

ORIGINAL ARTICLE

PROVIDER COSTS OF TREATING DEMENTIA AMONG THE ELDERLY IN GOVERNMENT HOSPITALS OF MALAYSIA

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ABSTRACT

The increased use of health care services by elderly has placed greater pressure to an already strained health care resources. Thus, an accurate economic cost estimation for specific age-related diseases like dementia is essential. The objectives of this project are to estimate costs of treating patient dementia among Malaysian elderly in the hospital settings. Two types of data were collected: Hospital costing data (using costing template) and patient clinical data (using questionnaire). The cost analysis for hospital setting was carried out using a step-down costing methodology. The costing template was used to organize costing data into three levels of cost centers in hospitals: overhead cost centers (e.g. administration, consumables, maintenance), intermediate cost centers (e.g. pharmacy, radiology), and final cost centers (all wards and clinics). In estimating the cost for each cost center, both capital cost (building, equipment and furniture cost) and recurrent cost (staff salary and recurrent cost except salary) were combined. Information on activities which reflects the workload such as discharges, inpatient days, number of visit, floor space etc., are gathered to determine an appropriate allocation factor. In addition, for each final cost center, the fully allocated costs are then divided by the total unit of in-patient days to obtain the cost of providing services on a per-patient per-day of stay basis, referred as unit cost. The unit cost is finally multiplied with the individual patient's length of stay to obtain the cost of care per patient per admission. All these steps were simplified by using the Clinical Cost Modeling Software Version 3.0 (CCM Ver. 3.0). The mean cost of dementia cases per episode of care was RM 12,806 (SD=10,389) with the length of stay of 14.3 (SD=9.9) days per admission. The top three components of cost for the treatment of dementia were the ward services 8,040 (SD=7,512), 62.78% of the total cost, followed by the pharmacy 1,312 (SD=1,098), 10.25% of the total cost and Intensive Care Unit 979 (SD=961), 7.64% of the total cost. A multivariable analysis using multiple linear regressions showed that factors which significantly influence ($p < 0.05$) the treatment costs of dementia cases were the length of stay ($p < 0.001$), followed by age ($p = 0.001$), case type severe ($p = 0.005$) and study location ($p = 0.032$). However, the factor length of stay is the tremendous parameter. In conclusion, data collection from selected hospitals as well as patient level data from medical record unit were successfully used to estimate the provider costs of hospital for the elderly with dementia disease. Results from the project will enable an assessment on the economic impact and consequences of cognitive impairment in an aged population. A cost quantification and distributive mapping of the burden of care can assist in policy implementation through targeted intervention for at-risk groups, which will translate into savings by means of delayed onset or progression of dementia.

Key words: dementia, Provider Cost, CCM, Step-down costing

INTRODUCTION

An accurate economic cost estimation for specific age-related diseases such as dementia is essential given the increased use of health care services by elderly¹. The increasing costs are attributed to the increasing elderly population. Malaysia as a developing country also has shown an increment in the trend of population ageing since the last few decades. For the year 1970, the population aged 60 and above was about 546,000 persons. Since then, the number has doubled within 20 years to 1.03 million persons in 1991. The Census of Malaysia (2000) reported that 6.3 percent or

1.3 million persons were 60 years and above in the year 2000 and projected to reach 9.9 percent or 3.4 million persons in 2020². In addition, based on the UN (2009) projections, the percentage of aged population in Malaysia in 2025 and 2050 will increase to 13.4 percent and 20.8 percent respectively³.

The increasing proportion of elderly in Malaysia shows the prevalence of dementia in the range more than 10%. A recent large community study of the elderly in Malaysia by using the nationwide sample with 2,980 persons aged 60 and above in all states of Malaysia including Kuala Lumpur from

2002 to 2006 was done by Hamid et al.⁴ They found the prevalence of dementia in Malaysia was 14.3 percent and the highest risk factors that influence the prevalence were the oldest age, female, no formal education, ethnic of Bumiputeras, bachelors, unemployed and bad health condition.

Meanwhile Wimo, Winblad and Jonsson (2010) used meta-analysis from previous published prevalence studies in Malaysia estimated total cost of dementia for Malaysia is USD\$672 million for mild dementia (using 1.6 hour/day informal care) and USD\$1,029 million for moderate dementia (using 3.7 hour/day informal care) among 73,423 demented persons in 2009⁵.

This study focuses on the cost analysis of dementia by using the real data from provider perspectives. This study quantifies the costs of treating cases of dementia among older Malaysians in hospital settings. The specific objective of this project is to estimate costs for inpatient care from the perspective of healthcare provider, which is mainly Ministry of Health that owned most of the hospitals in Malaysia.

RESEARCH METHODOLOGY

This study employed a nationwide cross-sectional design. The samples were selected by multi-stage stratified random sampling technique, where seven hospitals were identified from few states which were randomly selected from each region namely Johor (South Region), Kelantan (East Region), Perak and Kedah (North Region), Kuala Lumpur (Central Region) and including Sabah and Sarawak regions.

- The list of selected hospitals comprise: Raja Permaisuri Bainun Hospital, Ipoh, Perak
- Sultan Ismail Hospital, Johor Bharu, Johor
- Raja Perempuan Zainab II Hospital, Kota Bharu, Kelantan
- Kuala Lumpur Hospital, Wilayah Persekutuan
- Sultanah Bahiyah Hospital, Alor Setar, Kedah
- Queen Elizabeth I Hospital, Kota Kinabalu, Sabah
- Sarawak General Hospital, Kuching, Sarawak

Sampling Criteria

The ultimate sampling unit, were subjected to the inclusion criteria employed during data collection from patients' medical record i.e. patients aged 60 and above who were referred to psychiatrists for diagnosis as the elderly with dementia. Failing to fit to the criteria, patients listed in the records were excluded.

Data Collection Tools

Data from hospitals were obtained from the existing data in financial departments and

patient's medical record. The financial data were gathered for year 2008 through 2012 using a specially designed costing template spreadsheet. The costing template consisted of three main parts namely overhead cost centers, intermediate cost centers and final cost centers. The overhead cost centers were classified into several departments such as administration, nursing administration, cleaning services, security, general store and consumable, laundry and linen, maintenance, utilities, information technology unit and other services. The intermediate cost centers consist of pharmacy and drugs, radiology, laboratory, physiotherapy, intensive care unit and operating theaters, endoscopic unit, hemodialysis and forensic. Meanwhile, final care cost centers comprise different wards and clinics where patients received in-patient and out-patient care for instance, psychiatric ward, medical ward, surgical ward, psychiatric clinic, pediatric clinic and orthopedic clinic. All of the participating hospitals provided data for this data collection.

Meanwhile, patients' data were extracted from their medical records within the period of January 2010 through December 2014. A set of questionnaires adapted from National University of Malaysia research team were utilized for this purpose⁶. The questionnaires consist of two main sections namely patients' socio-demographic information and medical background. The most important section is patients' medical backgrounds which consists of several parts likes diagnosis, procedures, lab investigation, radiology investigation, treatment oral and treatment parenteral. For data collection from patients' medical records, all of the selected hospitals gave a good support.

An expert group discussion (EGD) comprising psychiatrists and geriatrists from the selected hospitals, public health medicine specialists from UKM Medical Centre and Ministry of Health Malaysia have been successful in developing the clinical pathway (CP) that is used as a reference in imputing the total cost of managing dementia⁷.

Costing Methodology

The cost analysis for hospital utilised the step-down costing methodology where data from costing template were computed to obtained the unit cost. The first step in step-to obtain the total expenditure of the hospitals. The total expenditure was divided by a measure of total output (e.g. patients visits, days or admissions) to arrive at an average cost per patient, per visit, per day or per admission⁸. The step-down costing method involves analyses of the actual hospital expenditure or operational costs at different levels of cost centres namely the overhead cost centres, the intermediate cost centres and the final cost centres. In the costing process, the hospital expenditure was first tracked from the overhead and intermediate cost centers and then allocated to final cost centres using appropriate allocation factors.

The step-down approach identifies the range of resources needed to run a facility, and then assigns these resources to chosen 'cost centres' on an allocation basis (e.g. floor space, occupied bed days etc). These costs in turn were filtered down until the final cost centres of interest remained. In summary, there are seven stages involved in computing the unit costs as stated in Shepard et al⁹. These steps are as follows:

- i) Define the purpose of the cost analysis;
- ii) Define cost centres;
- iii) Identify the full cost for each input;
- iv) Assign inputs to cost centres;
- v) Allocate all costs to final cost centres;
- vi) Compute total and unit costs for each final cost centre;
- vii) Report results.

All these steps were simplified through the usage of the Clinical Cost Modeling Software Version 3.0 (CCM Ver. 3.0) as it distributed the cost from top level overhead cost centers to intermediate and patient cost centers, with the final cost endpoint being cost per day of stay per patient with dementia. CCM is useful in carrying out cost analysis and able to produce accurate, robust and reliable costing information using routinely collected data in hospitals and other healthcare facilities. CCM is also capable of providing regularly updated costing data for the development of hospital base-rates.

In estimating the provider cost using the CCM software, the cost for each cost center which consisted of both capital cost (building, equipment and furniture cost) and recurrent cost (staff salary and recurrent cost except salary) were combined. Information on activities which reflect workloads such as admissions, in-patient days, number of annual test of laboratory and radiology, number of prescription of pharmacy and number of sessions of physiotherapy for both inpatient and outpatient care were gathered to determine an appropriate allocation factor. In addition, for each final cost center, the sum allocated costs were then divided by the total units of in-patient days to obtain the cost of providing services on a per-patient per-day of stay basis, which is referred to as the unit cost.

Ethical Approval

Ethical approval to conduct research in the hospital settings was obtained from the Ministry of Health Malaysia (MOH). The approval was obtained on 13th December 2013 with the registration number, NMRR-13-1023-14660.

Analysis

The data was analyzed using SPSS Statistics Software version 21. The dependent factors that predicted the (the treatment cost of dementia cases or log cost of dementia) were estimated in a multiple linear regression. Independent factors includes: study site (Kuala Lumpur area and outside Kuala Lumpur), ward type (surgical and medical ward), Gender (married and unmarried), Ethnic (Malay and non Malay), Discharge status (Recover and others), severity of illness (Severe and others or moderate and others) .

RESULTS

A total of 142 cases of dementia among the elderly were obtained from the patient records with male and female equally divided - i.e. there were 71 cases (50.0%) each for male and female. The average patient age was 75 (SD=8.05) years, with a minimum age of 60 years and maximum age of 100 years. A total of 39 cases (27.5%) were those aged 60-69 years, 64 cases (45.1%) aged 70-79 years, 33 cases (23.2%) aged 80-89 years, 5 cases (3.5%) aged 90-99 years and 1 case (0.7%) aged more than 100 years. A total of 65 cases (45.8%) were Chinese, 56 cases (39.4%) were Malays, 19 cases (13.4%) were Indians, and 2 cases (1.4%) were of other ethnics. A total of 125 cases (88.0%) were currently married, 2 cases (1.4%) were singles, 8 cases (5.6%) were divorced, and 7 cases (4.9%) were widowed. A total of 108 cases (76.1%) were discharged home (with follow ups), 16 cases (11.3%) were discharged home (without follow ups), 10 cases (7.0%) transferred to other hospitals and 8 cases (5.6%) died.

Treatment Costs of Dementia

Table 1 shows that the mean cost of mild dementia cases per episode of care was RM 8,182 (SD=4,811) with the length of stay of 10.8 (SD=6.7) days. The mean cost of moderate dementia cases per episode of care was RM 10,300 (SD=7,190) with the length of stay of 12.2 (SD=8.7) days. The mean cost of severe dementia cases per episode of care was RM14,034 (SD=11,419) with the length of stay of 15.5 (SD=14.5) days. The overall mean cost of dementia cases per episode of care was RM10,034 (SD=RM 7,604) with the length of stay of 12.2 (SD=9.4) days. The minimum cost of dementia cases per episode of care was RM1,880 with minimum length of stay 2 days and the maximum cost of dementia cases was RM51,805 with a maximum length of stay 67 days.

Are the treatment costs and length of stay data normally distributed? Is mean the best central tendency measurement in these data?

Table 1: Types of Dementia Severity

Types of dementia	N	Mean LOS (SD) (days)	Mean Cost (SD) (RM)
Mild dementia	69	10.8 ± 6.7	8,182 ± 4,811
Moderate dementia	44	12.2 ± 8.7	10,300 ± 7,190
Severe dementia	29	15.5 ± 14.5	14,036 ± 11,419
Total	142	12.2 ± 9.4	10,034 ± 7,604

Table 2 shows that the top three components of cost for the treatment of dementia were ward services RM5,694 (SD=RM 4,722) which comprise 56.74% of the total costs, followed by the

pharmacy RM1,185 (SD= RM 1,090), representing 11.81% of the total costs and Intensive Care Unit RM859 (SD=RM 767) which consist of 8.56% of the total costs of dementia

Table 2: Mean of Cost Component and Its Contribution to Overall Dementia Treatment Costs

Types of Cost Component	Mean Cost (SD)(RM)	Percentage
Ward Service	5,694 (SD=4,722)	56.74%
Pharmacy	1,185 (SD=1,090)	11.81%
ICU	859 (SD=767)	8.56%
Administration	523 (SD=484)	5.21%
Laboratory	507 (SD=386)	5.05%
Food	316 (SD=294)	3.15%
Laundry	266 (SD=233)	2.65%
Others	222 (SD=140)	2.21%
Maintenance	185 (SD=173)	1.84%
Radiology	129 (SD=118)	1.29%
Physiotherapy	80 (SD=69)	0.79%
Utility	69 (SD=68)	0.69%
TOTAL COST	10,034 (SD=7,604)	100%

SD = Standard Deviation

Factors Influencing the Treatment Costs of Dementia Cases

A multiple regression analysis was conducted to identify factors which significantly influence the treatment cost of dementia. The results of multivariate analysis (refer to table 3), it was found that these factors were significant (p <0.05)

influence and can be used to predict the estimated cost of patient treatment. They were the length of stay in hospital (p<0.001), study location (outside Kuala Lumpur, p = 0.032), age of patient (p=0.001) and case type severe (p = 0.005).

Table 3. Factors Influencing the Treatment Cost of dementia Cases Using Multivariate Analysis

Factors (Predictors)	Beta	S.E* (Beta)	P- value	Partial correlations coefficients
Length of Stay	0.024	0.002	<0.001	1.575
Study Location (Outside KL)	0.073	0.034	0.032	1.115
Age	-0.006	0.002	0.001	1.495
Case Type (Severe)	0.043	0.015	0.005	1.056

Constant = 3.988 and Adjusted R² = 0.790, Significant value: <0.05, *S.E = 'Standard Error'

The dependent variable data (total cost) distribution by severity level was roughly

symmetric. Log transformations have been done to make sure that the relationship between

dependent variable and independent variables is approximately linear and more symmetric.

Based on the results of the tests' general linear model multivariate analysis can be made of the model to predict the cost of treatment of dementia cases. Model for predicting the treatment cost of dementia cases:

Log cost = Basic cost (constant) 3.988 + 0.024 (LOS) + 0.073 (study location; outside Kuala Lumpur) - 0.006 (Age) + 0.043 (Case Type; severe)
Out of the above models, it is clear that the strongest factor was the length of stay, because "partial correlations coefficients" was very high (1.575) as compared to that of other factors.

Limitations

There are several issues and limitations found during the implementation of the study. Firstly, the costs were calculated based on ideal resources spent as stated in the expenditure book of hospital as well as the ideal staff strength and the full quota of equipment. However, this might underestimate the actual resources utilized for treating dementia. Secondly, the analysis cost was conducted based on average cost per patient. The length of stay was used as the cost drivers for dementia costing. However, the methodology adopted in this study is acceptable and comparable internationally.

DISCUSSION

Treatment Cost for Dementia Cases

The biggest component of costs was ward services which comprise 56.74% of the total costs, followed by the pharmacy representing 11.81% and Intensive Care Unit which consist of 8.56% of the total costs of dementia. The reason of highest costs of ward services because, include salary of doctors and nurses (39.14% of total cost ward). This is consistent with Suehs et al, and Hill et al stated that dementia is federated with increased health care resource utilization and the cost of treatment of various diseases among patient with dementia is greater that patient without dementia.^{10,11} Dementia patients were usually hospitalized for various of diseases and it is often not considered the primary reason for admission due to the limitations of the coding system and insufficient diagnose, especially for the mild case or patient is seen in nonspecialized units.^{12,13} Previous study shown only 5.6% of cases dementia was the reason for admission and more than 80% are on medical reasons¹³. They also found the dementia patients had hip surgery more frequently than patients without dementia. Meanwhile the dementia patients also have a greater prevalence of diabetes and atrial fibrillation that known as risk factor for vascular and Alzheimer's dementia. Their hospitalizations were usually lengthened by the age and the severity of the diseases. Dementia patients were older and had a longer hospital stay compared to

non-dementia patients will increased the treatment costs¹³.

Factors Influencing the Dementia Treatment Cost

Many factors affect the cost of patient care. Between the cost of this treatment is influenced by the same factors, but mostly influenced by different factors. The proof can be seen in the results of this study. For patients with dementia, it was found that the length of stay in hospital ($p < 0.001$), study location (outside Kuala Lumpur, $p = 0.032$), age of patient ($p = 0.001$) and case type (severe, $p = 0.005$) significantly affect costs patient treatment.

The length of stay in hospital is the most significant factor affecting the cost of treatment as there is in the model. Therefore, serious step from the hospital management or the government is encouraged to reduce the length of stay in hospital by involving various hospital staff involved, especially the doctors who are directly in charge of taking care and clinical decision making in the ward, without compromising on service quality.

It was different with age factor, an increase in age of patient will decrease the treatment cost. However, If the patient admitted in hospital outside Kuala Lumpur and has case type severe, the treatment cost will increase accordingly. In table 3, adjusted $R^2 = 0.790$. It means the model can explain 79% for predicting the treatment cost. The use model for the three severity level of Dementia as a result of this study can give a clear picture of the cost of treatment prediction. Overall, the results of this study can provide useful guidance to the hospital or on the hospital budget plan.

CONCLUSION

The mean cost of treating hospitalization for dementia per episode of care is RM10,034. Longer hospital stay results in higher hospitalization cost. Results from the project will allow policy makers to assess the economic consequences of cognitive impairment in the old age in Malaysia.

Author Contributions

AMN, SA & RK conceived and designed the investigation. AMN, AK & NI analyzed the data. Others and All authors read, reviewed and approved the final manuscript.

Conflicts of Interest

We declare we have no conflict of interest.

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