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Research Article

ENHANCING COST ASSESSMENT IN HEALTHCARE: A CASE-MIX VS TRADITIONAL COSTING APPROACH

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ABSTRACT:

Background: Healthcare systems strive to provide high-quality services while optimizing resource utilization and cost-effectiveness. Achieving these goals necessitates using scientific tools or methodologies to assess costs before implementing cost-reduction measures. Diagnosis related group DRGs) which is also called case-mix is a costing method in health. This study focused on a secondary hospital located in the Jazan region of Saudi Arabia. Our goal was to conduct a patient-level healthcare service cost analysis using the Case-mix system. The purpose of this current study was to identify the cost of DRG for each inpatient and compare it with previous price of services of inpatients**. Materials & Methods:** To achieve this, we conducted a retrospective cross-sectional analysis, classifying healthcare service costs they incurred throughout the year 2018 for inpatients diagnosis and methods. **Results:** Our findings revealed a notable disparity between DRG-based costing, amounting to SAR 138,147,926, and the average costing, which stood at SAR 118,799,359. The DRG-based costing method demonstrated excellent reliability and better representation of patient services. As a result, we recommend its use for reimbursement purposes.

KEY WORDS

Average costing, Case-mix costing, Health services costing, Health economics, Patient-level top-down costing, Secondary Hospital Saudi Arabia

1 | INTRODUCTION

As multifaceted institutions, hospitals offer various services with varying costs and quality levels. They also contain some of the most resource-intensive departments in the healthcare system, requiring careful cost control[1]. Efforts to contain healthcare costs are crucial, yet determining which services to target for cost reduction and identifying departments or units for resource optimization presents challenges[2]. Furthermore, factors such as output, facility

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size, service quality, and operational efficiency significantly impact the cost of hospital services[3]. Assessing the cost of hospital services is essential for productivity, resource allocation, planning, and benchmarking[4].

Seventy percent of hospital facilities are used by medical supplies, in and outpatients[3]. There is dire need of a holistic method to calculate such cost. Practitioners have introduced several costing methods[5]. DRG method was introduced four decades ago. This method categorized patients on basis of sex, sickness, methods used and age[6-8]. This method helps the hospitals to create patients groups and help policy makers to efficiently and effectively handling of resources[9-10]. Hospitals in Saudi Arabia also used case-mix method for estimating cost. Aim of such method is to use the information for informed and quality decision making[11-13]. This is the second study of authors which is identifying cost per DRG for each inpatient admission at secondary hospitals in Saudi Arabia.

2 | MATERIAL AND METHODS

This study has made a comparison between general and secondary hospitals DRGs cost and overall average health cost. There were 8 wards in the Jazan hospital. These wards were having separate sections for male and females. During 2018 there were around 8-9 thousands inpatient admissions. In order to give classification to patients' data hospitals started using ICD-10. In this ICD-10 DRG codes were given to patients' data to estimate cost. Some data had missing values those were excludes.

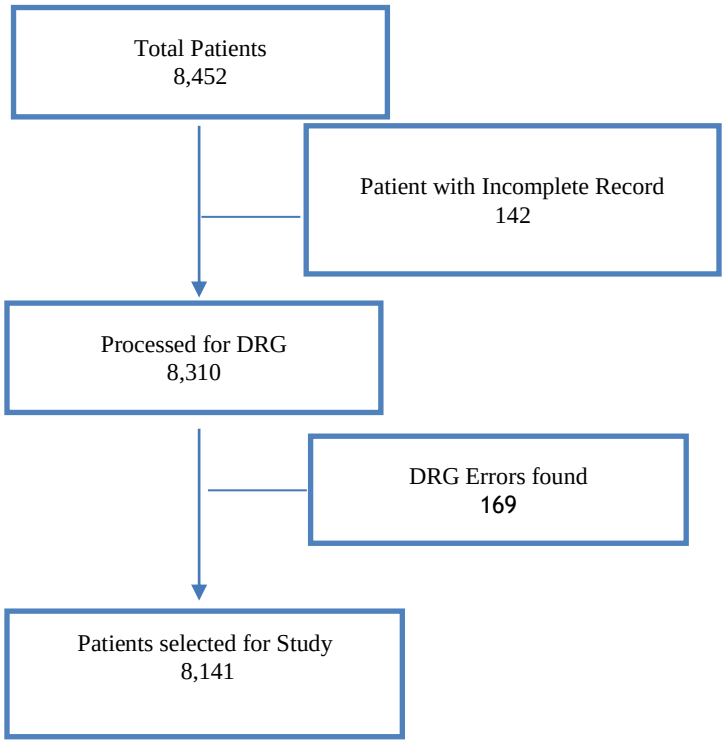

Figure 1: Flow chart for Patient selection

2.1 | CASE-MIX COSTING APPROACH

Our study compared DRG-based healthcare service costs with established average costs for inpatients. We followed a methodology inspired by[9 & 12] to create cost centers. Our study was divided into two parts. Part 1 aimed to classify patients' DRG a, while Part 2 calculate cost of patient level.

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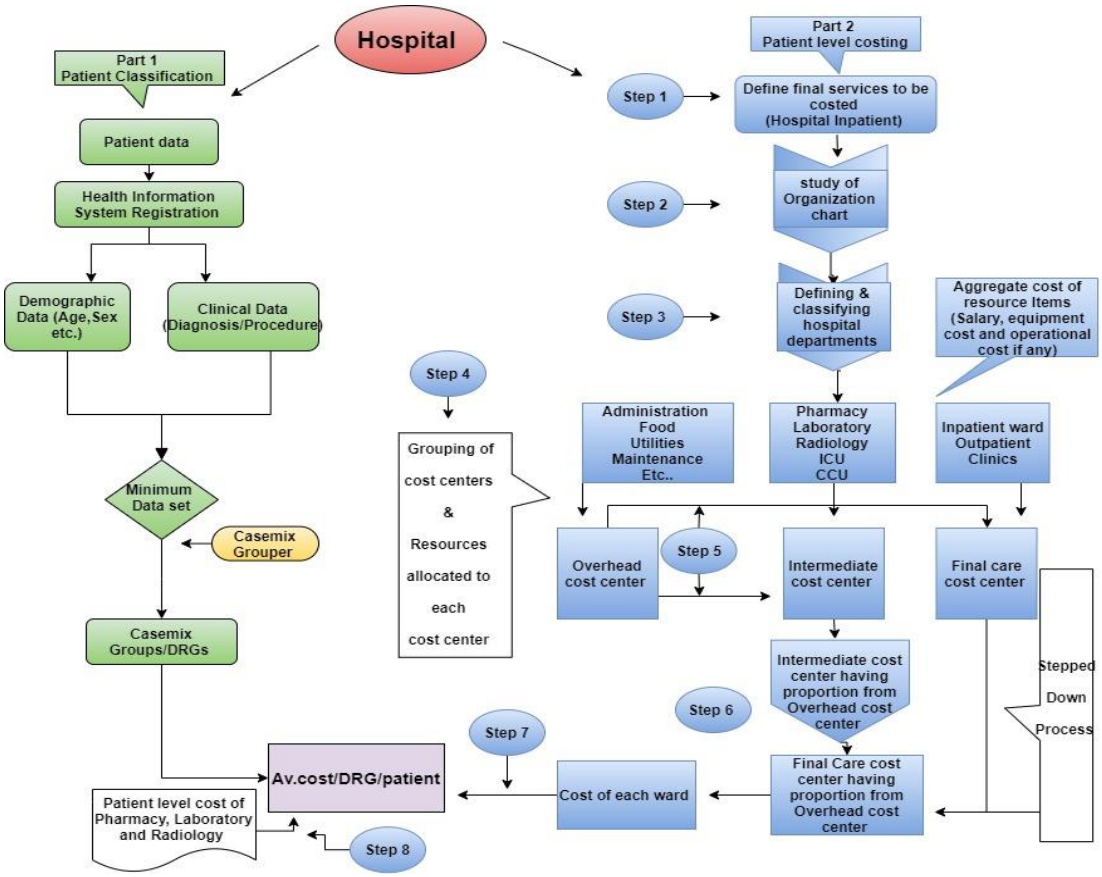

Figure 2: Steps for Case-mix costing (12,13)

3 | RESULTS

The hospital boasted a bed occupancy rate of 82%, surpassing the recommended 70%-80% range. Of the 8,141 patients selected for the study, 2,695 (33.10%) were male, while 5,446 (66.90%) were females. Out of all the patients who were discharged, the majority of them (40.43%) were from the Gynecology Ward, with a total of 3,291 cases. This was followed by patients discharged from the Pediatric Ward with 1,529 cases (18.78%).Refer to Table 1 for detailed ward information.

Table 1 Patients distribution on wards basis at secondary hospital

Wards	Male	Female	Total	%
Gynaecology		3,291	3,291	40.43
Paediatric	850	679	1,529	18.78
Male & Female Medical	700	769	1,469	18.04
Male & Female Surgery	604	518	1,122	13.78
Male & Female Orthopaedic	531	180	711	08.73
Burn unit	10	9	19	00.23

Through use of new method authors gets help to calculate standard cost and inpatient cost. The cost of health service was approximately 138147926 riyals and its average was 118799359.

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Table 2 Inpatient final care cost centre

Final Cost Centre	**Total cost of FCC Cost of case-mix c (SAR)**	**Average (13) (SAR)**
Surgical	51,792,337	46,759,150
Medical	40,044,088	31,944,190
Pediatric	11,393,341	9,342,220
Gynecology	20,879,267	18,411,197
Orthopedic	10,139,236	8,751,229
Burn unit	3,899,657	3,591,373
Total cost (SAR)	**138,147,926**	**118,799,359**

In addition to estimating the total cost of inpatient care, we utilized the case-mix system to determine the cost per patient in each ward. Our analysis included a comparison with the established average patient costs, as detailed in Table 3

Table 3 Comparison of costs

Wards	**Per patient cost**	
	Average t (13) (SAR)	**Case-mix (SAR)**
Surgical	41,675	44,958
Medical	21,746	27,130
Pediatric	6,110	7,229
Gynecology	5,594	6,196
Orthopedic	12,308	14,141
Burn unit	189,020	205,245

Table 4 shows per day cost and comparison of average and case-mix method.

Table 4 Comparison of DRG cost per patient per day with average cost per patient per day

Wards	**Avg. cost per day**	
	Average cost (13) (SAR)	**Case-mix cost (SAR)**
Surgical	5,954	6,332
Medical	3,624	4,260
Pediatric	764	901
Gynecology	1,119	1,336
Orthopedic	947	1,085
Burn unit	11,814	149,987

To provide a comprehensive analysis, we determined the total number of patients in each DRG for every ward and estimated the daily cost of each DRG. The DRG " L-1-50-I" (Breast Operations - Minor) had the highest average daily cost at SAR 101,336. The DRG " M-1-40-I" (Local Excision & Removal of Internal Fixaters-Minor) at SAR 95,516 was the second-highest average cost. A list of the top ten DRGs with the highest costs is presented in Table 5.

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Table 5 Top ten diagnosis-related groups average cost per day

DRG	Description	Average cost per day (SAR)
L-1-50-I	Breast Operations - Minor	101,336
M-1-40-I	Local Excision & Removal of Internal Fixaters-Minor	95,516
U-1-20-I	Other Ear Nose Mouth & Throat Operations - Minor	94,772
L-1-30-I	Skin Graft Excluding Burns - Minor	77,543
U-1-15-I	Tonsil & Adenoid Operations - Minor	73,858
H-1-20-I	Orbital & Extraocular Operation - Minor	73,577
L-1-40-I	Other Skin Subcutaneous Tissue & Breast Operations - Minor	50,860
M-1-80-I	Operations of Upper Limb- Minor	48,682
L-1-20-I	Skin Graft with Burns - Minor	41,675
L-4-14-I	Other Skin & Breast Diseases - Mild	30,376

4 | DISCUSSION

Our average cost estimation yielded lower results in medical supplies due to the unavailability of comprehensive data on total hospital medical supplies. To address this limitation in case-mix costing, we turned to patient-level data from pharmacy, laboratory, and radiology services, which offered a more granular and representative perspective of patient services. Further validation for the importance of medical supplies and pharmacy services as key contributors to healthcare costs was found through comparisons with studies conducted in Pakistan, Vietnam, and the Philippines. This underscores the value of patient-level data in our analysis[13-15]. Our study delved into estimating the average cost of DRGs per day per patient, uncovering intriguing results. The DRG " L-1-50-I " (Breast Operations - Minor) had the highest average daily cost at SAR 101,336. The DRG " M-1-40-I " (Local Excision & Removal of Internal Fixaters-Minor) at SAR 95,516 was the second-highest average cost. Conversely, a comparative cost study in Malaysia, Norway, and Finland reported cardiology cases ranking highest in terms of costs [20, 21, 22,23].

Furthermore, we identified discrepancies in the cost of the same DRG across different wards. Ideally, costs should remain consistent since DRGs represent the resources allocated to patients at a specific time. However, social norms, such as separate male and female wards for the same patient category, can impact resource consumption, resulting in varying costs across different wards. A comparison of the average cost per patient in each ward with the case-mix system's estimates revealed significant cost differences. Notably, the orthopedic ward displayed significant cost disparities. Within the case-mix system, patient classification by Diagnosis-Related Group (DRG) allowed for specific cost attribution based on the disease and procedures performed. This led to lower cost estimates per patient compared to the average cost. Similar variances were observed, in other words, as detailed in Table 3.

The cost of a specific healthcare service can significantly fluctuate depending on the intended costing objective[14]. Our cost allocation approach involved a thorough calculation of the particular services utilized by each patient. The significant number of patient cases and the extensive year-long study period strengthened our confidence in the credibility of cross-sectional clinical and financial contextual variations. Notably, the hospital's bed occupancy rate stood at an impressive 82%, aligning with the recommended range of 70% - 80% as suggested by Rahman[15]. This metric holds significant value in assessing the performance of healthcare facilities[16].

We made remarkable discovery when we compared the total estimated cost of the final care cost center, as calculated by the case-mix system, with the average cost shown in Table 2. The case-mix system yielded slightly higher costs for each ward than the average cost estimation. This disparity underscores the case-mix system's specificity and ability to represent better the services rendered within a defined timeframe. Similar studies in the Philippines, India, Myanmar, and Iran found the case-mix system to be more representative of healthcare services, which aligns with our findings[17-19].

5 | CONCLUSION

Additionally, this study presents opportunities for public hospitals to establish case-based payment systems regionally and nationwide. Our research focused on estimating the cost associated with healthcare services in

secondary care hospitals within Saudi Arabia's Jazan region. We found that the case-mix cost model, which accurately reflects hospital services, holds potential for reimbursement purposes. This cost model can also serve as a valuable reference for future studies, with the potential to enhance research outcomes. This study highlighted the challenges in estimating specific cost resources and components. Variations in unit costs were notably influenced by patient case mix and the types of wards. Furthermore, unit costs were affected by factors such as the medical services required by patients, resource utilization, and the availability of hospital services. Our findings offer essential cost insights for policymakers and can aid in estimating costs for prospective payment systems, aligning with Saudi Vision 2030's goals. In the future, healthcare costs may be impacted by changes like moving away from fee-for-service payments and adopting standardized electronic medical records.

Ethical Approval
No ethical approval was required for this study.

Conflict of Interests
None declared.

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None

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