

## Cost-Analysis of Heart Failure Cases: A Pilot Single Center Study in Egypt

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### Abstract

**Background:** Cardiovascular disorders accounted for 33% of the total DALYs lost and for nearly half of all Egyptians deaths from NCDs. Egypt is experiencing a rising trend in health care expenditure, in line with the global trend. Comprehensive studies evaluating the prevalence, mortality and total cost of heart failure (HF), are lacking in the Middle East generally and in Egypt particularly. Thus the current pilot study aimed to figure out an estimate of the costs incurred by heart failure patients at the cardiology department of Kasr-Alainy Hospital (KAH). **Objective:** To calculate estimate of both the direct medical and non-medical costs of HF patients. **Methods:** A pilot Economic Cost analysis study was conducted at Kasr Al Aini Hospitals' cardiology department. A convenience sample of 15 HF patients were recruited. Micro-costing approach was used to estimate the average daily hospital cost per HF patient through implementation of the Activity Based Costing (ABC) model. Data was collected, cleaned, and entered to Microsoft Excel program to perform quantitative analysis. **Results:** The mean age of the HF patients in the studied sample was  $53.5 \pm 13.7$ , of which 60% were males and 40% were females. The median (Min-Max) length of stay (LOS) was 13 (Range 2-20) days. The average HF inpatient cost/ day in the cardiology department from January to April 2016 was 55.52 (Range 11.98- 196.90) \$ and average cost per hospital admission was 721.83 (Range 155.74-2559.81) \$ (exchange rate of 2016). **Conclusion & Recommendations:** That kind of research could provide and built up a picture of the constraints and competing priorities in budget setting process and the health sector needs and willing to commit in term of performance and accountability, which will improve planning and reallocation of resources in health care sector.

**Key words:** Heart failure - Cost- analysis - Health economics in Egypt.

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### Introduction

Cardiovascular disease is now recognized as the principal cause of mortality and morbidity, worldwide. In 2008, World Health Organization estimated that 16.7 million deaths were caused by cardiovascular disease worldwide representing 30% of deaths from all causes.<sup>1,2</sup> Both epidemiological and demographic transitions grounded the tremendous increase of the non-communicable diseases burden across the world. According to the Global health estimates 2015, DALYs (Disability Adjusted Life Years) lost due to cardiovascular disease represented 12.2% of the total DALYs lost.<sup>3</sup> Furthermore, the costs of hospitalizations, long-term management and

rehabilitation care of cardiovascular disease, extensively debilitate the health care system' resources. From a societal perspective, healthcare costs attributed to cardiovascular disease constituted about two thirds of the total economic burden, where almost one third of these costs could be related to the productivity loss costs associated with increase work absenteeism of cardiovascular disease patients.<sup>4</sup> In the same context, Egypt experienced huge burden of non-communicable diseases particularly cardiovascular disease. It was estimated that DALYs lost due to non-communicable diseases accounted for 74% of the total DALYs lost. Cardiovascular disorders

accounted for 33% of the total DALYs lost and for nearly half of all Egyptians deaths from non-communicable diseases. Whereas, 14% of deaths were caused by cancer, 4% of deaths from chronic respiratory diseases and only 1% of deaths were caused by diabetes.<sup>5</sup> In 2012, a United Kingdom study covering 98.7% of the world population, (197 countries were included in the systematic review analysis) highlighted that, the overall economic cost of Heart failure was estimated at \$108 billion annually.<sup>6</sup> It was highlighted that Heart failure expenditure varied extensively between high-income, middle and low-income countries. The total Heart failure costs for selected MENA countries were calculated, where expenditures on Heart failure in Egypt, Saudi Arabia, United Arab Emirates and Algeria were estimated at 169 Mil USD, 648 Mil USD 387 Mil USD and 134 Mil USD, respectively.<sup>6</sup> Egypt is experiencing a rising trend in Health care Expenditure, in line with the global trend. Consequently looking to meet rising demand for services (driven by its growing population and increasing prevalence of chronic costly diseases), there is emphasis on application of Health economics science and conducting cost analysis studies to aid rational decision making in the healthcare sector. Total Health Expenditure and Health Expenditure per capita have increased from 23.1 billion LE in 2001/02 to 42.5 billion LE in 2007/08, and 61.4 billion in 2008/09, increasing to more than seven times its initial value,<sup>7</sup> Comprehensive studies evaluating the prevalence, mortality and total cost of Heart Failure, are lacking in the Middle East generally and in Egypt particularly.<sup>8</sup>

Thus the current pilot study aimed to figure out an estimate of the costs incurred by heart failure patients at the cardiology department of Kasr-Alainy Hospital. Aiding policy makers to establish evidence based decisions regarding new methods of service delivery, new technologies and new treatment.

The main aim of this study was to calculate estimate of both the direct medical and non-medical costs of Heart Failure patients' in cardiology ICU of Kasr-Alainy Hospital.

## Methods:

**Study design and site:** A pilot Economic Cost analysis study was conducted at Kasr Al Aini Hospitals' cardiology department, composed of 2 divisions; cardiology unit with 24 beds and cardiology Intensive Care Unit with 12 beds. **Study population and time:** All compensated Heart Failure adult patients admitted to cardiology department within the study time interval (3 months) were enrolled in the study. Inclusion criteria was meeting the case definition of Heart Failure, which is: "A syndrome in which patients have typical symptoms (e.g. breathlessness, ankle swelling and fatigue) and signs (e.g. elevated jugular venous pressure, pulmonary crackles, and displaced apex beat) resulting from an abnormality in cardiac structure or function"<sup>(9)</sup>. Clinical diagnoses were coded using the International Classification of Diseases (ICD-10) coding system. **Sample technique and size:** a convenience sample of 15 Heart Failure patients were recruited to the study. **Data collection:** Micro-costing approach was used to estimate the average daily hospital cost per Heart Failure patient through implementation of the Activity Based Costing model following three standard steps: a) Mapping activities, b) calculating the cost of each activity, c) Calculating the unit cost of each procedure

**a) Mapping activity consisted of systematic analysis of the standard procedures done for each patient.** (1) **Primary activities** are mutually exclusive activities; performed by the cardiology ward to each patient, e.g. registration of patients, examination, treatment and radiological imaging and nursing services. (2) **Secondary (Management) activities** included all other tasks performed by the cardiology ward but unrelated to a given patient (Cleaning services, Managing Department, educating Staff).

**b) Staffing levels and duration of each activity were assessed** by weighting the cumulated duration of each activity with its staffing level, we calculated the total staff cost of each activity.

**c) Average cost per patient was finally** computed by linking each procedure to

primary and secondary activities through actual durations, actual staffing levels and the total number of procedures.<sup>10</sup>

#### **Assessed Cost items:**

##### **1- Health care expenditure:**

**a) Direct medical cost include:** Physicians (Professors, associate Professors, lectures, residents) and nursing staff. Cost of laboratory investigations and radiological imaging (e.g. Complete Blood picture, lipid profile, ECG, Echocardiogram, X- Ray...) in addition to Drugs and consumables.

**b) Direct non-medical costs** (Utility Costs: e.g., food costs, water, electricity and laundry...etc.

**2- Capital cost (Annual costs of resources that have a life expectancy more than one year):** Building maintenance and depreciation, cardiology equipment's maintenance.

#### **Calculation of the different items cost estimate:**

##### **1a) Direct medical cost**

- **Data on direct medical cost items** and frequency of utilization were collected from patients' files, ,
- **Unit cost of each item** (accessed from hospital administration and financial department) was multiplied by consumption rate during their length of stay to get the cost estimate for each item.
- **Direct Labor cost driver** (for Physicians and nursing staff) was used to calculate the estimated cost of medical service provided per patient (*through assessing their monthly salary and the average time allocated per patient during provision of medical service*).

##### **1b) Direct non-medical costs**

Accessed from hospital administration and financial department

- **Utility Costs:** Water, electricity, laundry, sterilization and housekeeping were allocated to cardiology departments according to proportional surface area of the department.
- **Food cost:** was calculated by multiplying the average cost per meal by the consumption rate for each patient

##### **2 Capital cost**

Accessed from hospital administration and financial department

**a. Building maintenance and depreciation** were calculated according to the space area

of the cardiology department as a percentage of the total space area of the hospital.

##### **b. Cardiology Equipment maintenance and depreciation (e.g. ECG apparatus)**

Allocated to each patient according to the weight of equipment maintenance costs, to the total utilization rate.

**Data Analysis:** Data was collected, cleaned, revised, and entered to Micro Soft Excel software program to perform quantitative analysis of the data.

**Ethical consideration:** The protocol of the study was presented to Research Ethical Committee of Kasr-Alainy medical school, which decided waiving of the study of having informed consent, as it is a non-human subject research.

**Limitation of the study:** there was difficulty in getting access to the data, relatively short time for the research project. Out of pocket payment throughout the length of stay weren't estimated as data was assessed from patients' files without interviewing them.

#### **Results:**

The mean age of the Heart Failure patients in the studied sample was  $53.5 \pm 13.7$ , of which 60% were males and 40% were females. About one third had middle level education, two third of them were living in rural residency and nearly half performed non-skilled labor. The majority (66.7%) complained from Coronary heart disease, followed by Atrio-Ventricular Defect and Atrial Fibrillation (33.3%) (Table 1). The median (Min-Max) Length of stay was 13(2-20) days. Median cost of radiological investigation per patient per day was 13.77 (1.13- 112.74), while that for the laboratory investigations was 9.4 (1.02-36.56). The average HF inpatient cost/ day in the cardiology department from January to April 2016 was 55.52 (11.98- 196.90) and average cost per hospital admission was 721.83 (155.74-2559.81) (Table 2). Total overhead, utilities and workers' salaries constituted 57.5% of the health expenditure per Heart Failure patient in the cardiology department (Figure 1). Average cost of the ECG examination stands out as the first cost item contributing to the total cost of the radiological examinations performed for

**Table (1): Socio-demographic characteristics of Heart Failure patients:**

Items	N= 15
<b>Age</b> (Mean $\pm$ SD)	53.5 $\pm$ 13.7
<b>Sex</b>	
Male	9 (60%)
Female	6 (40%)
<b>Education</b>	
Middle education	5(33.3%)
<b>Residence</b>	
Rural	11(73.3%)
Urban	4 (20%)
<b>Occupation</b>	
Non skilled labor	7(46.7%)
<b>Co morbidities</b>	
CHD*	10 (66.7%)
AVD**	5 (33.3%)
CLD***	2 (13.3%)
Depression	2 (13.3%)
Stroke	1 (6.7%)
AF****	5 (33.3%)

\*Coronary heart disease (CHD), \*\*Atrio-Ventricular Defect (AVD), \*\*\*Chronic lung disease (CLD,) \*\*\*\*Atrial Fibrillation (AF),

Heart Failure patients in the Cardiology department (Table 1).

## Discussion

Heart failure is a prevailing disease considered one of the major public health concerns worldwide, and it is progressing.<sup>11,12</sup> In this pilot study, majority of Heart failure patients (66.7%) complained of Coronary heart disease, followed by Atrio-Ventricular Defect and Atrial Fibrillation (33.3%) for each and chronic lung disease 13.3%. Nevertheless in a study conducted at Northwestern US, on 4,696 Heart Failure patients, chronic lung disease co-morbidity was present in 29.2% of patients followed by Atrial Fibrillation in 15.3% of patients. It was highlighted that these co morbidities independently associated with higher cost for Heart failure.<sup>13</sup> In the present pilot study, the average hospital length of stay was estimated to be 13 days and ranging from (2-30) days. This goes in accordance with United Kingdom results where the mean length of stay for cardiac failure hospitalization has been reported as 11.4 days on acute medical wards. In a US study, the average length of stay has been found to be in the range of 8 to

11 days.<sup>14</sup> Moreover, the average cost of admission of a Heart Failure patient was estimated to 721.83 with a range of (155.74-2559.81) USD and the average cost per day per patient was estimated at 55.52 (11.98-196.90) USD. Diagnostic procedures accounted for 40.8 L.E. And 86 L.E. per day in both groups respectively.<sup>9</sup> Drug treatment accounted for 3.5% of the total costs in the management of cardiac failure (5.1 L.E. and 25.2 L.E.) in both groups respectively. Direct non-medical cost was summarized as average utilities, salaries for workers and secretary inside and outside the unit, average capital cost, equipment maintenance and building maintenance all of these were estimated per patient per day was estimated to be 24.21 $\pm$ 9.29 USD. Approximately 76.6% of hospital costs were attributed to overhead, utilities workers' and staff salaries. Radiological and Laboratory investigations accounted for 17% of total costs, this in contrast to 75% in an Irish study.<sup>14</sup> This could be explained by the escalating costs of the cardiology ICU owning expensive equipment e.g. Echocardiogram. An additional clarification of the high percentage of radiological and laboratory investigations costs from the total cost per patient, is that, whether such frequently required investigations, are actually needed or not. Several studies reported that congestive heart failure has been estimated to account for approximately 1% to 2% of the annual total expenditure of the health care system.<sup>15,16</sup> Moreover, it has been estimated that up to 70% of this expenditure is accounted to hospitalization costs.

## Conclusion and Recommendations:

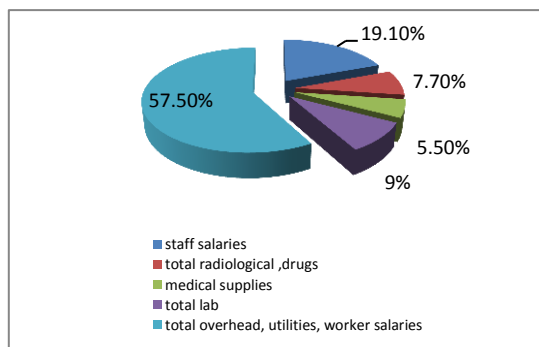
This study calculated an estimate of HF cost of inpatient stay in Kasr-Alainy teaching hospital. The average cost of such admission was 721.83 (155.74-2559.81) \$ and 55.52 (11.98- 196.90) \$ with the average cost per day per patient. That kind of research could provide and built up a picture of the constraints and competing priorities in budget setting process and what the health sector needed and willing to commit in term of performance and accountability, which

will improve planning and reallocation of resources in health care sector.

**Table (2): Description of Direct medical, non-medical, indirect and average inpatient costs among HF patients in Kasr Al-Aini Cardiology department:**

Items	N=15 Median (Min-Max)
LOS	13 (2-30)
<b>Direct medical cost items</b>	<b>Median (Min-Max) USD*</b>
Average medical staff and nursing cost/ patient / day (Mean ± SD)	13.42 ± 2.70
<b>Average radiological investigation cost/ patient/ day</b>	13.77 (1.13- 112.74)
ECG	12.85 (4.28-128.57)
X-ray	5 (5-10)
Echo	7.14(0-7.14)
Ultrasound	4.85 (0-4.85)
Average Lab investigation cost/ patient/ day	9.4 (1.02-36.56)
Average pharmaceutical cost/patient/day	11.27 (0.02-111.38)
Average medical supply cost/ patient/day	2.97 (0.32-10.07)
<b>Direct non-medical costs</b>	<b>Mean (SD) USD*</b>
Average Utilities/ patient/ day	5.89 ± 2.9
Average equipment maintenance/patient/ day	2.54± 0.74
Building maintenance / patient/ dayaverage	0.27± 0.08
Average salaries for workers, secretary inside unit/ patient/ day	1.11 ± 0.04
Average salaries for workers, secretary outside unit/ patient/ day	6.1 ± 2.21
Average Capital costs/ patent/ day	8.30± 3.32
<b>Average HF inpatient cost/ day</b>	55.52 (11.98- 196.90)
<b>Average HF inpatient cost/ hospital admission</b>	721.83(155.74-2559.81)

\*Length of stay (LOS), The used Exchange rate in the results was that of y 2016  
 N.B. current exchange rate 2018 (1 EGP = 0.0558791 USD), exchange rate 2016 (1EGP=0.12736)



**Figure (1): Percentage distribution of different cost items to the total cost per episode of treatment of HF patients in Kasr Al-Ainy Cardiology department.**

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