Direct Costs of Acute Exacerbation of Chronic Obstructive Pulmonary Disorder in Hospital Inpatient Setting: A Cross Sectional Study

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ABSTRACT

Introduction:

This study aimed to estimate the direct costs of acute exacerbations of Chronic Obstructive Pulmonary Disorder (AECOPD) in cases which required inpatient hospital admissions. The direct costs estimated were pharmaceutical costs, consumable costs and laboratory investigation costs.

Methods:

A cross-sectional study was carried out at medical wards of Sri Aman Hospital over three months. Study subjects were recruited using a convenience sampling method. All information and data of pharmaceuticals, consumables and laboratory investigations during patients' admissions were recorded in data collection forms.

Results:

A total of 66 patients involving 70 admissions were included. For each admission of AECOPD, the laboratory investigations constituted the highest costs with median costs of RM154.00, followed by pharmaceutical costs for the treatment of AECOPD (RM127.50), pharmaceutical costs for the treatment of comorbidities (RM72.22) and consumable costs (RM16.80). Notably, pharmaceutical costs contributed the most of the total costs (55.90%) over the study period, followed by laboratory investigation costs (39.30%) and consumable costs (4.70%).

Conclusion:

Different types of direct costs were incurred to treat patients with AECOPD in the inpatient setting of Sri Aman Hospital. Pharmaceutical costs were the major cost driver, followed by the laboratory investigations and consumables. Pharmacists are recommended to enforce Patient Own Medications (POM) more extensively to minimise the highly burdening pharmaceutical costs.

Keywords:

COPD, AECOPD, cost, pharmaceuticals, laboratory investigations, consumables

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is attributed to persistent respiratory symptoms and airway obstructions caused by exposure to harmful gasses and particles. It is regarded as the fourth leading cause of mortality in the world.[1] COPD leads to a significant economic burden in many countries. For instance, in the United Kingdom, the economic burden of COPD constitutes 30% of the total costs of respiratory illnesses, which is up to €1.9 billion each year.[2] Meanwhile, in the United States, COPD costs up to $50 billion in direct costs annually.[3]

Acute Exacerbation of Chronic Obstructive Pulmonary Disorder (AECOPD) which leads to hospitalisation, is the most significant healthcare costs associated with COPD. Studies have shown that hospitalisation costs of COPD constitute 40-57% of the total direct costs of COPD in a patient.[4] In the United States, AECOPD constitutes up to 70% of healthcare-associated COPD costs, with hospital admissions accounting for more than $15 billion annually.[3]

Direct costs such as pharmaceutical costs, consumable costs and laboratory investigation costs are significant key drivers of AECOPD costs. In one longitudinal study in Malaysia, the cost of drugs and consumables were the highest, followed by personnel, equipment, building, depreciation, electricity, fixed assets and communication.[5] Knowledge of costs is important to better manage budget allocations and improve management.[5]

In Malaysia, published data on the costs of AECOPD are still limited. Thus, this study aimed to estimate the costs of AECOPD in cases that required inpatient hospital admissions in Sri Aman Hospital. The costs that were investigated include the pharmaceutical costs, consumable costs, and laboratory investigation costs.

METHODS

Study Design

A cross-sectional study was carried out at the male medical ward and female medical ward of Sri Aman Hospital. The study was conducted over 3 months, from July 2022 until September 2022.

Study Participants

Study participants were selected using convenience sampling method. Patients diagnosed with COPD as per Chronic Obstructive Pulmonary Disease (GOLD) Guidelines 2020 (Presence of post-bronchodilator ratio of forced expiratory volume in one second to the forced vital capacity (FEV1/FVC) <0.7), AECOPD and any diagnosis precipitated by COPD were included in this study.

Each hospitalisation episode, including readmission, was considered as distinct admission. All readmission cases were included as the costs, clinical condition and progression were unique.

Patients with other diseases or diagnoses that could explain their reduced pulmonary function (for example, asthma, bronchiectasis, congestive heart failure and tuberculosis), as well as those who received treatment in the Emergency and Trauma Unit (ETU) but were not admitted, were excluded from this study.

Data Collection

A data collection form was used for each admission of the eligible patient. The form recorded the pharmaceuticals utilized, consumables used, and laboratory investigations performed during the patient's admission. The data was collected from the arrival in the ETU and throughout admission until discharge. The pharmaceutical and consumable costs were gathered by recording the types and number of each item used to treat AECOPD and other comorbidities, multiplied by unit cost.

Patient's own medicines (POMs) such as own inhalers were not included as pharmaceutical costs. Consumables included simple oxygen masks, venturi oxygen masks, nasal oxygen cannulas and aerosol masks. All information was extracted from the patient's medication, nursing and medical charts, whereas the unit cost of each item was obtained from the Pharmacy Information System (PhIS).

Likewise, laboratory investigation costs were gathered by recording the types and frequency of laboratory investigations carried out during the patient's stay, multiplied by unit cost. Laboratory investigations included were full blood count, renal profile, liver function test, arterial blood gas and coagulation profile. This information was acquired from the patient's laboratory investigation chart. The unit cost of laboratory investigations was provided by the Laboratory Services Unit.

Outcomes included median (interquartile range) of pharmaceutical, consumable and laboratory investigation costs respectively in Malaysian Ringgit (RM). These statistics were calculated using Microsoft Excel. The costs were divided into pharmaceuticals, consumables and laboratory investigations. Cost for pharmaceuticals was further divided into pharmaceuticals for treatment of AECOPD and for treatment of comorbidities.

Table 1. Demographic characteristics (n=66)

Demographic Data	n (%)
Age (Years)	
<30	1 (1.5)
30–65	25 (37.9)
>65	40 (60.6)
Gender	
Male	42 (63.6)
Female	24 (36.4)
Smoking History	
Yes	48 (72.7)
No	18 (27.3)
Comorbidities	
Hypertension	44 (66.7)
Pneumonia	38 (57.6)
Diabetes Mellitus	16 (24.2)
Dyslipidemia	14 (21.2)
Atrial Fibrillation	3 (4.5)
Ischemic Heart Disease	3 (4.5)
End Stage Renal Failure	2 (3.0)
Gout	2 (3.0)
Rheumatoid Arthritis	2 (3.0)
Anemia	1 (1.5)
Chronic Kidney Disease	1 (1.5)
Hyperthyroidism	1 (1.5)

RESULTS

A total of 66 patients, involving 70 admissions were included. The majority of patients were male (n=42, 63.6%), aged above 65 years old (n=40, 60.6%), had smoking histories (n=48, 72.7%) and had hypertension (n=44, 66.7%) and pneumonia (n=38, 57.6%) (Table 1).

Individual costing was tabulated in the Microsoft Excel. The highest cost was laboratory investigations, with median costs of RM154.00, followed by pharmaceutical costs for the treatment of AECOPD (RM127.50), pharmaceutical costs for the treatment of comorbidities (RM72.22) and consumable costs (RM16.80) (Table 2).

Total cost of AECOPD spent over the study period was estimated to be RM29,005.79. Pharmaceutical costs constituted the biggest portion at RM16,224.79 (55.9%), followed by laboratory investigation costs at RM11,412.00 (39.3%) and consumable costs at RM1,369.00 (4.7%) (Table 3).

Respimat Tiotropium had the highest costs at RM5,084.00 (31.3%). Arterial blood gas test had the highest cost in laboratory investigations at RM6,240.00 (54.7%). Meanwhile, aerosol masks costs were the highest among consumables at RM828.00 (60.5%).

Pharmaceuticals costs were further divided into the management of AECOPD RM 9,398.05 (57.9%) and the management of comorbidities RM6,826.74 (42.1%).

Table 2. Median (interquartile range) of costs per AECOPD admission

Costs	Pharmaceuticals		Consumables	Laboratory Investigations
	Treatment of AECOPD	Treatment of Comorbidities		
Median Costs (RM)	127.5	72.2	16.8	154.0
Interquartile range (RM)	109.60-148.33	39.43-141.65	16.80-25.00	109.50-206.00

Table 3. Total costs spent over study period (n=66)

Type of Costs	Total Cost (RM)	Percentage (%)
Pharmaceuticals	16,224.79	5.9
Treatment of AECOPD	9,398.05	32.4
Treatment of Comorbidities	6,826.74	23.5
Consumables	1,369.00	4.7
Laboratory Investigations	11,412.00	39.3
Total	29,005.79	100.0

DISCUSSION

In this study, pharmaceuticals were the major cost driver, amounting up to 56% of the total costs. This trend was similar to a longitudinal study done in Penang Hospital, Malaysia, in which drugs and consumables for the management of AECOPD, constituted up to US$59.88 (45.1%) of the mean cost per patient.[5] Likewise, a study by Iqbal et al. found that drug cost was the major cost driver, followed by unit cost of treatment per bed and laboratory investigation cost.[6] The high costs of pharmaceuticals are explained by the high costs of long-acting anticholinergic drugs which are usually initiated as maintenance therapy in AECOPD.

The presence of comorbidities contributes to an increase in the costs of AECOPD exacerbations. In this study, a significant number of AECOPD patients presented with comorbidities during admission. A total of 38 patients (54.3%) presented with pneumonia. A systematic review showed that the presence of pneumonia contributed to mark-up factors for total direct costs that ranged between 3.39 and 4.72.[7] This finding was also similar to a study by Jansson et al., which stated that comorbidities were the main cost driver of AECOPD in Swedish patients, accounting for up to 46% of the total costs.[8] Cardiovascular diseases and diabetes were also found to be the major cost drivers of AECOPD hospitalisations.[9] Thus, this highlights the importance of the complete and careful management of comorbidities in addition to optimizing AECOPD therapy.

In this study, laboratory investigations also contributed to high costs of RM11,412.00 (39.3%). This trend was similar to an asthma cost evaluation study in a Malaysian suburban hospital in Perak, which found that laboratory tests contributed the highest with a mean cost of RM781.20 (44.0%), followed by ward costs of RM541.60 (30.0%) and treatment costs of RM336.00 (19.0%) in hospitalized subjects.[10] This suggests that diagnostic procedures and investigations are linked to significant cost increases in the management of AECOPD in Malaysian hospitals.

Initiatives to minimize the costs of AECOPD are vital. For instance, appropriate initiation of maintenance therapy has been shown to decrease the incidence of AECOPD, thus possibly reducing overall costs with the management of patients with COPD.[11] A systematic review by Rutten-van Molken stated that the early initiation of long-acting anticholinergics, reduced healthcare costs in most studies.[12] Thus, it is recommended that future studies gather data on early initiation of maintenance therapy and its economic impact.

In addition, pharmacists should enforce POMs extensively for all hospitalized AECOPD patients in order to reduce pharmaceutical costs. In this study, possible cost savings of up to RM5,084.00 could have been experienced, if POMs were used. This includes checking if patients have brought their own inhalers into the ward and encouraging patients to use up existing inhalers before supplying new inhalers. Pharmacists should also ensure patients have good compliance and inhaler technique. Moreover, smoking cessation efforts should be emphasized as 48 (72.7%) patients in this study had smoking histories.

Limitations and Recommendations

There were a few limitations in this study. The costs recorded could be underestimated as consumables such as syringes, needles, and alcohol swabs were not included. Hospitalisation costs such as electricity, x-ray procedures, hospital beds, and personnel were also not included. Indirect costs such as productivity loss, missing hours due to COPD, and activity limitation due to COPD were also not considered. These costs were not included in this study due to resource limitations. Hopefully, more cost analysis studies will be undertaken to measure the economic burden of COPD and improve healthcare resource utilization.

CONCLUSION

COPD exacerbations incur different types of budget burdens. Pharmaceutical costs were the major cost driver, followed by laboratory investigations and consumables. Pharmacists should enforce POMs more extensively to minimize pharmaceutical costs. Lastly, collaboration between prescribers, pharmacists, and hospital policy-makers are vital to reduce healthcare budgetary burden.

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CONFLICT OF INTEREST

The author declares no conflict of interests.

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ETHICAL APPROVAL

This study has acquired ethical approval (NMRR ID-22-00953-EGU) from the Medical Research and Ethics Committee (MREC).

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