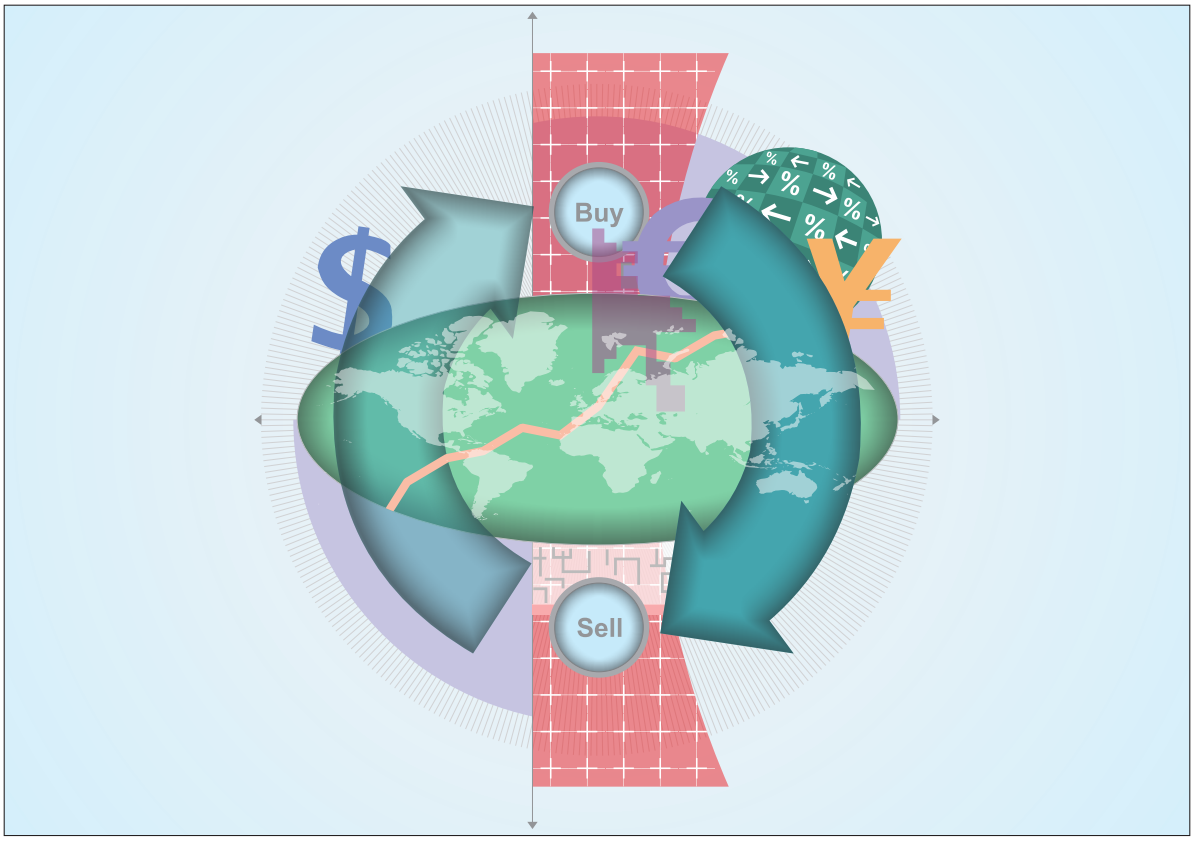

The International Journal of Applied Economics & Finance

ISSN 1991-0886

science alert

ANSInet
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OPEN ACCESS The International Journal of Applied Economics and Finance

ISSN 1991-0886
DOI: 10.3923/ijaef.2021.1.10

Research Article
Economic Cost of Dengue: A Selective Case in Bangladesh

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Abstract

Background and Objective: Dengue is a mosquito-borne viral infection that causes a severe illness called Dengue fever. Bangladesh is one of the countries that are affected by the Dengue virus. Dengue fever first appeared in the year 2000 but till now no research has been done to calculate the economic burden of Dengue in Bangladesh. The objective of this study was to estimate the components of health cost and to identify economic burden through computing the total expenditure. **Materials and Methods:** Both primary and secondary data were used to calculate the health cost of Dengue. Sample data were collected by doing the survey and taking interviews with the patients. Both tabular and statistical methods were used to determine the direct and indirect cost of the patients. **Results:** By calculating the aggregate economic costs through direct and indirect cost the variability of Dengue cases and the cost across the year was addressed. The cost for private health care facilities is higher compared to public health care facilities as in private hospitals 92% of expenditure goes for medical treatment purposes. The aggregate economic expenditure is around US$ 15.27 million. Aggregate expenditure would increase if the outpatient's cost and averting expenditure are acknowledged. **Conclusion:** In Dhaka, the aggregate economic expenditure for treating Dengue is significantly high. Dengue is a disease that can easily be avoided by taking precautionary steps and thus there will be no need to bear the huge amount of cost burden.

Key words: Dengue, mitigating expenditure, averting expenditure, direct cost, indirect cost, productivity loss, caregiver cost, the economic burden

Citation: Islam, S. and I. Huq, 2021. Economic cost of Dengue: a selective case in Bangladesh. Int. J. Applied Econ. Finance, 15: 1-10.

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Competing Interest: The author has declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Dengue is a mosquito-borne viral infection that causes a severe illness called Dengue fever. The virus mainly acquires by the female Aedes mosquito while feeding on the blood of an infected person and it passed to humans through the infective bites of these mosquitoes[1]. The disease is endemic in the South Asian countries, where heavy rains during the monsoon season have created the perfect breeding ground for the mosquito-borne virus. Bangladesh is one of the countries that are affected by the Dengue virus. Dengue fever first appeared in the year 2000 but till now no research has been done to calculate the economic burden of Dengue in Bangladesh. The objective is to estimate the components of health cost and to identify economic burden through computing the total expenditure.

According to IEDCR[2], Dengue fever first appeared in Bangladesh in 2000, when 93 people died because of this disease shown in Table 1.1 in the appendix. Since 2003, the death rate has gradually declined with zero fatalities in some years but at the end of 2019 it reached approximately 129. Illnesses attributable to Dengue disease have been increased rapidly in the last few years. In appendix Table 1.2 shows that from 2008-2017, the highest number of Dengue patients has got in 2016 and then 2019 came along. In 2019, the outbreak of Dengue was unprecedented. This disease was spread to all 64 districts of Bangladesh especially in the eastern and southern parts of Bangladesh and it was declared as an epidemic as a large number of people becoming infected with the same disease at the same time. Hospitals were packed with patients and there was an alarming number of deaths and infections. According to the Ministry of Health in Bangladesh[3], from January-December there were approximately 10,0201 patients admitted to hospitals and clinics who were suffering from Dengue fever. Hospitals needed to open new sections just to tackle the new Dengue patients as it was creating a huge pressure in both public and private hospitals. In Dhaka city, 51,179 were admitted in both types of hospitals, among them, 31,245 were admitted in public hospitals and 19,934 in private hospitals.

DGHS[4] records show more than 51% of cases in the country were concentrated in the capital city. Dhaka has thousands of building sites, which could easily turn into pools of stagnant water during monsoon season, becoming a perfect breeding ground for mosquitoes. Mosquito-borne diseases are very common in Bangladesh but it gets the least attention. It creates a huge pressure on the hospitals that the care workers need to study more than their working hours.

These Dengue cases generate costs for the individual as well as for the economy by raising health expenditures and also create a loss of productivity due to premature deaths and loss of healthy days. Costs for Dengue treatment are experienced by the government and also by the patients and their families. Costs of patients not only incurred by the direct costs that the patients spent to get the treatment but also by the indirect costs which consist of productivity loss of the patients and caregiver's costs. This huge number of affected people and their average costs in both public and private hospitals create an economic burden on the economy.

By calculating the aggregate economic costs through identifying the direct costs from medical and non-medical expenditure and indirect costs from productivity loss and caregivers cost, the variability of Dengue cases and the total economic burden across the year can be addressed.

The aim of this study was to analyze the total economic cost of Dengue in Bangladesh in terms of health costs. The objective was to explore the socioeconomic conditions of the Dengue affected people, to estimate both direct and indirect components of health costs, to identify economic burden through computing the total expenditure and to make conclusions based on the findings of the study.

MATERIALS AND METHODS

Study area: The study was carried out at Dhaka from July, 2019-January, 2020.

Data collection: In this study, both the primary and secondary data were used to calculate the health costs of Dengue.

The secondary data were collected from multiple sources, Dengue daily health status is obtained from the Directorate General of Health Services (DGHS). Information was also gathered from the Institute of Epidemiology and Disease Control and Research (IEDCR) and the Ministry of Health and Family Welfare. The number of deaths was collected from the Ministry of Health. The primary data was collected through interviewing Dengue patients admitted in both public and private hospitals by using a set of comprehensive questions. To estimate the cost of illness we surveyed 390 individual patients from Dhaka and Chattogram in 2019. These two cities were chosen because most of the Dengue patients were admitted in these two cities of Bangladesh (IEDCR, 2019)[2]. From the total sample, 338 of them were hospitalized and others were outpatients who were not required to admit to the hospitals for Dengue. Outpatient data were collected through a survey of 52 random individuals who were suffering from Dengue by using questionnaires.

The hospitals which have most of the Dengue patients are listed in the Ministry of Health database. The hospitals that were selected for this study were chosen from that list. The sample data was collected from 15 different hospitals where most of the patients were admitted. The names of the public hospitals that were selected for this study are Dhaka Medical College and Hospital, Suhrawardy Medical College and Hospital, Kurmitola General Hospital, Chittagong Medical College and Hospital. Private hospitals are Green Life Medical College and Hospital, Comfort Diagnostic Centre Pvt. Ltd, Central Hospital Ltd, IBN Sina Hospital, Bangladesh Medical College and Hospital, Holy Family Red Crescent Medical College Hospital, Uttara Adhnik Medical College and Hospital, Square Hospitals Ltd, Al-Manar Hospital Ltd, Islami Bank Hospital and Anwar Khan Modern Medical College Hospital.

The information on inpatients was collected for this study includes three general classes of information:

- Household-level information to determine the general characteristics of the household in terms of income and wealth
- Health, demographic and socio-economic characteristics of individuals
- Workdays lost, income loss, sick days and averting and mitigating activities both at the individual level. Averting activities here refer to the actions taken by individuals to avoid being affected by Dengue. Mitigating activities refer to the doctor and hospital visits

Statistical analysis: Both tabular form and statistical methods were used in this study. To determine the direct cost, indirect cost and the total expenditure of the economy, multiple steps have been followed including addition, multiplication and average calculation. The amount of expenditure has been shown by the currency symbol of Bangladesh Taka, BDT (৳).

The total cost of inpatient care includes:

$$\text{Total cost} = \text{Direct Cost} + \text{Indirect Cost}$$

$$\text{Direct cost} = \text{Medical Cost} + \text{Non-Medical Cost} + \text{Informal Cost}$$

where, Medical cost includes (bed cost, doctor visits, diagnosis cost, medicine cost), Non-Medical Cost (food and water cost, transportation cost) and Informal Cost is a cost that sometimes the patients had to spend money to get the basic services or facilities from the non-accountable hospital, for example: bed, stretcher and tips.

$$\text{Indirect cost} = \text{Income loss} + \text{Caregivers cost}$$

where, income loss is calculated by multiplying the average daily income of the patient with the number of days per hospitalization and caregiver cost includes transportation cost, cost of food and cost of the residence.

The aggregate economic expenditure/burden is calculated by multiplying the total number of patients admitted in the public and private hospitals with the average total cost.

RESULTS AND DISCUSSION

Description of the data: The data collected from the survey provides the information that meets the research objectives. A summary of statistics at the individual level is provided. According to Fig. 1 the average age of the individuals in the sample is 30 years and 61% of them are male patients and the rest are female. Figure 2 shows that 8% of them had no schooling whereas 58% of them were completed up to SSC level and the rest were completed HSC level or more than that. According to Fig. 3 from the sample data, it is found that 12% of the Dengue patients had already suffered from

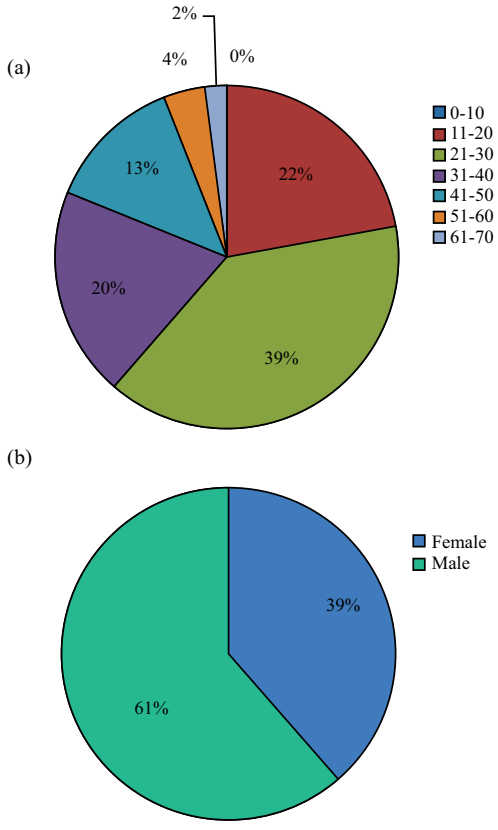

Fig. 1(a-b): Age group and Gender of Dengue cases
Source: Survey data, (a) Age and (b) Gender

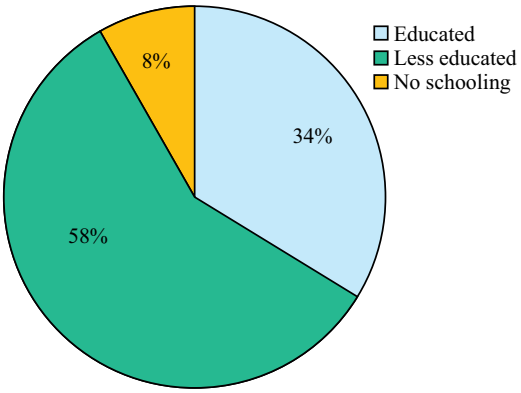

Fig. 2: Educational background of Dengue cases

Less-educated refers to those who have completed up to the SSC level, Educated refers to those who have completed HSC or more than that, Source: Survey Data

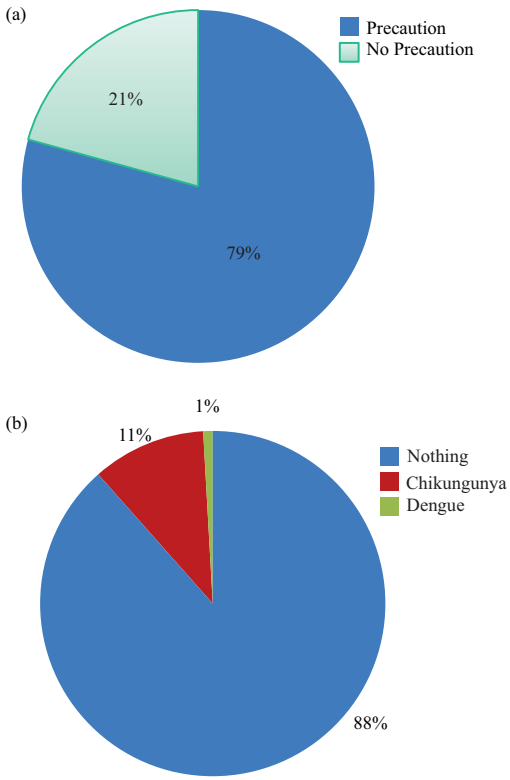

Fig. 3(a-b): Percentage of patients took precautionary steps and previously affected in mosquito-borne diseases

(a) Precaution and (b) Precaution mosquito disease, Source: Survey data

mosquito-related diseases like Dengue and Chikungunya before, although 79% of them took the precautionary steps.

Figure 4 describes their income levels are different in two types of hospitals. In the case of public hospitals, 23% of the

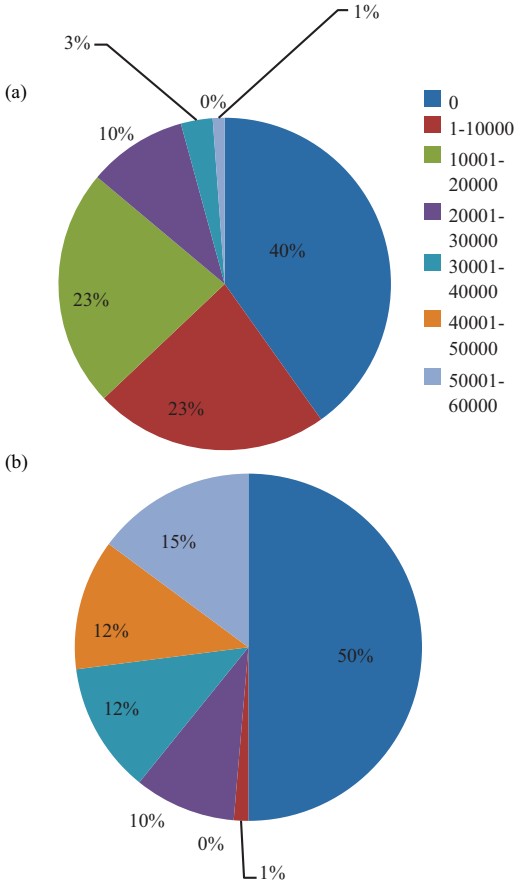

Fig. 4(a-b): Monthly income variation in public and private hospitals

(a) Public and (b) Private, Source: Survey data

patients had income up to BDT. 10,000 per month and in private hospitals this percentage is very less compared to the public which is only 1%. On the other hand, in private hospitals, 49% of patients had income more than BDT. 10,000-50,000 or more but in public hospitals, only 37% of patients had this level of income.

Outpatients costs of private health expenditures: Outpatients are those who did not need to get admitted to the hospital to get the treatment for Dengue. Table 1 shows the average expenditure for outpatient services e.g., doctor's fee, diagnosis, medication, transportation, caregiving, food and also the number of day's patients need to forgo for the disease.

Here, the average expenditure of Dengue outpatients is around 8,000 taka and on average, the patients need to forgo 7 days to get completely cured of the disease. In Fig. 5 shows the breakdown of the average cost per patient which indicates 42% of the expenditure goes for

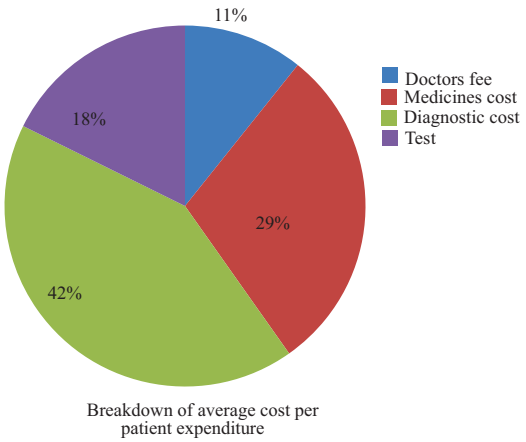

Fig. 5: Percentage distribution of total private expenditure for outpatient care
Source: Survey data

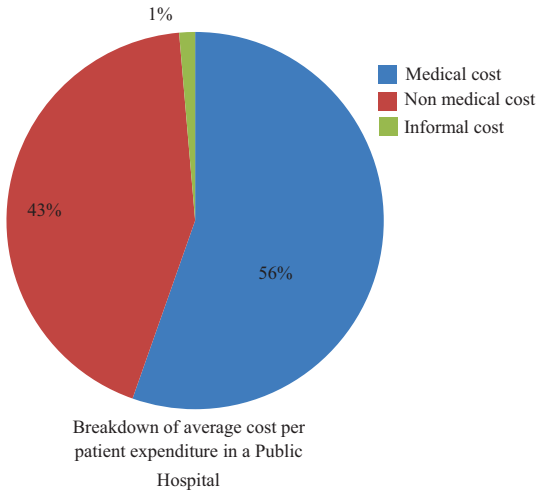

Fig. 6: Percentage distribution of average out-of-pocket expenditure per patient for inpatient care in public hospital
Source: Survey data

Diagnostic services, 29% goes for medical services and the rest goes for Doctor's fees and other costs.

Inpatients costs of health expenditures: Inpatients are those who need to get admitted to hospitals to get treatment for Dengue. When hospitalization occurred, it creates a direct and indirect cost for the patient. Direct and indirect costs are different in public and private hospitals.

Direct costs of public and private health expenditures: Direct Costs are costs that are directly being caused by patient

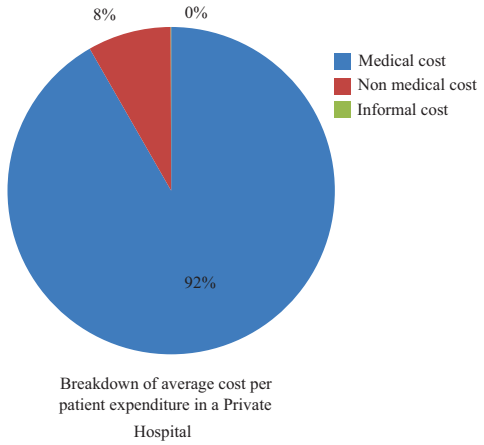

Fig. 7: Percentage distribution of average out-of-pocket expenditure per patient for inpatient care in private hospital
Source: Survey data

care such as nursing services, drugs, medical supplies, diagnostic imaging, bed cost and food services, etc. The direct cost of public health expenditure is the direct cost that the patients need to spend on public hospitals to get the treatment.

Dhaka Medical College was densely occupied by Dengue patients among all of these hospitals. From Dhaka and outside Dhaka all kinds of patients go there to get treatments. This is a public hospital and the cost of treatment is lower here compared to the private hospitals. However, the services were not up to the mark. Patients could hardly get a bed in the ward of Dengue, they had to lie down on the floor of the ward or in the corridor, even in the corner of the stairs. The direct medical costs are lower in public hospitals but unfortunately, the patients need to bear informal costs to get the basic services from the hospital or the health care providers. For example, if a patient came into the emergency through a stretcher then once the patient was transferred into the ward, he/she had to give some money to the service provider for having the service. Through bribing the ward boy/nurses, patients could get a bed in the ward in some scenarios. Here, Table 2 will give the idea of inpatient's direct cost in public hospitals.

As shown in the table, per day a patient needs to spend more than 1,500 takas in medical and non-medical services. On average, the patient has to stay 7 days in the hospital and that leads the patient to spend around 12,000 takas. In Fig. 6 shows the breakdown of the average cost per patient where 56% of the expenditure goes for direct medical services, 43% goes for non-medical services and the rest goes for informal cost.

Table 1: Outpatients average cost and total expenditure

(z) The average expenditure for outpatient services (e.g., doctor's fee, diagnosis, medication, transportation, caregiving, food)	৳ 7,722
Number of days the patients need to forgo for the disease	৳ 7 days
Total private expenditure for outpatient care (z)*number of sample (52)	৳ 4,01,544

Table 2: Inpatients direct costs in public hospitals and average out-of-pocket expenditure

(c) Average out-of-pocket expenditure per day for inpatient care in a public hospital	৳ 1,666
(d) The average number of days per hospitalization	৳ 7 days
(y) Average out-of-pocket expenditure per patient for inpatient care in public hospital (c)*(d) = (y)	৳ 11,663

Table 3: Inpatients direct costs in private hospitals and average out-of-pocket expenditure

(a) Average out-of-pocket expenditure per day for inpatient care in a private hospital	৳ 5,525
(b) The average number of days per hospitalization	৳ 5 days
(x) Average out-of-pocket expenditure per patient for inpatient care in private hospital (a)*(b) = (x)	৳ 27,623

Table 4: Productivity loss of Dengue patients in public hospitals

(e) Average daily earning per patient in public hospitals	৳ 485
(f) The average number of days per hospitalization	৳ 7 days
(p) Total productivity loss of patients for seeking health care services in public hospitals (e)*(f) = (p)	৳ 3,395

Table 5: Productivity loss of Dengue patients in private hospitals

(g) Average daily earning per person in private hospitals	৳ 1,345
(h) The average number of days per hospitalization	৳ 5 days
(q) Total productivity loss of patients for seeking health care services in private hospitals (g)*(h) = (q)	৳ 6,728

Table 6: Caregivers cost of Dengue patients in public and private hospital

(m) The average expenditure for each patient's Caregivers in public hospitals	৳ 3,289
(n) The average expenditure for each patient's Caregivers in a private hospital	৳ 2,111

On the other hand, Table 3 indicates that private hospitals more or less were the same in the category compared to public hospitals with some exceptions like the cost for each service given to the patients were officially charged. Thus, more the patients spent the more the service they received.

In private hospitals, per day a patient needs to spend more than 5,000 takas in medical and non-medical services which is much higher compared to the public hospitals. On average the patient has to stay 5 days at the hospital and that leads the patient to spend around 28,000 takas on an average. As private hospitals do not receive funding from the government patients need to spend more on these hospitals to get the basic services. In Fig. 7 shows the breakdown of the average cost per patient where 92% of the expenditure goes for medical service and the rest goes for non-medical services.

Indirect costs of public and private health expenditures: Indirect costs are that which are not directly accountable for the treatments of patients such as productivity or income loss and caregiver's costs.

Income loss of Dengue patients: Each patient has to face some income loss due to hospitalization for the disease. This income loss varies across patients and there are also variations in income losses between public and private hospitals. Differences in the socio-demographic background of the public and private hospitals patients are responsible for this variation.

Table 4 shows the productivity losses incurred by patients in public hospitals through calculating their income losses and the number of days per hospitalization.

In public hospitals, the total productivity loss per patient is close to 3,500 takas on average as their daily income is close to 500 takas and on average, they had to stay in the hospital for 7 consecutive days.

Table 5 shows the average daily earning per person hospitalized in private hospitals and their total productivity loss due to hospitalization. Their daily earning is much higher compared to public hospital's patients.

In private hospitals, the daily income is more than 1,000 takas of a patient, which is higher compared to public hospital patients. So, their total productivity loss for staying on an average of 5 days in the hospital is around 7,000 takas.

Caregiver's costs of Dengue patients: Caregivers are those who stay with the patient during the treatment period and thus they also incure costs due to their productivity loss. Table 6 shows that the cost of caregivers also varies in public and private hospitals.

Table 7: Total cost of Dengue patients in public hospital

(p) Average Productivity loss	৳ 3,395
(m) Average Caregivers Cost	৳ 3,289
(I) Average Indirect Cost (p)+(m) = (I)	৳ 6,684
(y) Average Direct Cost	৳ 11,663
(T) Average Total Cost (I)+(y) = (T)	৳ 18,347

Table 8: Total cost of Dengue patients in private hospital

(q) Average Productivity loss	৳ 6,728
(n) Average Caregivers Cost	৳ 2,111
(I') Average Indirect Cost (q)+(n) = (I')	৳ 8,839
(x) Average Direct Cost	৳ 27,623
(T') Average Total Cost (I')+(x) = (T')	৳ 36,462

Table 9: Total expenditure in public hospitals of Dhaka city

(T) Average total cost in a public hospital	৳ 18,347
(H) Number of people hospitalized in public hospitals	৳ 31,245
(R) Public Expenditure (T)*(H) = (R)	৳ 57,32,52,015

Table 10: Total expenditure in private hospital of Dhaka City

(T') Average total cost in a private hospital	৳ 36,462
(H') Number of people hospitalized in private hospitals	৳ 19,934
(S) Private Expenditure (T')*(H') = (S)	৳ 72,68,33,508

Table 11: Aggregate total economic expenditure in Dhaka city

(R) Public expenditure	৳ 57,32,52,015
(S) Private expenditure	৳ 72,68,33,508
(ATE) Aggregate Total Expenditure (R)+(S) = (ATE)	৳ 130,00,85,523

Caregivers had to spend higher than the private hospitals, the reason behind this is most of the patients in the public hospital came from outside Dhaka and so that their caregivers needed to stay in the hospital throughout the treatment. Therefore, their costs of food, costs of residence are higher than the private hospital patient's caregivers because most of the private hospital patients commute and bring food from their homes.

Total cost of Dengue patients: The total cost is calculated by adding the direct and indirect cost of inpatient care. So the average total cost of inpatient care includes:

$$\text{Average total cost} = \text{Average Direct Cost} + \text{Average Indirect Cost}$$

where, Average Indirect Cost = Average productivity loss+ Average caregivers cost.

Table 7 and 8 shows the average total cost of Dengue patients in public and private hospitals.

Here, the result in the table shows the value of the average total cost in public hospitals. This total cost is more than 18,000 takas which include the direct and indirect cost of a Dengue patient.

Table 8 contains the value of the average total cost of Dengue patients in private hospitals. This cost is more than 36,000 taka including both the components of the total cost.

It can be observed from the table that the total cost of Dengue patients in public and private hospitals are not identical. The components of total cost have different values for public and private hospitals and this is the reason for the variation in average total cost in public and private hospitals.

Aggregate economic expenditure in Dhaka city: From the earlier calculations, the study specifies that the average total public health expenditure for a Dengue patient is around taka eighteen thousand. The average total private health expenditure for a Dengue patient is around 36,000 taka. The numbers of patients admitted in public hospitals from January-December were 31,245 and in private hospitals were 19,934 within Dhaka city (Table 9, 10).

By multiplying the average total cost with the number of patients admitted in public hospitals the total public expenditure has been calculated. In Dhaka city, the total expenditure of Dengue patients is more than 57 crore taka in public hospitals which is around $6.7 million.

However, the total expenditure of Dengue patients in private hospitals is more than 72 crore takas which is around $8.5 million. Although the number of people admitted in private hospitals is lower than public hospitals but the total expenditure of Dengue patients in private hospitals is higher compared to public hospitals. The higher average total cost in a private hospital is responsible for this higher private expenditure.

Through adding both the public and private expenditure, the aggregate total economic expenditure has been found. Table 11 is presenting the aggregate expenditure that the economy had to bear because of Dengue.

From the earlier calculations, the total public expenditure and private expenditure has been specified. Here, from the table, it is observed that the aggregate total economic expenditure is more than 130 crores in Dhaka city which is around $15.28 million. This huge amount of expenditure has been done by Dengue patients from both public and private hospitals.

In different countries, many researches have been conducted and from those studies, we can see that many countries have calculated their economic burden by using similar or different methods. In different circumstances but similar study has been done by Wettstein *et al.*[5], they researched the burden of Dengue in Nicaragua. They have used the primary data from the Ministry of Health in Nicaragua to calculate the total cost and burden of Dengue. The total cost included both direct cost from medical expenditures and prevention activities and indirect costs from loss of productivity. The total cost was estimated to be US$13.5 million/year.

Edilo *et al.*[6] researched different economic cost and the burden of Dengue in the Philippines. They have estimated that the country's annual number of Dengue episodes and their economic cost. They estimated an annual average of 842,867 clinically diagnosed Dengue cases with direct medical costs of $345 million that means $3.26 per capita. Here inpatient hospitals served 65% of cases which represents 90% of direct cost and ambulatory settings treated the rest of the cases so 10% of direct cost.

On the other hand, Halasa *et al.*[7] conducted a research partially similar to this study in Puerto Rico. They have collected the data through surveillance and interviews in 2010 to assess direct and indirect costs of hospitalization and ambulatory Dengue illness. Starting from 2002 until 2010 the aggregate annual cost of Dengue illness is $38.7 million on average. Among this cost 70% was for adults whose age is more than 15 years, hospitalized patients accounted for 63% of the cost and fatal cases represented an additional 17%. By including Dengue surveillance and vector control activities the overall annual cost of Dengue was $46.45 million which means $12.47 per capita. However, Beauté J and Vong S[8] estimated that the average cost per Dengue case varies between US 36-75$ in 2006-2008 which results an overall annual cost from US 3,327,284-14,42,951$ in 2007. Patients share the costs by paying 78% of total costs and 63% of direct medical costs on an average.

Undurraga *et al.*[9] estimated that annual economic and disease burden of Dengue in Mexico for 2010-2011. Although they are different from this study as they incorporated multiple data sources, including a prospective cohort study, patient interviews and macro-costing from major hospitals, surveillance, budget and health data from the Ministry of Health. Their result suggests that Mexico had about 139,000 Dengue episodes and 119 fatal Dengue cases annually on average in 2010-2011. The annual cost was US$170 million or $1.56 per capita including surveillance and vector control. However, Pankaj *et al.*[10] have researched in the neighboring country India to estimate the economic burden using different methods. A quantitative analysis was performed using a regression model to estimate the costs to the health system in India. The average cost of treatment per hospitalized Dengue patient was US$432.2 and the average total economic burden was US$27.4 million. In the private health sector the cost for Dengue illness was estimated to be almost four times compared to the public sector expenditures. After that in 2014, Shepard *et al.*[11] have done a research where they found out that in between 2006-2012 an annual average of 20,474 Dengue cases were reported in India. Unofficially on average it is 5,778,406 clinically diagnosed Dengue cases between 2006 and 2012 or 282 times compared with the reported number per year. The total direct annual medical cost was US$548 million.

Differently in Colombia Carlos *et al.*[12] estimated the burden of Dengue and severe Dengue for 2011-2014. They used the Colombian surveillance data to estimate the annual number of Dengue and severe Dengue cases for both who are receiving medical care and who do not. Their model estimated that there would be 56,998 Dengue cases requiring medical attention among them 22,799 ambulatory and 34,199 were hospitalized, 1851 cases of severe Dengue and 205 deaths. The economic analysis showed that per year Colombia spends between US $52.2 and US $61.0 million for Dengue control activities and case management on average. In this study, it is found that in Dhaka city the aggregate expenditure from Dengue in US$15.28 million which includes both direct and indirect cost, except the ambulatory cost and prevention activities done by the patient. However, the cost is only for Dhaka city in Bangladesh, so compared with all those studies conducted in different countries this cost is very alarming.

By incorporating this economic cost the aggregate cost burden for the entire country can be calculated. According to this study, it shows that less educated people are more affected by this disease so the expenditure on public and private health services can easily be avoided by creating awareness among the people. It can easily be kept away by

taking precautionary steps and thus there will be no need to bear the huge amount of cost burden. This entire burden can easily be avoided by acknowledging appropriate measures at an early period. Therefore, this total expenditure can be used in some other productive economic sectors.

The main objective of our study was to estimate the economic burden of Dengue in Bangladesh but this study has some limitations. This study was conducted using samples from Dhaka only. Moreover, the total cost of additional precautionary measures such as buying mosquito repellent products was not measured in this study.

CONCLUSION

The study has provided some key sets of results in terms of costs caused by Dengue fever. Aggregate economic expenditure in Dhaka city is very alarming and the total private hospital expenditure is very much higher compared to the total public hospital expenditure. Aggregate expenditure may increase if the outpatients' cost and averting expenditure is acknowledged. The study examined that, not only the mitigating and averting expenditure but also there are some indirect costs that the patients had to bear to get rid of the disease. Therefore, patients had some productivity loss due to this disease. In addition to these caregivers also had some productivity loss for being with the patient. But all of these costs can be kept away if the disease is acknowledged at an early age.

SIGNIFICANCE STATEMENT

The study estimates health cost expenditures occurred by Dengue which is used to calculate the economic burden for the entire economy. The incidence of Dengue is persistent in Bangladesh, however, the economic burden of such preventable disease has not been calculated. The extent of the burden calculated in this study can help policymakers to realize the importance of the issue and address it accordingly.

ACKNOWLEDGMENT

I would like to express my deepest appreciation to the authorities of every hospital that I visited to collect the sample data, for their unwavering support. Also, I am extremely grateful to the patients and their caregivers for their cooperation during the entire data collection process.

Appendix

Table 1.1: Year-wise Dengue deaths in Bangladesh from 2000-2019

Year	Number of death	Year	Number of death
2000	93	2010	0
2001	44	2011	6
2002	58	2012	1
2003	10	2013	2
2004	13	2014	0
2005	2	2015	6
2006	11	2016	14
2007	0	2017	8
2008	0	2018	26
2009	0	2019	129

Source: IEDCR

Table 1.2: Year and month wise Dengue reporting from 2008-2019

Months	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
January	0	0	0	0	0	6	15	0	13	92	26	38
February	0	0	0	0	0	7	7	0	3	58	7	18
March	0	0	0	0	0	3	2	2	17	36	19	17
April	0	0	0	0	0	3	0	6	38	73	29	58
May	0	1	0	0	0	12	8	10	70	134	52	193
June	0	0	0	61	10	50	9	28	254	267	295	1884
July	160	4	61	255	129	172	82	171	926	286	946	16253
August	473	125	183	691	122	339	80	765	1451	346	1796	52636
September	334	188	120	193	246	385	76	965	1544	430	3087	17758
October	184	154	45	114	107	501	63	869	1077	512	2406	8143
November	0	0	0	36	27	218	22	271	522	409	1192	4011
December	0	0	0	9	0	53	11	75	145	126	293	-
Total	1151	472	409	1359	641	1749	375	3162	6060	2769	10148	-

Source: IEDCR

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