

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

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 Uganda 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 at public and private healthcare facilities in four districts for an accurate representation of the population of Uganda. Cost and utilization data were collected from August 2017 to July 2018, based on in-person interviews and administrative data.

Engaging district health officers, facility managers and healthcare professionals early provided invaluable insights on how the data should be accessed at the facilities, district health offices and National Medical Stores (NMS). It facilitated the recruitment of measles cases, particularly outpatient cases. They also shared their opinion on how the cost estimates should be framed to be used later. They recommended against using the caregiver's income as valuation for the indirect costs, preferring the head of the household's instead. Time loss due to care should also be reported without any valuation.

The average societal cost per episode of pneumonia, diarrhea and measles was \$42, \$33 and \$52 respectively, representing about 5-8% 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

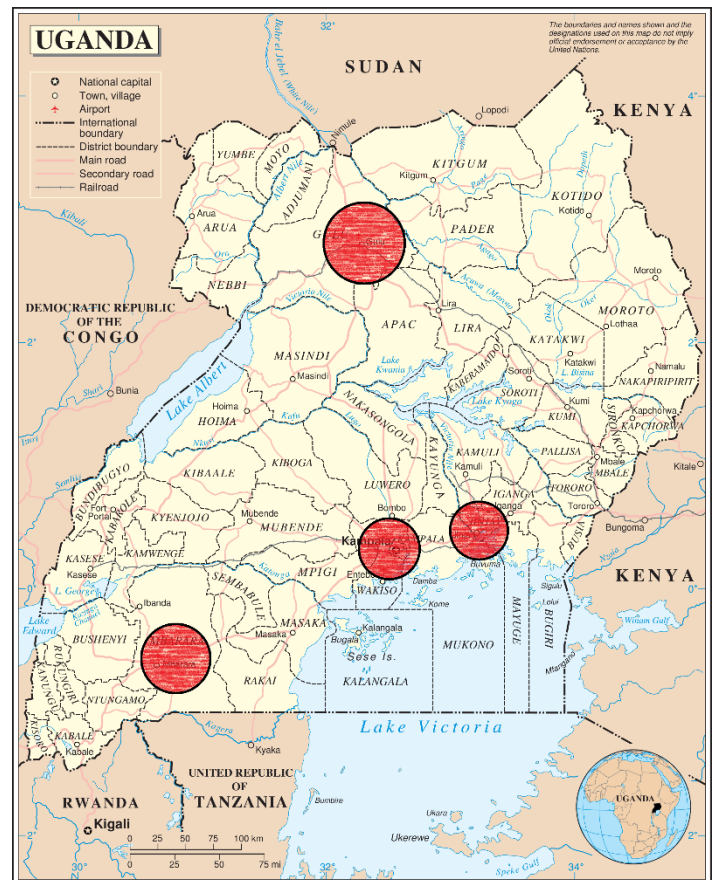
Four districts from all regions of Uganda were represented: Gulu district (Northern Region), Jinja (Eastern), Mbarara (Western) and Wakiso (Central). Healthcare facilities in urban and rural areas were selected, including remote facilities, based on the number of disease cases reported for 2016-17 <sup>1</sup>. We selected 48 healthcare facilities: 16 public, 15 private for-profit and 17 private not-for-profit facilities. Based on the recommendations of the healthcare facilities' staff, we selected a total 282 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

Six 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 one-time district health office survey recording drug pricing (National Medical Stores), medical staff wages and benefits.
- 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.

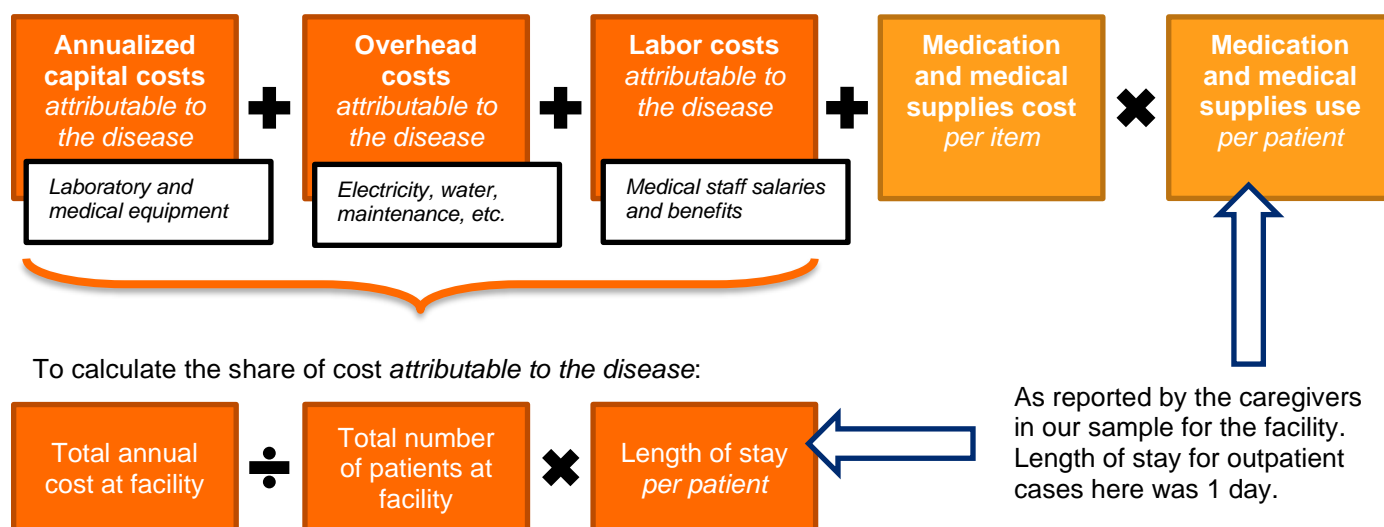


## Costing approach for government costs

The government cost of illness refers to the healthcare costs subsidized by the Government of Uganda and not paid by the caregivers. They included the capital cost 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 per day. 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 National Medical Stores price list 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



## 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

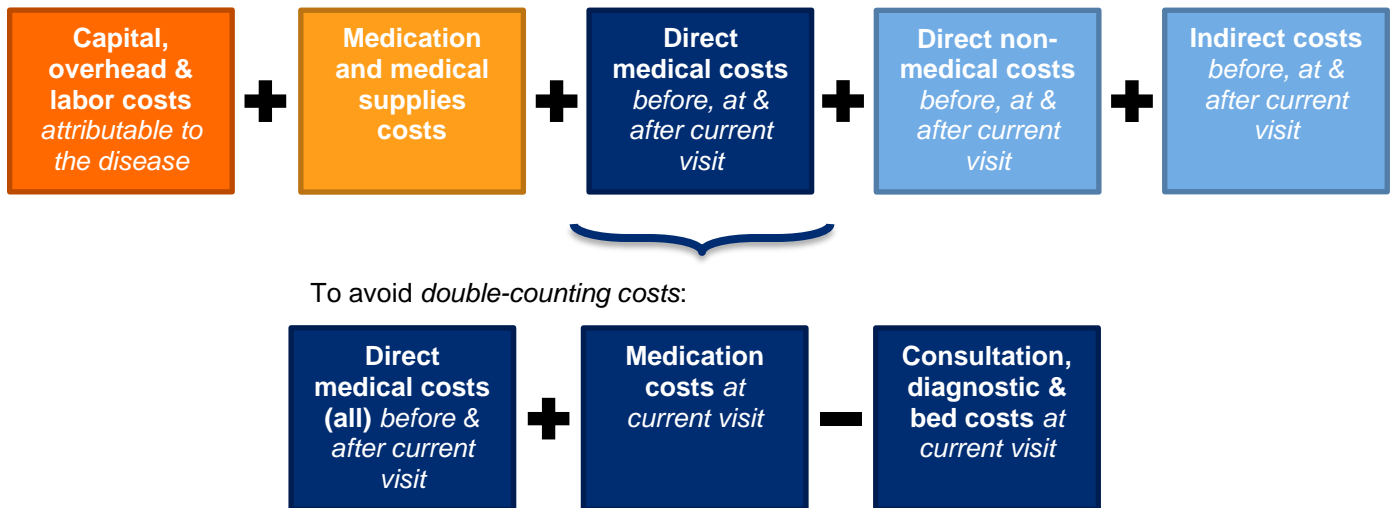
Caregivers were asked about their out-of-pocket payments made during the episode of illness, prompting them about direct medical costs including registration fees, medications, medical procedures, hospitalization, and non-medical costs such as transportation to and from the facilities and meals<sup>2,4</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 traveling to and at the facility. Combined with the reported average income of the head of the household, the time spent on care 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

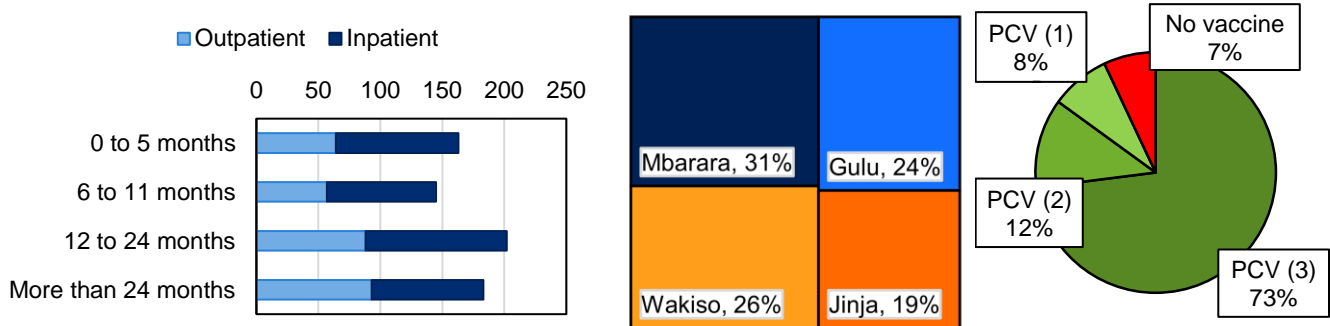
Results are presented as government or caregiver cost of illness. The government cost of illness refers to the healthcare costs subsidized by the Government of Uganda and not paid by the caregivers. Societal cost refers to the total cost, government and caregiver, spent on the episode of illness<sup>4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

All costs are reported in 2018 US dollars. Conversion rate for 2018: USD 1 = UGX 3,727<sup>6</sup>.

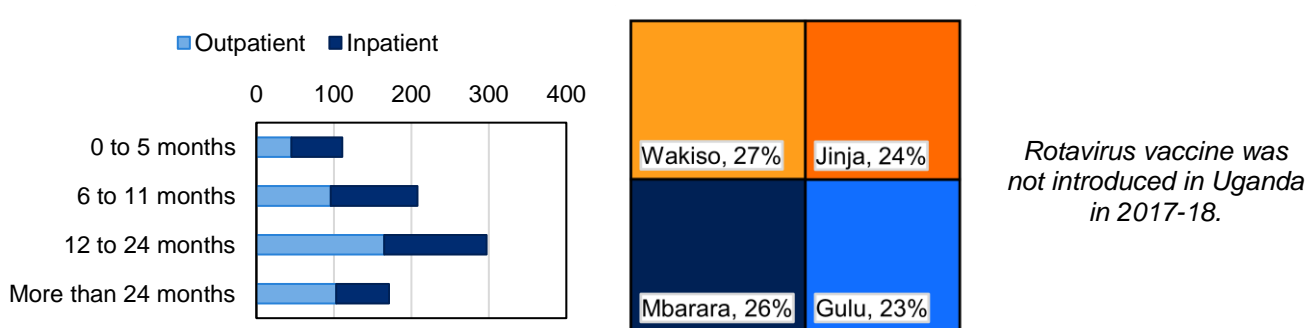
A total of 1,637 children were selected: 695 cases of pneumonia, 791 cases of diarrhea and 151 cases of measles. Cases of measles were concentrated in Jinja and Wakiso districts.

**Figure 1: Child age group, district and immunization status (number of doses in parentheses)**

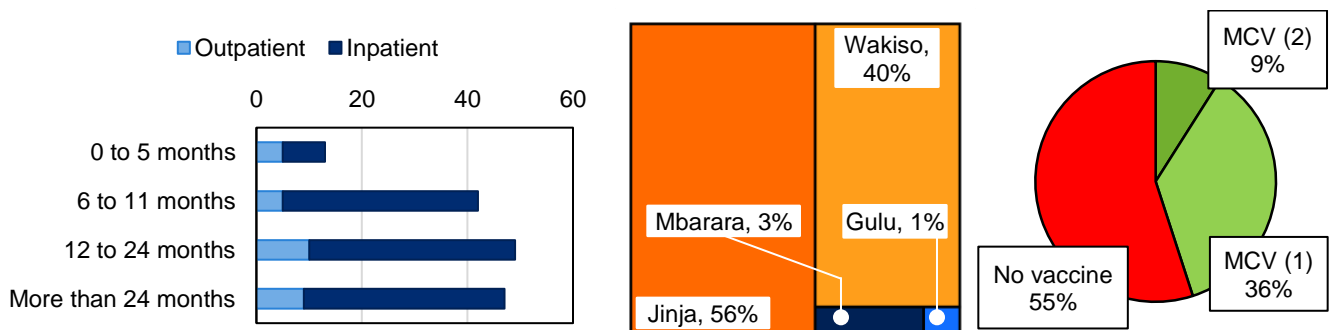
## Pneumonia



## Diarrhea



## Measles

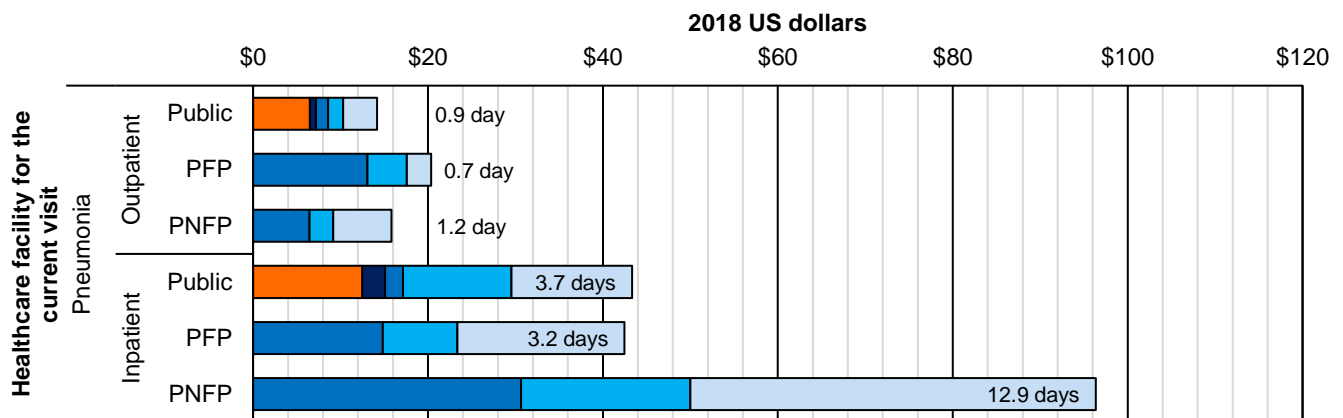


## Pneumonia

When weighted to represent the sample utilization rates of each facility, **the average societal cost per episode of pneumonia was \$42**, about **7% of the GDP per capita**. Hospitalized episodes accounted for an average of \$62 per episode, while episodes only requiring ambulatory care had an average of \$16.

- Government cost
- Caregiver direct medical cost at public facility  
*Costs paid for by the caregiver at the public facility and normally covered by the government*
- Caregiver direct medical cost
- Caregiver direct non-medical cost
- Caregiver indirect cost (# days spent on care)

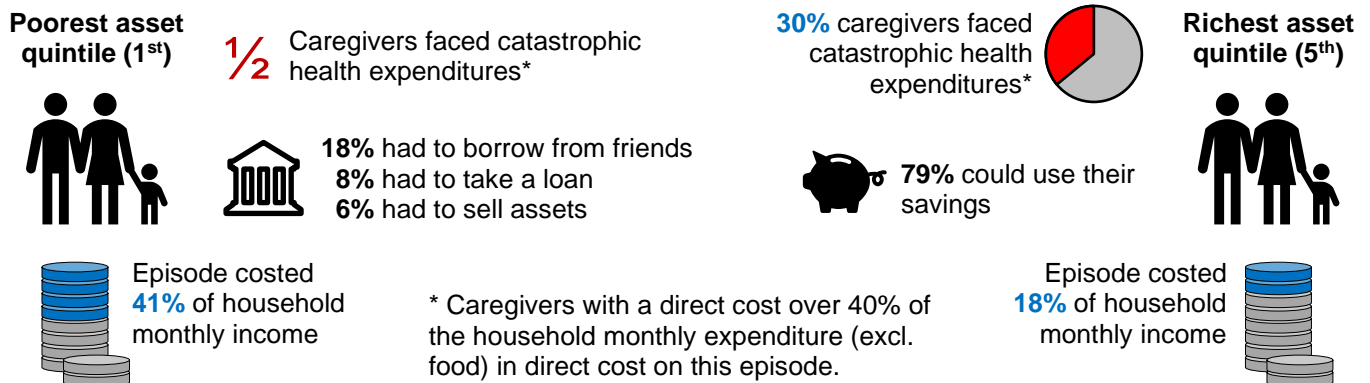
**Figure 2: Societal cost per episode of pneumonia**



Government costs were on average \$7 for an outpatient case and \$12 for an inpatient case. Labor cost of medical staff was the main driver of the government costs ranging between 64% and 74% of the total cost for an outpatient case and 48% to 82% for an inpatient case. Shortages of medications and supplies transferred a portion of the government costs to the caregiver: on average \$1 for outpatient and \$3 for inpatient.

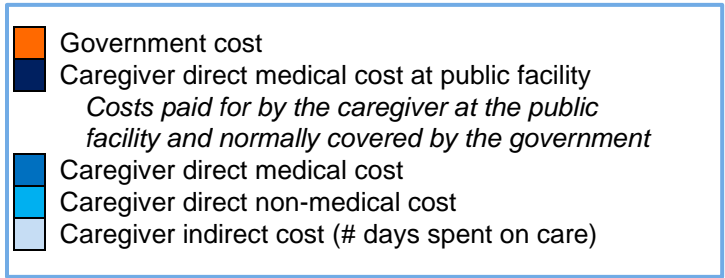
On average, **caregivers faced an economic cost of \$37**, which represents about 10% of the annual GDP per capita, including \$20 in out-of-pocket payments. Caregivers using public healthcare facilities faced the lowest costs for care.

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

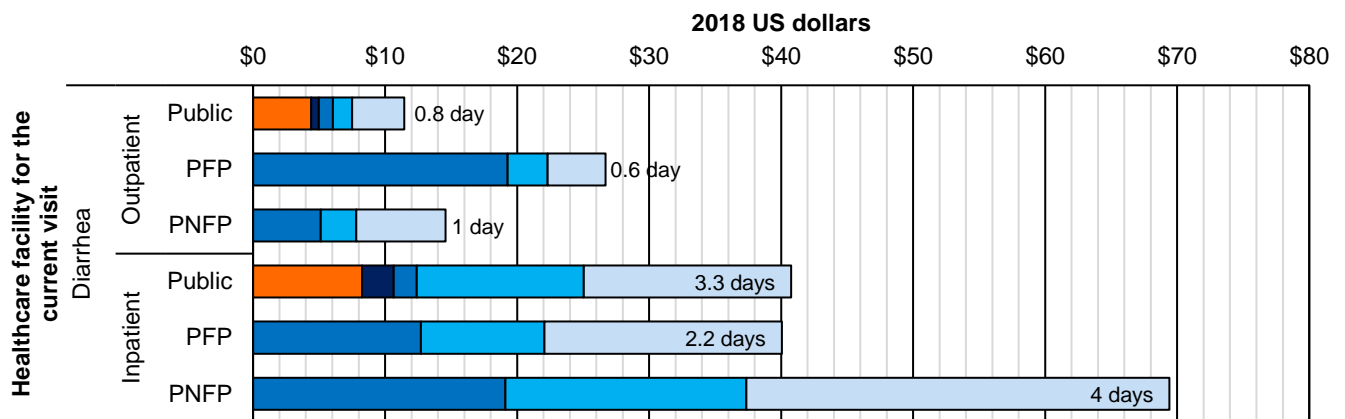


## Diarrhea

When weighted to represent the sample utilization rates of each facility, **the average societal cost per episode of diarrhea was \$33**, about **5% of the GDP per capita**. Hospitalized episodes accounted for an average of \$53 per episode, while episodes only requiring ambulatory care had an average of \$14.



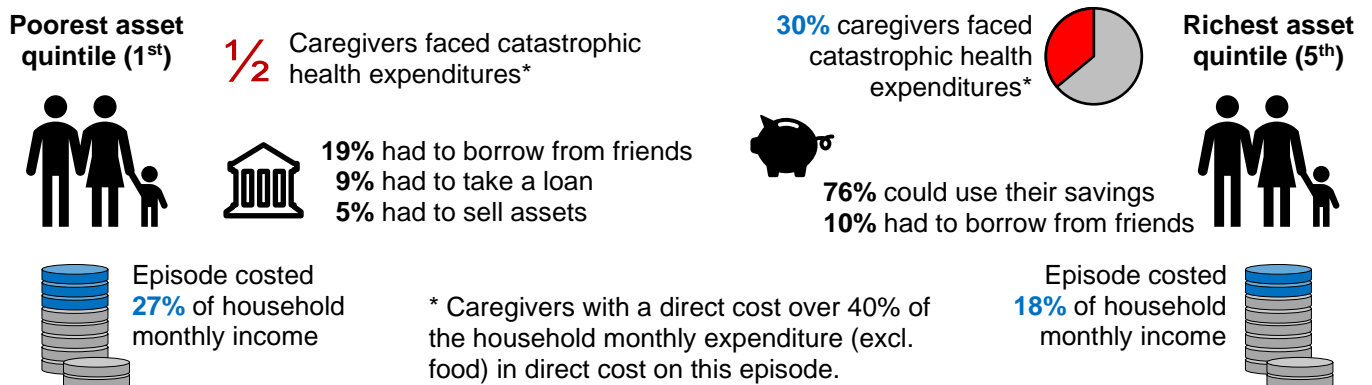
**Figure 4: Societal cost per episode of diarrhea**



Government costs averaged \$5 for an outpatient case and \$8 for an inpatient case. Labor cost of medical staff was the main driver of the government costs ranging between 57% and 82% of the total cost for an outpatient case and 56% to 90% for an inpatient case. Caregivers faced significant costs at government facilities: about \$1 for outpatient care and \$3 for inpatient care.

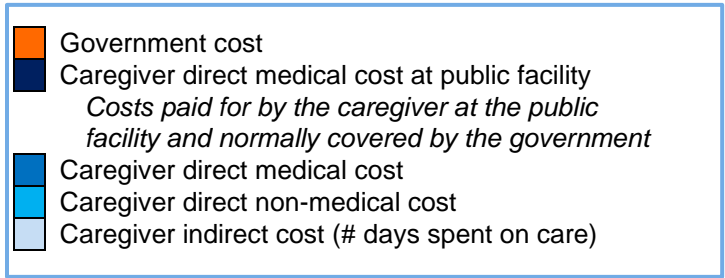
On average, **caregivers faced an economic cost of \$29**, which represents about 10% of the annual GDP per capita, including \$16 in out-of-pocket payments. Caregivers using public healthcare facilities faced the lowest costs for care.

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

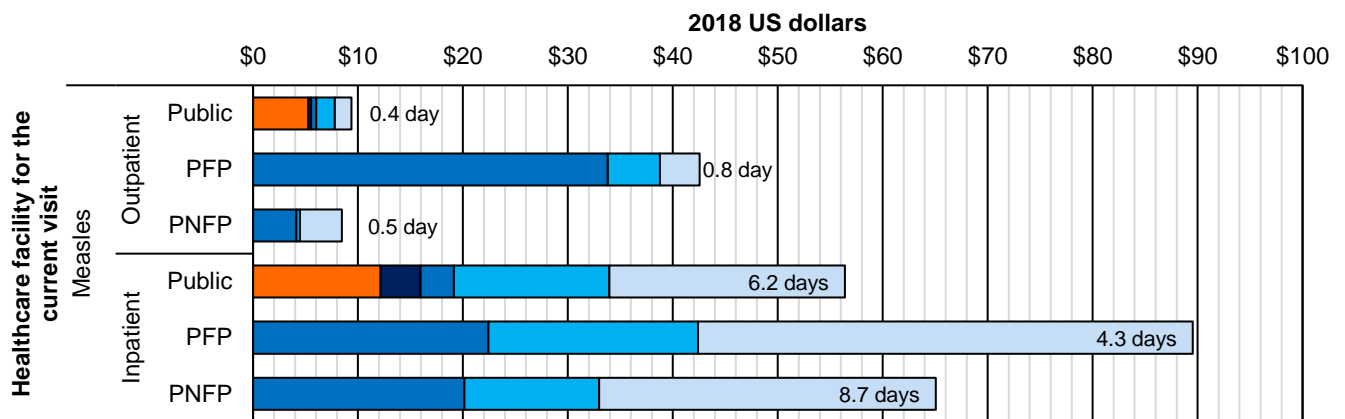


## Measles

When weighted to represent the sample utilization rates of each facility, **the average societal cost per episode of measles was \$52**, about **8% of the GDP per capita**. Hospitalized episodes accounted for an average of \$60 per episode, while episodes only requiring ambulatory care had an average of \$15.



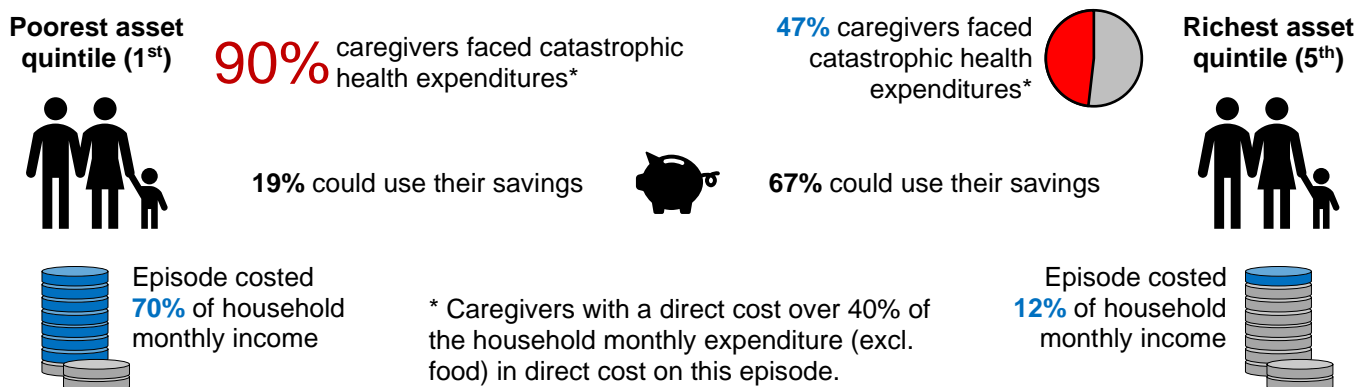
**Figure 6: Societal cost per episode of measles**



Government costs were \$5 for an outpatient case and \$12 for an inpatient case. Labor cost of medical staff was the main driver of the government costs ranging between 56% and 81% of the total cost for an outpatient case and 65% to 97% for an inpatient case. A portion of the government costs were transferred to the caregiver: on average \$1 for outpatient care and \$4 for inpatient care.

On average, **caregivers faced an economic cost of \$44**, which represents about 11% of the annual GDP per capita, including \$23 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 Uganda:

- An episode of pneumonia, diarrhea and measles has a societal cost worth **5-8% of the annual GDP per capita** and caregivers carry most of this cost. For the poorest households, the out-of-pocket expenses for episode of pneumonia and measles costed **over 41% and 70% 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.
- Most children affected by pneumonia in our sample were vaccinated with PCV10. Drawing from findings in Kenya<sup>7</sup>, it is likely that a large proportion of pneumonia cases was caused by the Respiratory Syncytial Virus (RSV). **Introducing the RSV vaccine would likely reduce cases in Uganda.**
- **Expanding the coverage** of the measles vaccine and **strengthening the cold chain** to ensure the viability of the vaccines<sup>8</sup> are key steps to reduce the incidence of measles in Uganda. Lack of funding in recent years allowed for a recrudescence of cases in 2017-18<sup>9,10</sup>.



*This report was developed by the International Vaccine Access Center at Johns Hopkins Bloomberg School of Public Health (United States) and Makerere University School of Public Health (Uganda). Report prepared by Gatién De Broucker, Bryan Patenaude, Elizabeth Ekirapa-Kiracho, Dagna Constenla, Anthony Ssebageraka, Rachael Rebecca Apolot and Mutebi Aloysius.*

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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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