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## Direct cost of treatment in hospitalized community- acquired pneumonia patients

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### ABSTRACT

Treatment of community acquired pneumonia (CAP) puts an extensive burden on hospitals resources. The aim of the study was to determine direct medical cost of treatment in hospitalized community acquired pneumonia patients. The study was a prospective, observational study involving 258 patients with age group >1 year of age and less than 90 years of age. Direct medical cost (ward cost, medication cost and diagnostic tests cost) were assessed. The influence of co-morbidity and severity of disease were analyzed on direct medical cost associated with hospitalized CAP patients. The study was conducted in a 350 bed hospital situated in central district of Karachi. The cost study was conducted from hospital perspective. Patient with co morbid condition, higher severity index and higher age experienced higher cost. Co-morbidity was found in 45.35% patient. The median total cost was PK Rupees 12163 and the component of costs was: ward cost PK Rupees 7200 diagnosis cost PK Rupees 1310, medication cost PK Rupees 3679. A descriptive analysis approach was used to analyze clinical management, clinical outcome and healthcare resources. All data were analyzed using SPSS 15 version and spearman correlation was used to determine correlation. A positive correlation was found between the total cost ( $\gamma=0.486$ ),  $p=0.000$ ) as well as the cost of each component and the PSI i.e. the higher the risk class, the greater the cost. In conclusion, medication, diagnostic procedures and length of stay in hospital are the important component of cost of treatment of hospitalized CAP patient. Patient with higher age, co morbidity and higher length of stay experienced higher cost. The cost increases as the severity of the disease increases. Strategies designed to ensure correct medication use, early management of associated co morbidity, may help in decreasing in-patient costs in hospitalized patient of community-acquired pneumonia.

Key words: Community acquired pneumonia, Length of stay, Pneumonia severity index



### INTRODUCTION

Community acquired pneumonia is a very serious disease with high occurrence and have a huge monetary effect on both direct and indirect cost. [1]. The primary direct expense of the ailment is because of hospitalization of CAP patients, which can represent up to 90% of the worldwide expense associated with CAP [2]

The worldwide components of the direct expenses of hospitalized CAP patients have been evaluated [3, 4]. The most essential parts of the cost are hospital length of stay and anti-microbial treatment, both of which are impacted by severity of diseases and the clinical course took after by the patient

admitted in hospital. Moreover, CAP is more frequently occur in elderly patients with co morbidities, and intensifying of co morbidities is regular. Therefore, this delays the length of hospital stay (LOS) and expands the direct expenses [5,6]

As indicated by the study the total direct expense for treating CAP was \$8.4 billion (in 1995 dollars), of which \$4.8 billion was for patients of 65 years old. Eighty-nine percent of the total expense, or \$7.5 billion, was for inpatient [7]. In another study author explained that indicated by the 2005 Nationwide Inpatient sample, the average hospital length of stay (LOS) for CAP was 5.52 days, and hospital mortality was 4% [8]. The occurrence of CAP in Europe ranges from 1.6 to 10.8 for every 1,000 adults for every year, but, accurate figures

are presented just for Finland, Spain, and the United Kingdom [1]. CAP is associated with a significant utilization of health care resources, essentially because of its high frequency. In 1997, the total direct and indirect expenses of pneumonia in Germany were evaluated to be \$1.64 billion; of which \$983 million were direct expenses and \$656million were indirect expenses. Currently, various publications have dissected the cost component of CAP, planning to assess costs in outpatients and in those admitted to the hospital [4]. Likewise in another study it is found that direct expenses associated with severity of the diseases as measured by the Pneumonia Severity Index (PSI) [9]. The present study gives an analysis from the hospital perspective of the direct expenses due to the hospitalization of CAP patients and assesses the impact of high age, co morbidities and PSI on the direct expense components.

## METHODOLOGY

**Study Subjects:** This study was A prospective observational study is carried out from August 2012 to August 2013. This study was performed in a 350 bed tertiary care private hospital in Karachi.

**Eligibility Criteria:** The inclusive criteria were a clinical judgment perfect with CAP with two or more clinical indications and a new infiltrate on the chest radiograph. Patient of age group >1year to ≤90years were included. Of the patients with pneumonia, the following were then excluded patient with pregnancy/lactation and breast feeding, immunosuppressant, including human immunodeficiency virus infection, patients who had been hospitalized in the previous 15 days and those with tuberculosis were also excluded, as were those patients who received attention in the intensive care unit and the patient with complication were excluded from the study.

**Data Collection:** The following data were collected: patient age and sex, socioeconomic status and the PSI were recorded. The following evaluative parameters were recorded: co morbidity, length of stay in hospital, diagnosis, medication from patient record file. Specific co morbidity details included chronic obstructive pulmonary disease (COPD), asthma, cardiac diseases, renal or hepatic diseases; diabetes mellitus associated with CAP were recorded.

**Ethical approval:** Ethical approval permission was ensured from the Board of Advance Study and Research (BASR) of the University of Karachi. Permission was obtained before conducting the study from institution. Informed consent was not necessary, since there were no interventions

affecting either physician's treatment decisions or the patients.

**Cost Calculation:** The expense study was carried out from the hospital perspective. All the direct costs during hospitalization were examined, i.e. those identified with the utilization of medicinal services assets such as diagnostic tests, treatment and LOS. The indirect costs associated with work days missed or transport to hospital were not considered. The tests performed during hospitalization were quantified and classified as follows. 1) Complete blood counts, blood culture, urine detail report, creatinine, urea, and electrolytes. 2. Microbiological studies: sputum culture and gram staining 3) Radiological studies included chest-rays 3. The treatment provided was classified as either antibiotic treatment or associated with CAP related symptoms. Other medication incorporated the symptomatic treatment of community acquired pneumonia, concomitant medication and medication of complications was not recorded. In relation to each drug used, the number of doses administered and the route of administration (oral, intravenous, intramuscular or inhaled) were recorded. The LOS in hospital was accounted as the number of days of admission, from arrival at the hospital until the day of discharge. The computed expense were assembled as follows: 1) expense of medication, sub classified as cost of antibiotic treatment and cost of other treatments; 2) ward cost( 3) cost of diagnosis tests The total hospital cost was accounted as the sum of the categories above. All costs were calculated in Pakistani rupees for the year 2012 to 2013. The medication costs were calculated as the median cost of the drugs for the hospital during 2012-2013 (data provided by the Pharmacy Service of the hospital). The costs of the radiological, microbiological and other relevant tests were obtained from the official fees of the hospital.

**Statistical Analysis:** The expense results are accounted as median cost. In the first step the information was entered in the excel sheet and then investigated further on SPSS, mean, variance, valid frequency of answer, percentage and cumulative percentage was taken. A descriptive analysis approach was utilized to investigate clinical administration, clinical results and medical services resources .All data were analyzed using SPSS 15 version and spearman correlation was used to determine correlation between the total cost PSI and the direct cost and the cost components.

**Cost of Diagnostic Test:** Table 1: represent the diagnostic tests charges in PK Rupees used for the diagnostic cost calculation.

## RESULTS

**Study Population:** The study included 258 patient hospitalized due to CAP, their demographic characteristics, co morbidity, PSI, length of stay at hospital were recorded. Comorbidity was found in 117(45%) patient. PSI Score were also recorded. Patients included PSI I (135)(52%), PSI II(54)(21%), PSI III(35)(13%), PSI IV(17)(7%) and PSI V(17)(7%). these demographic characteristics are presented in table 2.

**Cost Results:** Direct cost of treatment of CAP in hospitalized patient in Pakistani rupee.

Table 3 represents the median total direct cost of treatment of the cohort was PK Rs12163. The distribution of each component was as follows: length of stay at ward median cost was 7200, diagnosis test median cost was PK Rs.1310 and medication median cost was PK Rs. 3679. The percentage of the total median cost corresponding to each component was as follows medication cost(30%), diagnostic procedures(11%), length of stay cost(59%). Which indicate that the major portion of the cost of treatment of community acquired pneumonia is due to length of stay at hospital. Hospital cost according to patient Age, Sex and presence of co morbidities.

Table 4 represents the median total cost according to the patient age, sex and co morbidity .The patient having age greater than 70years experience higher cost of treatment than patient having age less than 70years. Higher cost was obtained in female patient than the male patient of community acquired pneumonia. The median cost in patient having no co morbidity was (PK Rs.9883) less than that patient having co morbidity.

Direct cost of community acquired pneumonia based on PSI

Table 5 summarizes the direct health care costs according to the PSI. A positive correlation was found between the total cost as well as the cost of each component except diagnostic tests. The cost is increasing as the severity of the diseases increases, i.e the higher the risk class the higher will be the cost.

## DISCUSSIONS

The yearly financial burden of pneumonia was accounted by the European Respiratory society to be €10.1 billion in Europe. In patient medication expenses accounted for €5.7 billion of this amount. In the present study the inpatient total direct cost of treatment of community- acquired pneumonia

was obtained PK Rs.12163. In a study carried out in Spain the direct cost of inpatient care were €1210 and €1553. in Europe, the direct cost ranged from €1,333 in Germany to €2550-7650 in the UK. However the European expenses were fundamentally lower than those reported for doctor's facilities in the USA in spite of longer hospital stay [10]. In the present study the patient having age of > 70years experienced higher median expense i.e PKRs.17367 and the patient age ≤ 70 years bear an expense of PKRs.10949. In a study reported that altogether higher expense in patient > 65 years old [11]. In contrast to our study the author explained that 1.1 million Hospital discharges resulting in inpatient costs of \$4.4 billion (52.4% of the \$8.4 billion) for the 0.6 million patients aged > or =65 years and \$3.1 billion (36.9% of the \$8.4 billion) for the 0.5 million patients aged <65 years. The average hospital length of stay was 7.8 days with an average cost of \$7166 for patients aged > or =65 years and 5.8 days with an average cost of \$6042 for younger patients. Room and board represented the largest percentage of the average hospital bill for patients with CAP. Inpatient physician service costs were \$305 million and \$192 million for the > or =65 and <65 groups, respectively [7]

In present study an increasing trend of cost was demonstrated for patient with increasing severity of CAP. In another study reported more significant expenses for patients with severe pneumonia requiring admission to ICU, looked at with patients with less serious pneumonia, predominantly because of longer LOS in hospital stay (Us\$2,300 versus Us\$1,242; p=0.001).[4] In spite of the fact that the present study did exclude patients admitted to the ICU, an expanded cost in patients with a high PSI, because of an expanded number of tests and a more drawn out LOS, was affirmed

In the present study patient with co-morbidity (45%) included cardiovascular illness, diabetes, renal infections, respiratory diseases and congestive heart failure, illness encounter longer stay in ward. The higher age group patient's possess more co-morbidity that results longer stays and leads to higher expense of treatment. In the present study patients with co-morbid condition experience high cost of CAP as contrast with patient with no co morbidity. Another similar study explained that. Hospital stay was longer in patients with co-morbidities than in those without co morbidity. Patients with co-morbidities (n = 1,598), which included respiratory ailment, diabetes and congestive coronary illness, experienced longer stays in both hospital and ICU than those without co morbidity [12]. In the present study the segment of the total median expense were medication cost PK Rs.3679, diagnosis methods cost PK Rs.1310,

length of stay expense was PK Rs.7200 and the percentages of every part were as per the following 30%, 11% and 59%. In contrast to that a study conducted in CAP patients consist of a total of 114 cases with an average age of 70.9 were examined. 80 (70.2%) of cases were male and 34 (29.8%) female. 97 (85.1%) and found average costs of medicine was 484.59 Euro and a total cost of treatment was €1630.77.[13]. In another study conducted and assessed direct cost of treatment in a prospective, observational study of 271 patients admitted to a hospital ward due to CAP. He found the total direct medication cost including antibiotics and other medication were as total medication was €187 consist of antibiotic cost €138 and other medication cost €38.[10].

The significant segment of the expense of CAP in hospitalized patient was length of stay. In this present study the mean length of stay was 6.67±5.83. Comparing to other studies the author determined, average hospital stay 11.0± 6.6 days and stated that the most important factor that affects the costs significantly is the length of hospital stay [13]. In another study carried out which confirm that an increased cost in patients with a high PSI, due to an increased number of tests and a longer LOS, was confirmed[10]. In a similar study the author determined the mean length of stay at hospital 10.8±6.2 days [11].

In the present study a positive correlation was found between the total cost as well as the cost of each component except diagnostic tests. The cost is increasing as the severity of the diseases increases. i.e the higher the risk class the higher will be the cost. The other studies also support our study like in a study conducted and the author found cost based on PSI were PSI class I €1071 ,PSI Class II

€1143,PSI class III €1143 ,PSI class IV €1286 PSI Class V €1429 he explained that a positive correlation was found between the cost of length of stay and the PSI severity class said that cost of length of stay increases the as the severity of the diseases increases.[10]. According to another study the author determined the total cost of the low-risk group was 1274.60 Euro based on the PSI scoring, the total cost of the high-risk group was observed as 1929.49 Euro, their difference proved to be significant (p= 0.04) [13]. Similarly in another study the author found the severity based cost. The median cost increased from risk class's I-III and leveled off for risk classes IV-V. This is, in part, due to the median values. Mean values were \$1,253, \$1,372, \$1,638, \$1,672, and \$1,676 for the PSI classes I through V, Respectively. The median increases from PSI risk class's I-III and levels off for PSI risk classes IV-V.[4]. Majority of the studies concluded that the cost of treatment increases as the severity of the disease increases due to the effect of mainly length of stay and medication treatment .

**CONCLUSION**

Taking everything into account, medicine, diagnosis and length of stay in hospital stay are the important segments of expense of treatment of hospitalized CAP patient. However patient having higher age and co morbidity experienced higher expense and higher length of stay. The expense is increases as the severity of the diseases increases. Strategies intended to guarantee right medicine use, early administration of related co morbidity, may help decreasing in-patient expenses in hospitalized patient of community acquired pneumonia.

Table 1: Cost of Diagnostic tests

| Diagnostic test                          | Charges (PK Rupees) |
|--|---------------------|
| Complete blood count                     | 560                 |
| Chest X Ray                              | 750                 |
| Sputum culture with sputum gram staining | 1230                |
| Blood culture                            | 1100                |
| Electrolytes                             | 650                 |
| Urine DR                                 | 260                 |
| Creatinine                               | 390                 |
| Urea test                                | 300                 |

Table 2: Demographic characteristics, co morbidity and PSI Score of the patient

| Characteristics              | Frequencies                             | Percentages (%) |
|------------------------------|---|-----------------|
| Patient n %                  | 258                                     | 100             |
| Age (year)                   | Range=( $\geq 1$ year - $\leq 90$ year) |                 |
| SEX(M/F)                     | 172/86                                  | 67/33           |
| co morbidity                 | 117                                     | 45.35           |
| Cardiovascular disease       | 58                                      | 22.5            |
| Diabetes mellitus            | 33                                      | 12.8            |
| Liver diseases               | 3                                       | 1.2             |
| Kidney disease               | 3                                       | 1.2             |
| Asthma                       | 9                                       | 3.5             |
| COPD                         | 3                                       | 1.2             |
| CNS                          | 4                                       | 1.6             |
| CHF                          | 4                                       | 1.6             |
| Patient without co morbidity | 141                                     | 54.7            |
| PSI Score                    |   |                 |
| I                            | 135                                     | 52              |
| II                           | 54                                      | 21              |
| III                          | 35                                      | 13              |
| IV                           | 17                                      | 7               |
| V                            | 17                                      | 7               |
| LOS(Length of stay)          | Mean LOS=6.67 $\pm$ 5.83                |                 |

Table 3: Direct cost of treatment

| Variables                       | Median cost in PK rupee | Percentages |
|---------------------------------|-------------------------|-------------|
| Medication cost                 | 3679                    | 30%         |
| Diagnosis cost                  | 1310                    | 11%         |
| Length of stay in hospital cost | 7200                    | 59%         |
| Total CAP cost                  | 12163                   |             |

Table 4: Hospital cost according to patient Age, Sex and presence of co morbidities.

| Characteristics                       | Median cost in PK Rupees |
|---------------------------------------|--------------------------|
| Age $\leq 70$ years                   | 10949                    |
| Age > 70years                         | 17367                    |
| Gender                                |                          |
| Male                                  | 11483                    |
| Female                                | 15586                    |
|                                       |                          |
| Median cost with co morbidity         |                          |
| Cardiovascular disease                | 18652                    |
| Diabetes                              | 19336                    |
| Liver disease                         | 8001                     |
| Renal disease                         | 10995                    |
| Asthma                                | 49664                    |
| Chronic obstructive pulmonary disease | 31695                    |
| Central nervous system diseases       | 14723                    |
| Congestive heart failure diseases     | 61100                    |
| Median cost without co morbidity      | 9883                     |

Table 5: Direct cost community acquired pneumonia based on PSI

| Variables            | PSI  |       |       |       |       | P-Value |
|----------------------|------|-------|-------|-------|-------|---------|
|                      | I    | II    | III   | IV    | V     |         |
| Medication cost      | 2234 | 6692  | 5006  | 14770 | 25590 | 0.000   |
| Diagnostic test cost | 560  | 1310  | 1310  | 1310  | 1310  | 0.000   |
| Hospital stay cost   | 5700 | 9000  | 9000  | 28500 | 34200 | 0.000   |
| Total CAP cost       | 9883 | 16882 | 15318 | 51130 | 61100 | 0.000   |

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