusion, pneumothorax) and infections (pneumonia, empyema) were the major causes of hospitalization. The health care services were overburdened during winter months. Performance of Pulmonology unit remained persistently within the range of optimal functionality.

Key Words: Bed Occupancy Rate; Bed Turnover Rate; Length of Stay; Respiratory Disease Pattern

This article may be cited as: Ahmad H, Rahim A, Zaman M. Five years performance evaluation of pulmonology unit and disease pattern of admitted patients. Pak J Chest Med 2016; 22(1): 19-25

INTRODUCTION

Respiratory diseases represent a public health challenge because of their frequency, economic impact, morbidity and mortality in both industrialized and developing countries.¹ In England and Wales, about 15% of all deaths occur due to respiratory diseases, and of these about one third from chronic obstructive pulmonary disease (COPD) alone.² Respiratory diseases were the third leading cause of hospitalization and death, after cardiovascular disease and cancer among Canadians³ in 1998-1999 and were responsible for 6.5% of all hospital

admissions in 1991-1992 in United Kingdom.⁴

COPD, asthma, bronchiectasis, interstitial lung diseases, pleural diseases and respiratory infections are the most common causes of hospitalizations. Seasonal variation in frequency and exacerbations of various respiratory diseases have been documented particularly for COPD, asthma and respiratory infections but is generally an overlooked phenomenon.⁵ It has important consequences in terms of poor outcome and imposes a considerable burden on already overloaded health care resources.⁶ Two large multi-centre randomized controlled trials (TORCH and

POET-COPD) have shown that apart from the tropics, health care services come under pressure during winter months partly because of increase in frequency of COPD exacerbations.^{7,8}

Optimal utilization of health care services and performance of hospitals and/or its subdivisions can be assessed by Pabon Lasso graphical model⁹ which utilizes three important indices; Bed occupancy rate (BOR), bed turnover rate (BTR) and average length of stay (ALOS) at hospital. Bed occupancy rate shows the actual utilization of indoor health facility for a given period of time and bed turnover rate is a measure of productivity of a hospital. These indices are also useful to calculate cost allocation. WHO estimated cost/bed/day was 666 rupees for Pakistan in 2013.¹⁰ The aforementioned indicators not only reflect how well the services are being utilized but also provide necessary data of seasonal variations. By knowing these indicators, we can suggest necessary managerial measures to improve the quality of services and prepare for the community requirement.

As no data is available in our set up, we planned this study to determine the percentage of different respiratory diseases in hospitalized patients, any seasonal variation in rate of admissions and health care resource utilization in terms of bed occupancy rate, bed turnover rate, turnover interval and average length of stay at hospital to find the pressure areas and suggest allocation of resources.

OBJECTIVES

The objectives of our study were to;

1. Determine the frequency and seasonal variations of respiratory diseases in hospitalized patients.
2. Evaluate five years performance of Pulmonology unit, at a tertiary care hospital.

METHODOLOGY

We conducted a five year (2011-2015) retrospective, descriptive study at Pulmonology ward Khyber Teaching Hospital, Peshawar by retrieving data from ward admission registers excluding patients with pulmonary tuberculosis admitted in isolation rooms. Patient's age, gender, diagnosis, outcome of discharge and length of stay at hospital were the main variables recorded and analyzed via SPSS-16. Descriptive analysis was performed for sex, diagnosis and outcome of discharge. Mean with standard deviation was calculated for age and length of hospital stay. Hospital performance indicators represented by bed occupancy rate (BOR), bed turnover rate (BTR) and turnover interval (TI), average length of stay (ALOS) and mortality were calculated by

the following formulae and interpreted according to Pabon Lasso graphical model.⁹

1. Bed occupancy rate (BOR): $(ALOS \times \text{admissions} / \text{number of beds} \times 365) \times 100$.
2. Bed turnover rate (BTR) = Total number of discharges per year/average number of beds per year
3. Average length of stay (ALOS): Total length of stay in days per year/total number of discharges per year
4. Turnover interval (TI) = $(365/\text{bed turnover rate}) - \text{Average length of stay}$.
5. Mortality rate: Number of deaths divided by the sum of numbers of discharges and deaths.

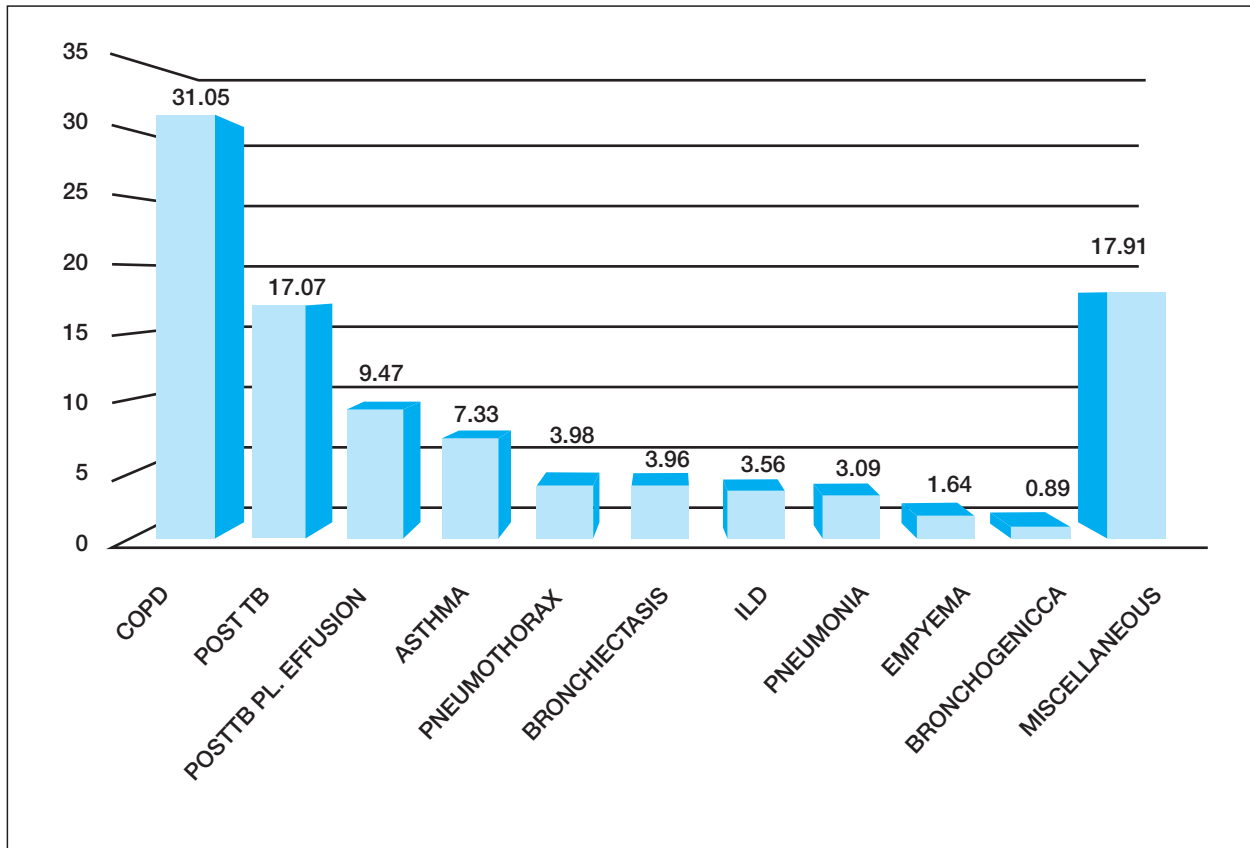
RESULTS

We enrolled a total of 6771 patients during a five year period (2011-2015). Mean age of the patients was 52 (± 19.3) years and females constituted 53%. The top 10 diagnoses in order of decreasing frequency included COPD (31%), post TB lung fibrosis (17%), pleural effusion (15%), asthma (7.3%), pneumothorax (3.98%), bronchiectasis (3.96%), ILD (3.56%), pneumonia (3%), empyema (1.64%), bronchogenic carcinoma (0.89%) as shown in figure 01. Admissions during winter months (Dec to Feb) outnumbered the summers (Jun to Aug) by 27% ($P < 0.01$) but other seasonal changes were not uniform throughout the years (figure 2). The pattern of winter peaks and summer troughs in hospitalization was generally constant from 2011-2015. An increase in admission rate during winter months were noted in COPD, asthma, bronchiectasis and pneumonia as shown in figure 03. Hospital performance parameters of all the years from 2011-2015 constantly fell in the efficient zone (3) of Pabon Lasso graphical model shown in Figure 4. Average bed occupancy rate throughout the year was 84% (winters 91%, summer 74%). The average bed turnover rate was 58 times/year (winter 62/yr, summer 54/yr) as shown in table 01. Turnover interval was 1.00 day and average length of stay at hospital 5.2 days (Table 01). ALOS ranged from 4.69 days in asthmatic patients to 6.1 days in pneumothorax and empyema. The average mortality was 6.4% and there was a significant correlation ($p < 0.01$) between length of stay and mortality

DISCUSSION

This study has demonstrated that obstructive airway diseases were responsible for nearly one third of the total hospital admissions. Literature shows that COPD is the 4th leading cause of death in the world¹¹ with an estimated prevalence of about 6-14% in Pakistan.¹² A marked increase (52%) was observed in COPD related

Figure 1: Percentage of top 10 respiratory diseases in hospitalized patients.



hospitalizations during winter months (Dec to Feb) as compared to summers (Jun to Aug). Similar higher prevalence of winter peaks has been described by large randomized controlled trials.^{13,14} The exact cause of this increase is not known but is thought to be due to increased viral infections, overcrowding, cold air and survival of viruses in cold.¹⁵ There are many causes of COPD exacerbations, many of these can be modified by quitting smoking, yearly influenza vaccination, adherence to treatment and proper inhaler technique and education.¹⁶ Similarly, the hospitalizations due to asthma attacks were more in winters with additional peaks during May and September probably associated with change in weather and exposure to allergens.

The complication of previous pulmonary tuberculosis (lung fibrosis) was the second leading cause of admissions. Tuberculosis is one of the major public health problems in developing countries. Pakistan ranks fifth amongst TB high-burden countries worldwide. Late diagnosis and improper treatments lead to preventable complications in these patients.¹⁷

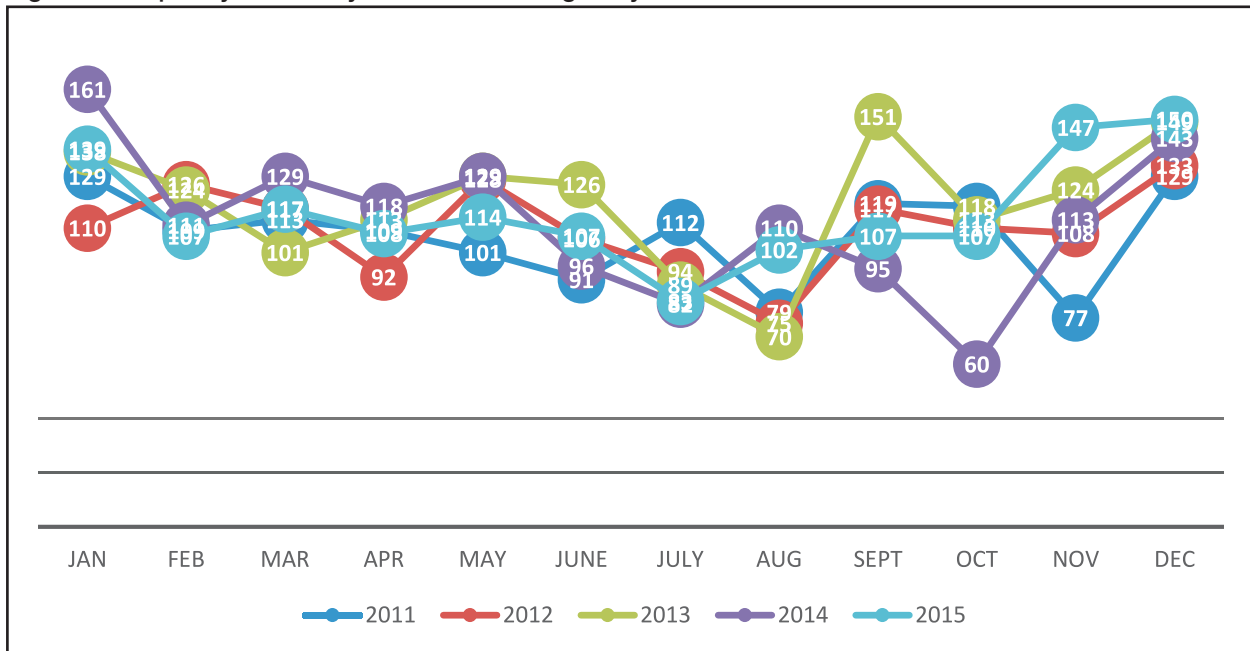
Pleural diseases including massive pleural effusions (due to multi-factorial etiologies), pneumothorax

(primary and secondary) and empyema (bacterial and tuberculous) collectively constituted 15% of total admissions. The seasonal variations in hospitalizations were observed (i.e. peaks during May and September) but the seasonal peaks were not constant throughout the years.

The total numbers of admissions were 27% higher in winters (BOR 91%, BTR 62/year) as compared to summers (BOR 74% and BTR 54/year) suggesting an overburden during winters; this was a constant feature throughout the years with non-persistent peaks during May and September. The winter peak may be explained by increase in exacerbations of COPD/Asthma and pneumonias during winter seasons. A threefold increase in hospital visits during winters has been described due to these three conditions.¹⁸ The implication of this feature could be managerial measures to make sure necessary arrangements beforehand to improve the quality of service during this period.

Measuring the performance of hospitals and its subdivisions can be useful for policy makers and managers who monitor the efficiency over time and develop more efficient mechanisms to allocate scarce

Figure 2: Frequency of monthly admissions during five years from 2011-2015



resources. Among the various approaches, Pabon lasso graphical model designed in 1986 provides a useful snapshot of the overall performance. It takes into account three important indices of bed occupancy rate (BOR), bed turnover rate (BTR) and average length of stay (ALOS) at hospital to measure the efficiency of a hospital.¹⁹ These parameters can differ in different specialties mainly because of the nature of various disorders in addition to many other factors. High BOR, High BTR and short hospital stays

suggest efficient utilization of health care resources. The hospital performance is considered as optimal if BOR is more than 70%, BTR > 50times/year and TI (turnover interval) below 2days.²⁰

BOR exceeding 85% in acute care hospital has been shown to be associated with problems in handling both emergency and elective admissions in UK.²¹ Another study demonstrated that BOR more than 90% in acute care hospitals can expect regular bed

Figure 3: Monthly changes in frequency of admissions due to different respiratory diseases during five years (2011-2015)

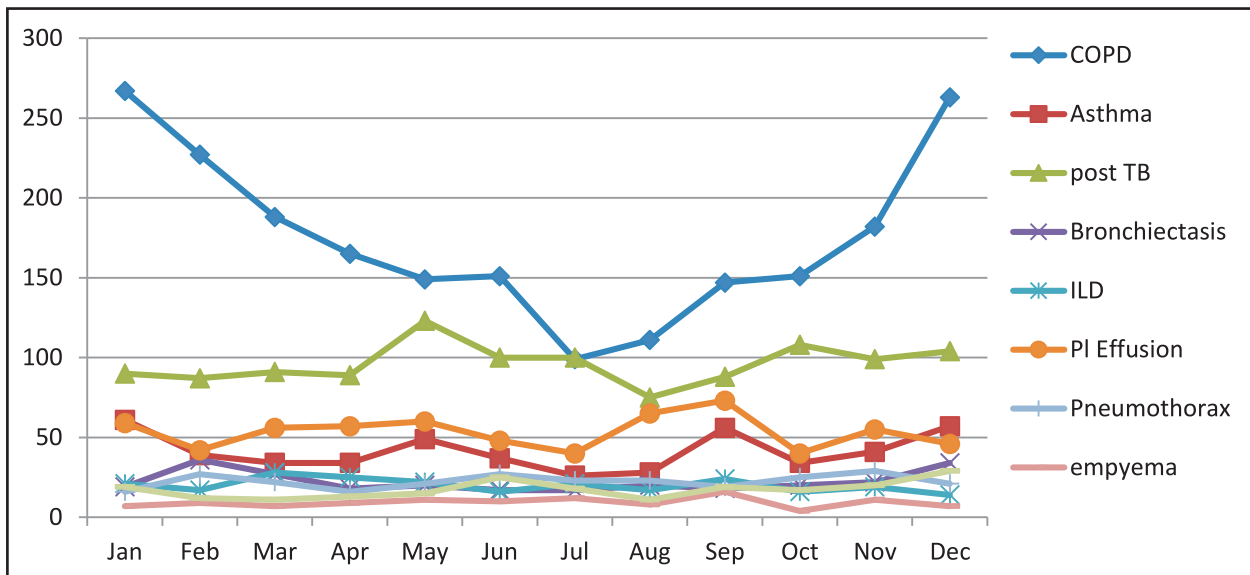
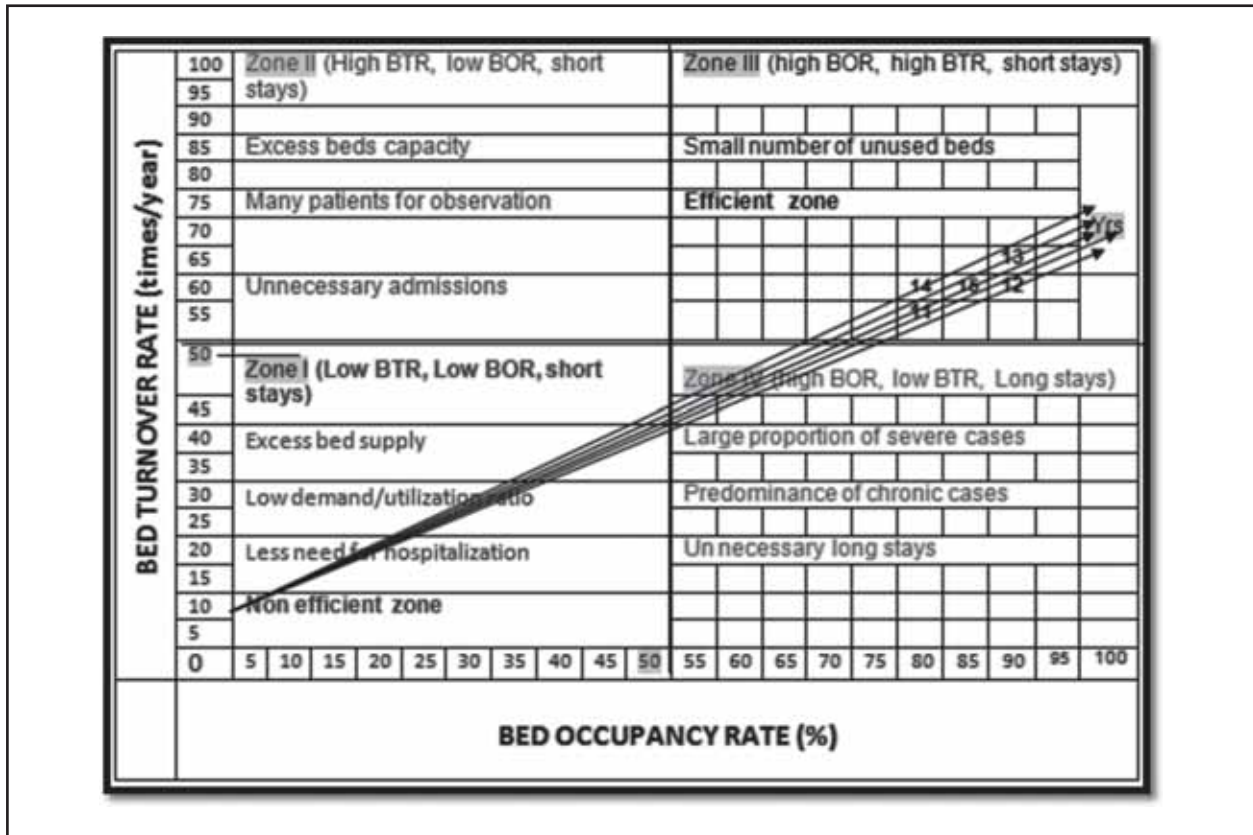


Figure 4: Pulmonology unit performance indicators



shortages and periodic bed crises.²² Very high BOR contributes significantly to nosocomial infections.²³

The average values for each of these capacity utilization measures of our department were ALOS: 5.2 days, BOR: 84% and BTR: 58 times/year. The average BOR was higher (91%) during winter months as compared to summers (74%). The shortest length of stay was observed in asthma because it is a quickly reversible disease while pneumothorax and empyema required longer stays most probably because of the nature of these disorders. A statistically significant association has been reported between the nature of diseases and duration of stay. Different studies conducted in Medicine wards show variable length of stays i.e. 4.7, 5.4, and 8.4 days.^{22,23} Different percent-

ages of BOR of chest disease hospitals/wards have been reported abroad and locally ranging from 90% to 19%.^{24,25}

When these three indicators were put in Pabon Lasso graphical Model, our department was constantly located in zone 3. This implies efficient utilization of resources. Our higher bed occupancy rate of 91% during winters may be alarming because it may be affecting the quality of care during winter months. The problem can be resolved by arranging more equipped beds with the required resources. Another possible solution could be early discharges but too early/premature discharges may result in high re-admission rate.

Table 1: Performance indicators summary statistics of Pulmonology Unit from 2011-2015

Year	Beds (number)	Total discharges /yr	ALOS (days)	BOR (%)	BTR (times/yr)	TI (day)	Mortal ity (%)
2011	23	1286	5.2	79.9	55.9	1.3	4.4
2012	23	1318	5.58	87.6	57.3	0.78	7.6
2013	23	1428	5.28	89.8	62.0	1.1	7.1
2014	23	1347	5.0	80.2	58.5	1.2	6.0
2015	23	1387	5.1	84.2	60.3	0.95	7.0
Average	23	1353	5.2	83.8	58.8	1.0	6.43

CONCLUSION

Obstructive airway diseases (COPD, asthma), post TB lung fibrosis, pleural diseases (pleural effusion, pneumothorax) and infections (pneumonia, empyema) were the major causes of hospitalization. The health care services were overburdened during winter months. Performance of Pulmonology unit remained persistently within the range of optimal functionality.

Obstructive airway diseases (COPD, asthma), post TB lung fibrosis, pleural diseases (pleural effusion, pneumothorax) and infections (pneumonia, empyema) were the major causes of hospitalization. The health care services were overburdened during winter months. Performance of Pulmonology unit remained persistently within the range of optimal functionality.

LIMITATIONS

As this is a quantitative assessment, audits of individual respiratory diseases are needed, to know the quality of care. We did not compile the data of various co-morbid conditions which can affect the length of stays and mortality.

Acknowledgement: We acknowledge the tiring efforts of our pulmonology technicians (Miss Ainab and Miss Sonia) for collecting data from various admission registers.

REFERENCES

1. Khaled NA, Enarson D, Bousquet J. Chronic respiratory diseases in developing countries: The burden and strategies for prevention and management. Bulletin of the World Health Organization. Print ISSN 0042-9686. Bull World Health Organ: Geneva 2001;79(10):971-979.
2. Mannino DM, Homa DM, Akinbami LJ, Ford ES, Redd SC. Chronic obstructive pulmonary disease surveillance-United States, 1971-2000. Respir Care 2002; 47(10):1184-1199.
3. Respiratory Disease in Canada. Canadian Institute for Health Information. Canadian Lung Association. Health Canada: Statistics Canada 2001. p. 1-102.
4. The burden of respiratory disease. Lung and Asthma Information Agency, Department of Public Health Sciences. St. George's Hospital Medical School, Cranmer Terrace, London SW17 0RE. Factsheet 95/3.
5. Moineddin R, Nie JX, Domd G, Leon AM, Upshur RE. Seasonality of primary care utilization for respiratory diseases in Ontario: A time-series analysis. BMC Health Serv Res. 2008; 8: 160.
6. Public Health England. Cold Weather Plan for England 2013: Protecting Health and Reducing Harm from Cold Weather. London: Public Health England 2013.
7. Jenkins CR, Celli B, Anderson JA, Ferguson PW, Jones J, Vestbo JC. et al. Seasonality and determinants of moderate and severe COPD exacerbations in the TORCH study. Eur Respir J. 2012; 39(1):38-45.
8. Rabe KF, Fabbri LM, Vogelmeier C. Seasonal distribution of COPD exacerbations in the Prevention of Exacerbations with Tiotropium in COPD trial. Chest 2013; 143(3):711-719.
9. Pabon Lasso H. Evaluating hospital performance through simultaneous application of several indicators. Bulletin of the Pan American Health Organization 1986; 20:341-57.
10. WHO-CHOICE. Estimates of unit costs for patient services for Pakistan. choosing interventions that are cost effective. www.who.int/choice/country/pak/cost/. accessed 10-02-2013.
11. Halbert R, Natoli J, Gano A, Badamgarav E, Buist A, Mannino D. Global burden of COPD. Systematic review and meta-analysis. Eur Respir J 2006; 28:523-32.
12. Akhtar T, Ullah Z, Khan MH, Nazli R. Chronic bronchitis in women using solid biomass fuel in rural Peshawar, Pakistan. Chest 2007; 132:1472-5
13. Calverley PM, Anderson JA, Celli B, Ferguson GT, Jenkins C, Jones PW, Yates JC, Vestbo J; TORCH investigators. Salmeterol and fluticasone propionate and survival in chronic obstructive pulmonary disease. N Engl J Med 2007; 356:775-89.
14. Rabe KF, Fabbri LM, Vogelmeier C, Kogler H, Schmidt H, Beeh KM. et al. Seasonal distribution of COPD exacerbations in the Prevention of Exacerbations with Tiotropium in COPD trial. Chest 2013; 143(3):711-719.
15. Crighton EJ, Moineddin R, Upshur RE, Mamdani M. The seasonality of total hospitalizations in Ontario by age and gender: a time series analysis. Can J Public Health 2003; 94:453-457.
16. Garcia-Aymerich J, Barreiro E, Farrero E. Patients hospitalized for COPD have a high prevalence of modifiable risk factors for exacerbation. Eur Respir J 2000; 16:1037-42.

17. Khan KS.S etting health care priorities in Pakistan. *J Pak Med Assoc* 1995; 45:222-27.
18. Moineddin R, Nie JX, Domb G, Leon AM and Upshur RE. Seasonality of primary care utilization for respiratory diseases in Ontario: A time-series analysis. *BMC Health Ser Res* 2008; 28:160.
19. Mehrotra A, Lee S, Dudley RA. Hospital performance evaluation: what date do we want, how do we get it, and how should we use it. Washington DC: National Business Coalitions on Health 2006.
20. Bahadori MK, Sadeghifar J, Hamouzadeh P, Hakimzadeh SM, Nejati M. Combining multiple indicators to assess hospital performance in Iran using the Pabon Lasso Model. *Australas Med J*. 2011; 4(4):175-9.
21. Keegan A.D. Hospital bed occupancy; more than queuing for a bed. *Med J Aust* 2010; 193(5):291-3.
22. Bagust A, Place M, Postnett JW. Dynamics of bed use in accommodating emergency admissions; stochastic simulation model. *BMJ* 2009;319(7203):155-8.
23. Clements A, Halton K, Graves N, Pettitt A, Morton A, Looke D, et al. Overcrowding and understaffing in modern health care systems. Key determinants in MRSA. *Lancet Infect Dis* 2008; 8(7):427-34.
24. Usman G, Memon KN, Shaikh S. Bed occupancy rate and length of stay of patients in Medical and allied wards of a tertiary care hospital. *J Ayub Med Coll Abbottabad* 2015;27(2):367-70.
25. Ekiyor A. Evaluation performance of chest diseases departments using hospital efficiency indicators in turkey. *BJEMT* 2015; 6(2):145-50.