

# THE ECONOMIC BURDEN OF PNEUMONIA, DIARRHEA AND MEASLES IN BANGLADESH

ECONOMIC EVALUATION RESULTS TO INFORM  
POLICY RECOMMENDATIONS AND RESEARCH

## SUMMARY

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This cost-of-illness study generated estimates of the cost of pneumonia, diarrhea and measles in Bangladesh from the perspectives of the government, households, and society. It was designed as an incidence-based study using an ingredient-based approach and capturing a full episode of acute infection. Cases were recruited from public and private healthcare facilities in Rajshahi and Sylhet divisions, effectively representing a high and a low performing division in terms of vaccine coverage and healthcare provision<sup>1</sup>. Cost and utilization data were collected from August 2017 to March 2018, based on in-person interviews and administrative data.

Engaging public agents, facility managers and healthcare professionals provided invaluable insights on how the data should be accessed at the facilities and how the cost estimates should be framed. They recommended to report time loss due to care without any valuation.

The average societal cost per episode of pneumonia, diarrhea and measles was \$109, \$71 and \$154 respectively, representing about 4-9% of the GDP per capita.

## OBJECTIVES

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1. Estimate the cost of treatment and productivity losses for pneumonia, diarrhea and measles by socio-economic status and location of care to understand their economic impact.
2. Examine the distribution of the burden by household socio-economic status, immunization status, gender and residence.

# METHODS

## Study population and sites

Four districts – 2 rural districts and 2 city corporations – from 2 divisions of Bangladesh were represented: Rajshahi city corporation and Natore district (Rajshahi division) and Sylhet city corporation and Maulvibazar district (Sylhet division). Healthcare facilities were selected based on the number of disease cases reported for 2016-17. We selected 48 healthcare facilities. Based on the recommendations of the healthcare facilities' staff, we selected a total of 20 pharmacies from the area surrounding the facilities. Pharmacies were all privately owned and registered. Interviews were conducted with administrators and managers of the healthcare facilities and the district health offices to obtain cost data, and medical staff, laboratory technicians, statisticians and storekeepers for data on utilization from the healthcare perspective. Administrative data and reports were used to support the recorded estimates.

Adult caregivers of children under 5 years old with a diagnostic of pneumonia, diarrhea or measles were included. Disease case definition was based on clinical assessment: for inpatient cases, the diagnosis at discharge was considered, with or without confirmation with laboratory tests, while for outpatient cases, the first diagnosis was considered. We excluded cases with comorbidities. Caregivers were interviewed at the time of discharge from the facility and 7 to 14 days later over the phone, effectively capturing all costs incurred at the facility where the interview took place, in previous facilities, and after discharge.

## Data collection

Five surveys were developed and implemented:

- A one-time facility survey recording laboratory equipment, clinical equipment, annual overhead, medical staff wages and benefits, drug and medical supply pricing.
- A monthly facility survey recording monthly utilization of the facility, monthly overhead, and medication and supply stock levels.
- A patient caregiver exit survey done at facility discharge recording out-of-pocket payments relative to the current facility visit and to facilities visited beforehand, medications prescribed, supplies used, laboratory tests performed, household wage-earners and income, and other socio-economic status information.
- A patient caregiver follow-up survey done over the phone recording out-of-pocket payments incurred after the exit survey.
- A one-time pharmacy and drug shop survey recording drug pricing in the private sector and pharmacy utilization.

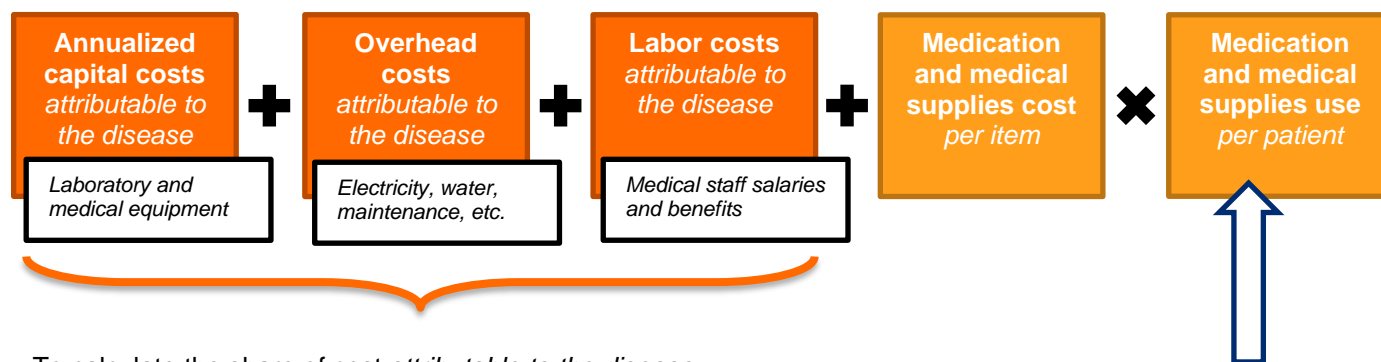


## Costing approach for government costs

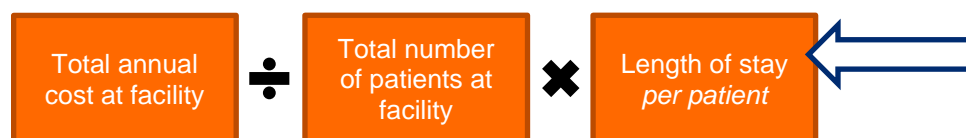
The government cost of illness refers to the healthcare costs subsidized by the Government of Bangladesh and not paid by the caregivers. They included the capital cost of the building infrastructure, and of the medical and laboratory instruments (microscopes, X-Ray machine) used to treat pneumonia, diarrhea and measles, the overhead costs necessary for the daily operation of the facility (e.g., electricity, water, cleaning and maintenance, vehicle used for supply procurement), the labor costs encompassing the salaries and benefits (in monetary terms) of the medical staff, and the supplies and medications used for diagnostic tests, hospitalization and treatment<sup>2,3</sup>.

The total annual capital, overhead and labor costs for the pediatric ward were divided by the annual number of patients recorded to the facility to produce an average cost per patient. This average cost was multiplied to the length of stay of each patient to generate an average cost per case of disease (for outpatient cases, the length of stay was set at 1 day). Medication and medical supplies costs were taken from the pharmacy surveys and their use was obtained from the reported use per patient, recorded through the patient caregiver surveys.

### Equation 1: Composition of the government cost per episode of illness



To calculate the share of cost *attributable to the disease*:



As reported by the caregivers in our sample for the facility. Length of stay for outpatient cases here was 1 day.

## Caregivers and household costs

**Caregivers** provided information on:

- Out-of-pocket payments (medical and non-medical)
- Demographic information (residence, household size, distance from facility)
- Income of all wage-earners in the household
- Activities foregone due to care for this episode
- Monthly household expenditures (food, clothing, rent...)
- Dwelling and assets characteristics

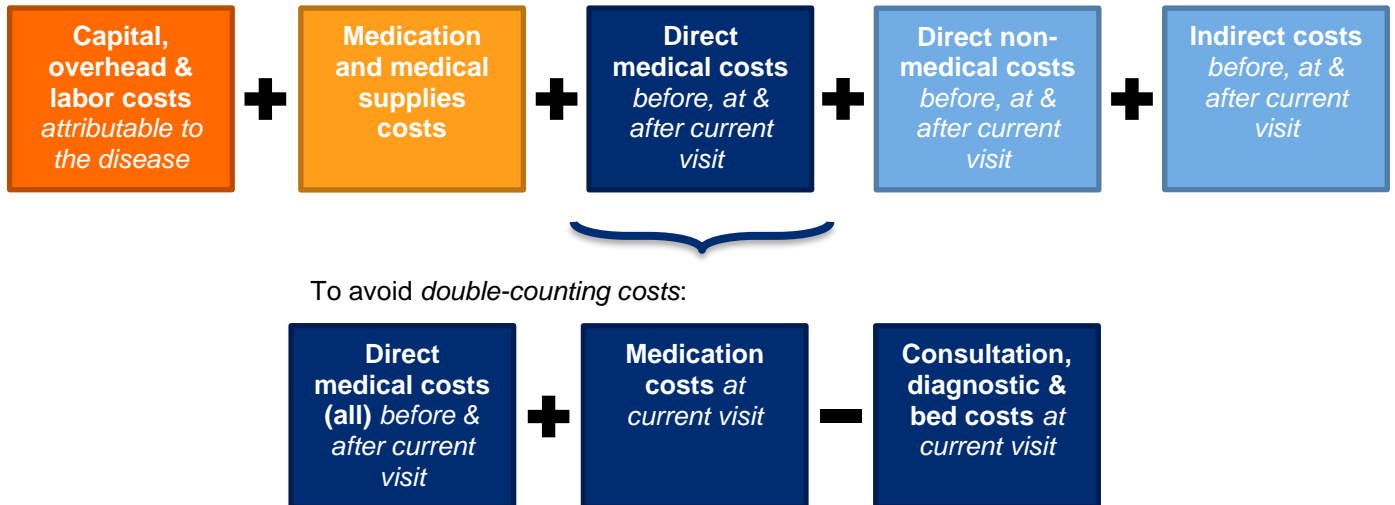
Caregivers were asked about their out-of-pocket payments made during the episode of illness, prompting them about direct medical costs including registration fees, medications, medical procedures, hospitalization, and non-medical costs such as transportation to and from the facilities and meals<sup>2,4</sup>. Out-of-pocket payments made for direct medical and non-medical costs produced the **financial cost of illness**. Caregivers were also asked about the time spent providing care for the child at the facility and at home. Combined with the reported average income of the head of the household, the time spent on care for up to 2 caregivers generated an estimate of the productivity loss (indirect cost) due to care. Adding the latter to the financial cost of illness generated the **economic cost of illness**.

Costs were associated with the current facility visit and with the visits done before and after the current facility. Additional information about the household: their daily expenditures, their assets, and the characteristics of their dwelling (e.g., material used for the roof, ceiling and wall, water source, electricity source) were collected via survey to assess their socio-economic status<sup>5</sup>.

## Societal costs

Societal cost refers to the total cost, healthcare provider and caregiver, spent on the episode of illness<sup>4</sup>. For an episode treated in a public healthcare facility, it meant adding the government cost to the caregiver cost, minus fees and costs that the caregiver incurred at the public facility (to avoid double-counting costs)<sup>2</sup>. The societal cost of episodes treated in private facilities is equal to the caregiver cost, assuming private healthcare facilities transfer the totality of their cost to the user.

### Equation 2: Composition of the societal cost per episode of illness



# RESULTS

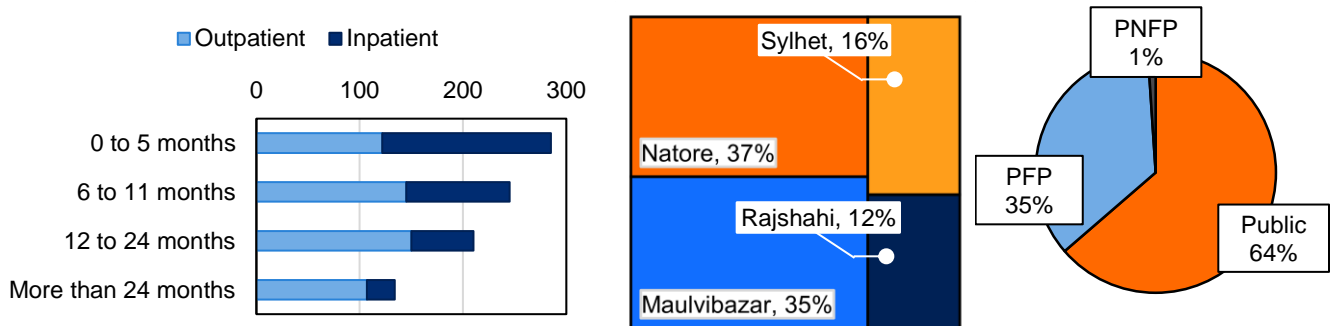
Results are presented as government or caregiver cost of illness. The government cost of illness refers to the healthcare costs subsidized by the Government of Bangladesh and not paid by the caregivers. Societal cost refers to the total cost, government and caregiver, spent on the episode of illness<sup>4</sup>.

All costs were reported in 2018 US dollars. In 2018, USD 1 = BDT 83.5<sup>6</sup>.

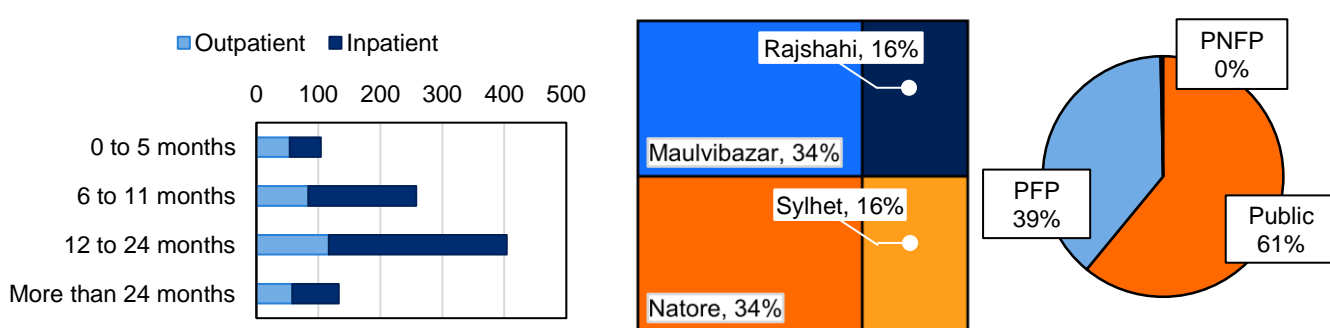
A total of 1,858 children were selected: 864 cases of pneumonia, 899 cases of diarrhea and 95 cases of measles. Cases of measles were concentrated in Sylhet city corporation.

**Figure 1: Child age group, district and healthcare facility management**

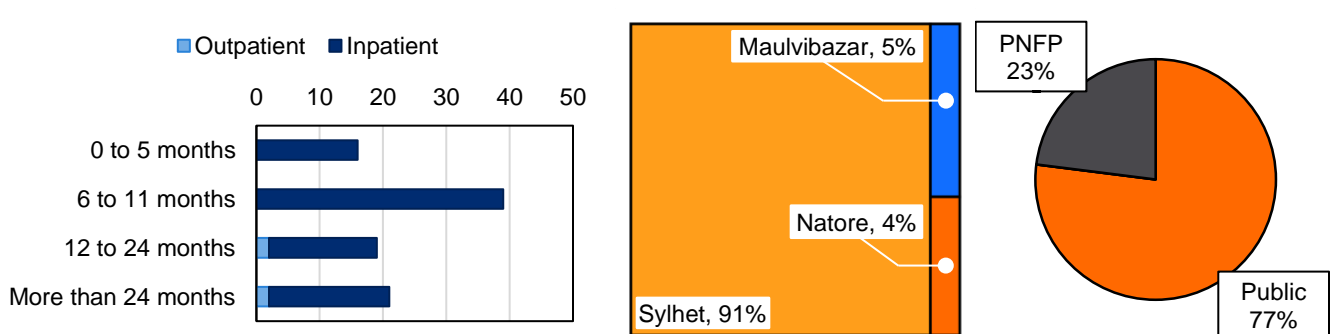
## Pneumonia



## Diarrhea

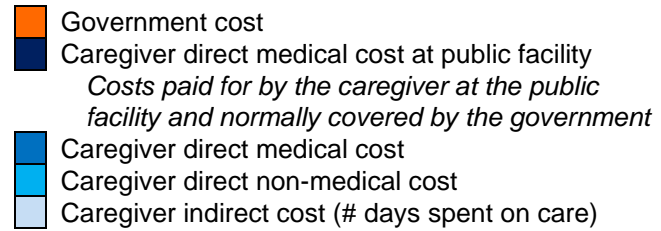


## Measles

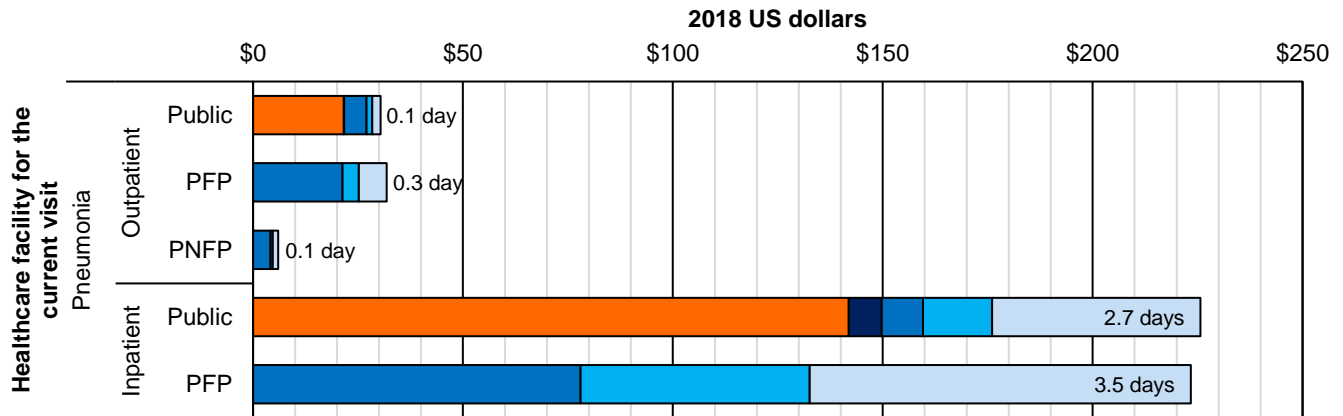


## Pneumonia

When weighted to represent the sample utilization rates of each facility, **the average societal cost per episode of pneumonia was \$109**, about **7% of the annual GDP per capita**. Hospitalized episodes accounted for an average of \$225 per episode, while episodes only requiring ambulatory care had an average of \$30.



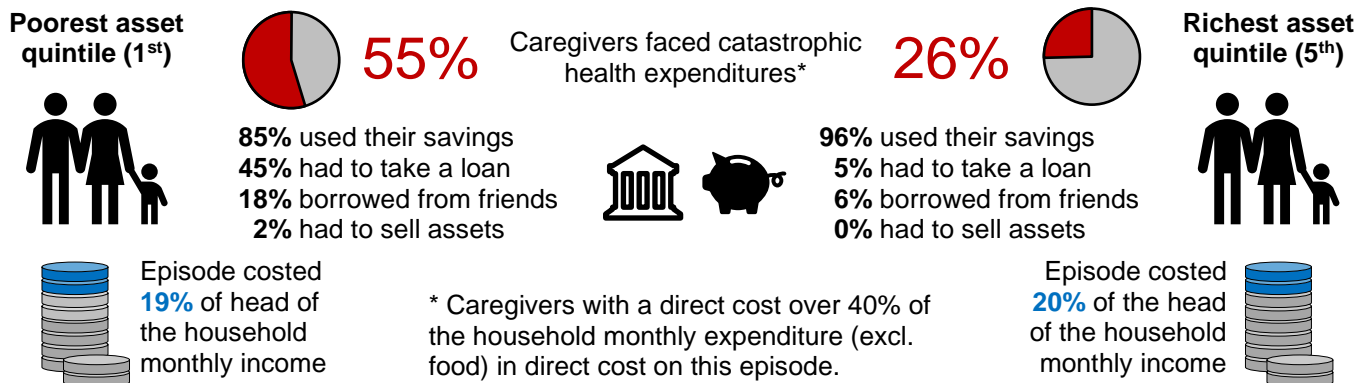
**Figure 2: Societal cost per episode of pneumonia**



Government costs were on average \$22 for an outpatient case and \$142 for an inpatient case treated in public facilities. Medication use was the main driver of the government costs ranging between 84% and 86% in primary and secondary level facilities, decreasing to 48% in tertiary level facilities. Shortages of medications and supplies transferred some portion of the government costs to the caregiver: on average <\$1 for outpatient and \$8 for inpatient.

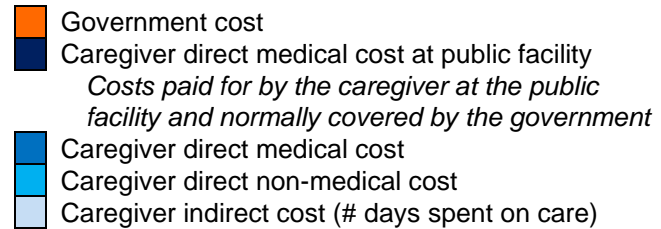
On average, **caregivers faced an economic cost of \$71**, including \$41 in out-of-pocket payments. Caregivers using public healthcare facilities faced the lowest cost for care.

**Figure 3: Social divide facing the economic burden of pneumonia**

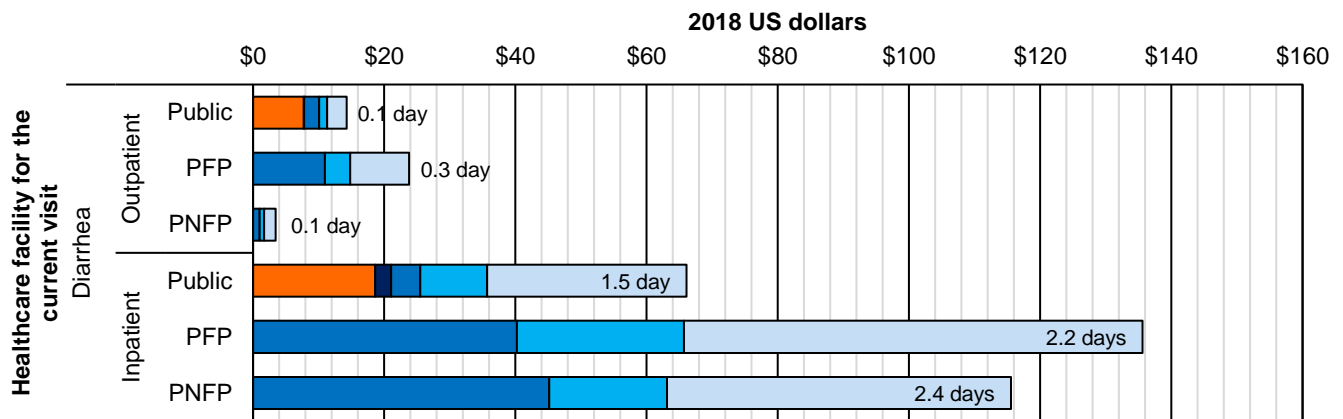


## Diarrhea

When weighted to represent the sample utilization rates of each facility, **the average societal cost per episode of diarrhea was \$71**, about **4% of the annual GDP per capita**. Hospitalized episodes accounted for an average of \$100 per episode, while episodes only requiring ambulatory care had an average of \$16.



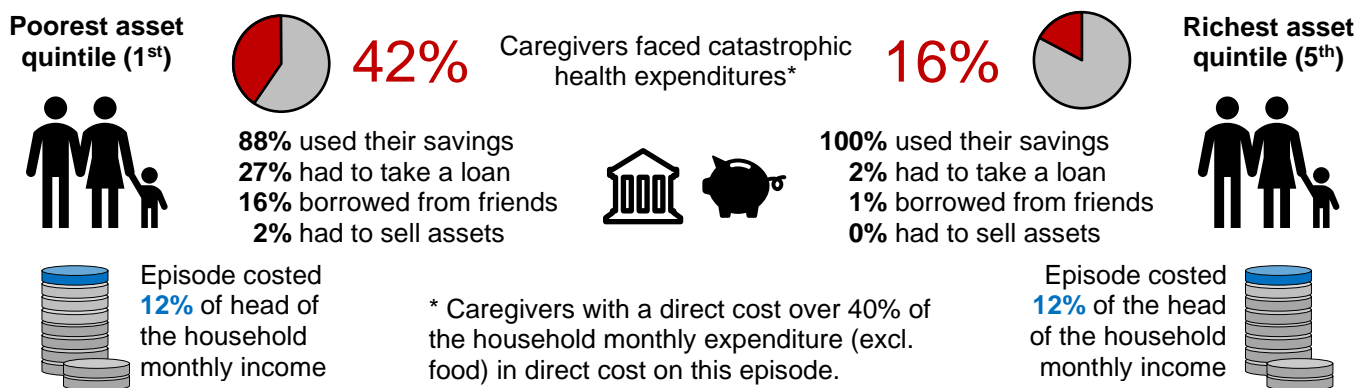
**Figure 4: Societal cost per episode of diarrhea**



Government costs averaged \$8 for an outpatient case and \$19 for an inpatient case treated in public facilities. Medication use was the main driver of the government costs ranging between 14% and 83% of the total cost for an outpatient case and 23% to 25% for an inpatient case. Caregivers faced some costs at government facilities: about <\$1 for outpatient care and \$2 for inpatient care.

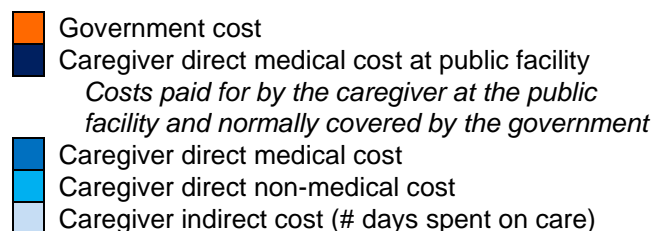
On average, **caregivers faced an economic cost of \$62**, including \$29 in out-of-pocket payments. Caregivers using public healthcare facilities faced the lowest costs for care.

**Figure 5: Social divide facing the economic burden of diarrhea**

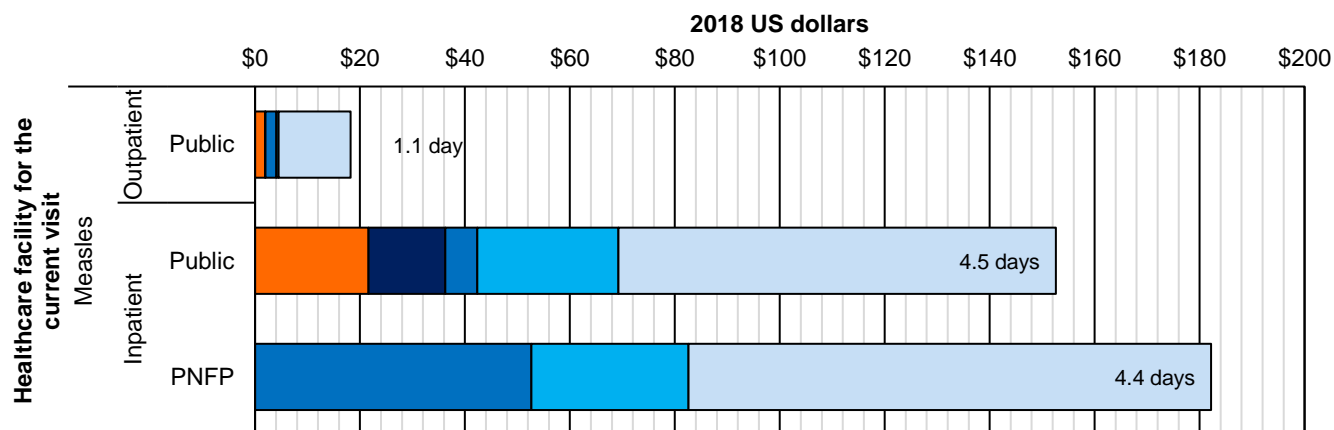


## Measles

When weighted to represent the sample utilization rates of each facility, **the average societal cost per episode of measles was \$154**, about **9% of the annual GDP per capita**. Hospitalized episodes accounted for an average of \$160 per episode, while episodes only requiring ambulatory care had an average of \$18.



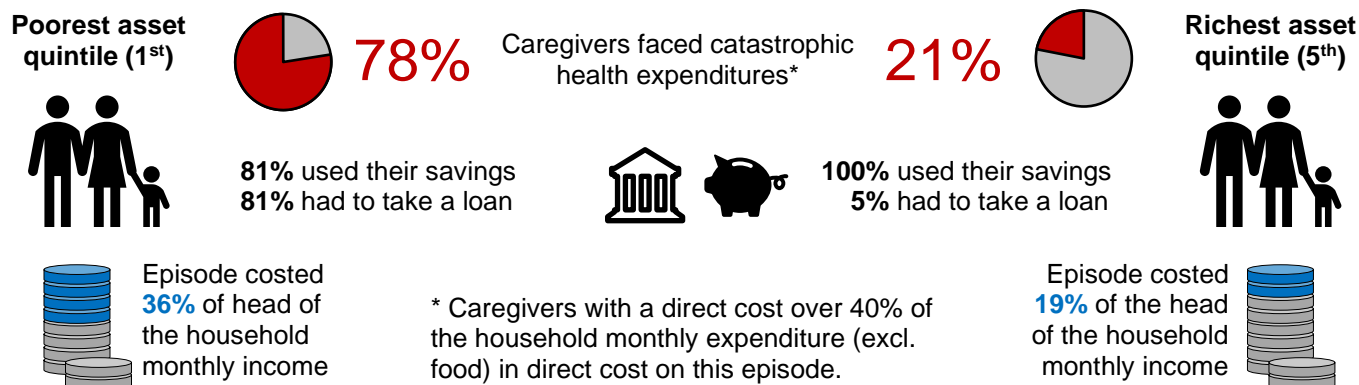
**Figure 6: Societal cost per episode of measles**



Government costs were \$2 for an outpatient case and \$22 for an inpatient case treated in public facilities. Medication use was the main driver of the government costs ranging between 1% and 83% of the total cost for an outpatient case and 13% to 51% for an inpatient case. A portion of the government costs were transferred to the caregiver: on average <\$1 for outpatient care and \$15 for inpatient care.

On average, **caregivers faced an economic cost of \$138**, including \$54 in out-of-pocket payments. Caregivers using public healthcare facilities faced the lowest costs for care.

**Figure 7: Social divide facing the economic burden of measles**



## POLICY RECOMMENDATIONS

The results of this economic evaluation suggest several policy recommendations that would alleviate the economic burden of pneumonia, diarrhea and measles in children under-five in Bangladesh:

- An episode of pneumonia, diarrhea and measles has a societal cost worth **4-9% of the annual GDP per capita** and caregivers carry most of this cost. For the poorest households, the out-of-pocket expenses for an episode of pneumonia and measles costed **over 19% and 36% of the head of the household's monthly income**. Disease prevention, particularly through better immunization of the poor, would significantly alleviate the economic burden of these diseases.
- **Productivity loss is a dominant portion of the costs** due to the time spent on care, from home care to facility visits and stays. Shorter delays before seeking healthcare and efficient triage and care would reduce the time loss due to the episode.
- Drawing from findings in Bangladesh<sup>7</sup>, it is possible that a significant proportion of pneumonia cases was caused by the Respiratory Syncytial Virus (RSV). **Introducing the RSV vaccine could reduce cases in Bangladesh.**
- Sylhet presented lower immunization coverage rates than other divisions in previous studies<sup>1</sup>: **expanding the coverage** of the measles vaccine in Sylhet would curb the recrudescence of cases in the division<sup>8</sup>.



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## RESOURCES

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The following resources are available online:



Full Methods  
Report



Survey tools



Datasets

## REFERENCES

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1. Shawon MSR, Adhikary G, Ali MW, et al. General service and child immunization-specific readiness assessment of healthcare facilities in two selected divisions in Bangladesh. *BMC Health Serv Res* 2018; **18**(1): 39-48.
2. Hodgson TA, Meiners MR. Cost-of-Illness Methodology: A Guide to Current Practices and Procedures. *The Milbank Memorial Fund Quarterly Health and Society* 1982; **60**(3): 429-62.
3. Rice DP. Estimating the cost of illness. In: Service USPH, editor. Washington, D.C.; 1967.
4. Jo C. Cost-of-illness studies: concepts, scopes, and methods. *Clinical and Molecular Hepatology* 2014; **20**(4): 327-37.
5. Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. *Health policy and planning* 2006; **21**(6): 459-68.
6. World Bank. Official exchange rate (LCU per US\$, period average). 2019. <https://data.worldbank.org/indicator/PA.NUS.FCRF> (accessed 20/09 2019).
7. O'Brien KL, Baggett HC, Brooks WA, et al. Causes of severe pneumonia requiring hospital admission in children without HIV infection from Africa and Asia: the PERCH multi-country case-control study. *The Lancet* 2019; **394**(10200): 757-79.
8. World Health Organization. Measles and Rubella Surveillance Data. August 12 2019. [https://www.who.int/immunization/monitoring\\_surveillance/burden/vpd/surveillance\\_type/active/measles\\_monthlydata/en](https://www.who.int/immunization/monitoring_surveillance/burden/vpd/surveillance_type/active/measles_monthlydata/en) (accessed September 21 2019).