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Household economic burden of childhood severe pneumonia in Bangladesh: a cost-of-illness study

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ABSTRACT

Objective To estimate household cost of illness (COI) for children with severe pneumonia in Bangladesh.

Design An incidence-based COI study was performed for one episode of childhood severe pneumonia from a household perspective. Face-to-face interviews collected data on socioeconomic, resource use and cost from caregivers. A micro-costing bottom-up approach was applied to calculate medical, non-medical and time costs. Multiple regression analysis was applied to explore the factors associated with COI. Sensitivity analysis explored the robustness of cost parameters.

Setting Four urban and rural study sites from two districts in Bangladesh.

Patients Children aged 2–59 months with severe pneumonia.

Results 1472 children with severe pneumonia were enrolled between November 2015 and March 2019. The mean age of children was 12 months (SD ±10.2) and 64% were male. The mean household cost per episode was US\$147 (95% CI 141.1 to 152.7). Indirect costs were the main cost drivers (65%, US\$96). Household costs for the poorest income quintile were lower in absolute terms, but formed a higher proportion of monthly income. COI was significantly higher if treatment was received from urban health facilities compared with rural health facilities (difference US\$84.9, 95% CI 73.3 to 96.3). Child age, household income, healthcare facility and hospital length of stay (LoS) were significant predictors of household COI. Costs were most sensitive to hospital LoS and productivity loss.

Conclusions Severe pneumonia in young children is associated with high household economic burden and cost varies significantly across socioeconomic parameters. Management strategies with improved accessibility are needed particularly for the poor to make treatment affordable in order to reduce household economic burden.

BACKGROUND

Pneumonia is the leading cause of death among under-5 children worldwide, with an estimated 0.8 million deaths in 2017.^{1,2} Mortality is disproportionately higher in low-income and middle-income countries (LMICs), where 95%–99% of pneumonia-specific under-5 deaths occur.³ The estimated incidence of clinical pneumonia among under-5 children in LMICs is 0.28 episodes per child-year and is predominant in South Asia and sub-Saharan Africa.^{4,5} A total of 12% of pneumonia episodes progressed to severe pneumonia, which relies on hospitalisation with supportive treatment

What is already known on this topic?

- Pneumonia is the leading cause of death among under-5 children worldwide.
- Seeking care for pneumonia is poor in resource-poor countries and involves substantial costs for households, particularly for lower socioeconomic groups.
- Previous studies, largely from small urban and small-scaled samples, estimated the cost of management from US\$42 to US\$5977 per episode of severe pneumonia.

What this study adds?

- The study estimated the mean household cost (US\$147) with a large sample from rural and urban areas in Bangladesh using a micro-costing approach.
- The study identified the common resources used and calculated the indirect costs to unpaid caregivers (US\$95), along with direct medical and non-medical costs.
- The study compared cost burden according to socioeconomic group and facility location, assessed the predictors of cost and determined cost-sensitive parameters.

and careful monitoring.^{5–8} In Bangladesh, pneumonia accounts for 28% of under-5 mortality and about 40% of paediatric hospital admissions,^{9,10} while only 42% of parents report seeking care from trained providers for a child with pneumonia symptoms.¹¹

Childhood pneumonia imposes high economic burden on households, healthcare systems and society as a whole.^{12,13} The high prevalence among lower socioeconomic groups in Bangladesh is a significant concern because a substantial amount of costs are borne by households when seeking care from any healthcare facility.^{14–17} In a systematic analysis, Zhang *et al*¹² reported the costs of pneumonia management, where the cost of inpatient care ranged from US\$42 to US\$5977 (2019 inflation-adjusted). Three studies were conducted in Bangladesh but were small-scaled, limited in terms of the scope of costs included and were largely conducted in urban areas.^{18–20} In addition, evidence from the review reveals methodological limitations with lack of detailed information on resource use, particularly from the household's perspective.¹²



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Detailed cost estimation based on rigorous methodologies is crucial to accurately inform policy to efficiently allocate scarce resources. In this context, the current study intended to estimate the household cost of illness (COI) per episode of childhood severe pneumonia, to assess cost variation across rural and urban groups, and to determine the associated predictors in the context of Bangladesh.

MATERIALS AND METHODS

Study setting

This study was nested in an effectiveness trial that compared daycare management approach (DCA) with usual care for treatment of childhood severe pneumonia. The trial was conducted by the International Centre for Diarrhoeal Disease Research, Bangladesh between November 2015 and March 2019 and covered an urban district (Dhaka) and a rural district (Kishoreganj). In this effectiveness trial, severe pneumonia in children aged 2–59 months was defined following the WHO criteria as ‘cough or difficulty in breathing, plus at least one of the following: central cyanosis or oxygen saturation <90% on pulse oximetry, severe respiratory distress (e.g., grunting, very severe chest indrawing), signs of pneumonia with a general danger sign: inability to breastfeed or drink, lethargy or unconscious, convulsions’.⁸

Study sites and sample

A total of 32 public or non-governmental organisation-run clinics (clusters) were randomly selected from the trial sites and allocated equally to either DCA or usual care management. For usual care (control clusters), enrolled children were referred directly to the local hospitals after initial assessment. The referral patterns in the control arm of the trial were unchanged from usual practice, with trial setting having no influence on participant behaviour or referral patterns. All enrolled children in the control clusters (n=16) were included for household COI estimation in the study.

Method of measuring cost

This study adopted a household perspective to estimate incidence-based COI for one episode of childhood severe pneumonia. Household costs include all illness-related out-of-pocket (OOP) costs and time cost/wage loss of patients and caregivers. The main cost components included direct medical, direct non-medical and indirect costs.

Identification of resources

A bottom-up micro-costing approach was applied to collect all relevant economic data related to resource use associated with pneumonia treatment.²¹ This involved identification of all resources used, with the quantity and unit price of each item. Medical care expenses such as physician consultation fees, medicines, diagnostic tests and bed charges were considered as direct medical costs. Non-medical expenses such as transportation, food and lodging were considered as direct non-medical costs²¹ (online supplemental material 1 table S1).

Indirect costs refer to income and/or productivity loss incurred due to illness.²² The human capital approach was applied to estimate lost wages/productivity, using self-reported wage rate/direct income loss for paid workers as per earlier studies and the minimum hourly wage rate for unpaid workers in Bangladesh.^{17 18 23 24}

Data collection tool

Existing literature and prior experience of the research team were used to design the COI questionnaire.^{12 15 16 18 23} Data collection tools (household questionnaire) were piloted in both urban and rural areas to identify questions/variables that needed to be added or excluded and to identify potential barriers (online supplemental material 2). All of the identified challenges were resolved before final data collection. Trained and experienced interviewers collected data in face-to-face interviews with the parent/caregiver. Interviews were conducted on the day of trial enrolment and on the day of hospital discharge. Data on demographics, socioeconomic characteristics, resource use (quantity and expenses), waiting time, caregivers’ time, wage and/or productivity loss, and household coping strategies to manage expenses were collected. To reduce recall bias and minimise reporting errors, the interviewee was asked to check items, quantities and prices from purchase receipts or prescriptions. Informed written consent was taken prior to the start of each interview.

Data analysis

Data were checked to identify potential errors and then verified to conserve data accuracy. Cost data were skewed; therefore, we presented median and IQR along with mean and SD in US dollars, in 2019 price year. Due to skewness, log-linear models were adopted to explore the predictors of household costs.²⁵ Household cost was considered as the dependent variable and logged-linear regression models were constructed using demographic and socioeconomic variables.¹² Variables were added to the regression model that had a correlation coefficient of >0.15 with the dependent variable. A multivariate logged linear regression model was used to adjust for potential confounding factors; a low mean value of variance inflation factor confirms that there was no notable multicollinearity in the model.

One-way sensitivity analysis was undertaken to test the robustness of the results. We tested the effect of changes of $\pm 20\%$ in each cost parameter value for both direct and indirect costs and ± 1 day in average length of stay (LoS) to identify the most cost-sensitive parameters.^{18 24} Mean imputation method was used to replace any missing data.²⁶ All analyses were undertaken first as complete case and then using mean imputation. Imputed results are presented, although given the low level of missing data (2%) complete case results were very similar (online supplemental material 3 table S2 and S3). Statistical significance level was considered as p value less than 0.05 with 95% CI. All analyses were performed using STATA V.16.1 statistical software.

Written informed consent was taken from the parents/guardians of the recruited children prior to data collection.

RESULTS

Background characteristics of the study participants

Background characteristics of the children are described in table 1 by urban and rural distribution. A total of 1472 children were enrolled, of whom 65% were male, with a mean age of 12.2 (SD ± 10.2) months. Age and gender distributions were similar for the urban and rural groups. Overall, age was skewed, with 65% of children aged up to 1 year. The sample revealed skewness towards the wealthier quintiles, particularly in urban areas (table 1). The average monthly household income was US\$277 (SD ± 275), with higher income for urban residents. The average LoS in hospital was 5.0 days.

Table 1 Background characteristics of under-5 children with severe pneumonia in Bangladesh (N=1472)

| Variables | Overall (N=1472) | Urban (n=954) | Rural (518) |
|--|------------------|---------------|---------------|
| Sex, n (%) | | | |
| Male | 947 (64.3) | 617 (64.7) | 330 (63.7) |
| Female | 525 (35.7) | 337 (35.3) | 188 (36.3) |
| Patient age (months), n (%) | | | |
| <6 | 461 (31.0) | 282 (29.5) | 179 (34.5) |
| 6–12 | 494 (34.0) | 342 (35.9) | 152 (29.2) |
| 13–18 | 228 (15.5) | 138 (14.5) | 89 (17.3) |
| 19–24 | 111 (7.5) | 67 (7.0) | 44 (8.5) |
| 25–30 | 64 (4.4) | 49 (5.1) | 16 (3.1) |
| 31–36 | 49 (3.3) | 30 (3.1) | 19 (3.7) |
| >36 | 65 (4.4) | 46 (4.8) | 19 (3.7) |
| Patient age in months, mean (±SD) | 12.2 (10.2) | 12.2 (10.3) | 11.8 (10.2) |
| Length of stay in days | | | |
| <1 | 28 (1.9) | 14 (1.5) | 14 (2.7) |
| 1–3 | 233 (15.8) | 65 (6.9) | 168 (32.4) |
| 4–6 | 792 (53.7) | 481 (50.3) | 311 (60.1) |
| 6+ | 421 (28.6) | 394 (41.3) | 25 (4.8) |
| Length of stay, mean (±SD) | 5.0 (2.6) | 5.7 (2.6) | 3.6 (2.1) |
| Mother's education, n (%) | | | |
| No formal education | 207 (14.0) | 146 (15.3) | 60 (11.6) |
| Up to primary | 410 (27.8) | 257 (27.0) | 151 (29.3) |
| Secondary | 691 (46.9) | 423 (44.3) | 265 (51.7) |
| Higher | 166 (11.3) | 128 (13.4) | 38 (7.4) |
| Father's education, n (%) | | | |
| No formal education | 251 (17.0) | 165 (17.3) | 85 (16.5) |
| Up to primary | 428 (29.0) | 249 (26.1) | 178 (34.5) |
| Secondary | 567 (38.5) | 360 (37.8) | 203 (39.7) |
| Higher | 228 (15.5) | 180 (18.8) | 48 (9.3) |
| Household size (members), mean (±SD) | 5.2 (2.2) | 4.9 (1.6) | 5.9 (2.3) |
| Mother's occupation, n (%) | | | |
| Housewife | 1327 (90.0) | 847 (88.7) | 477 (92.8) |
| Informal worker | 36 (2.4) | 29 (3.0) | 7 (1.3) |
| Service | 58 (3.9) | 40 (4.1) | 18 (3.5) |
| Student | 13 (0.8) | 4 (0.4) | 9 (1.7) |
| Home worker | 20 (1.4) | 18 (2.0) | 1 (0.2) |
| Other | 18 (1.2) | 16 (1.7) | 2 (0.4) |
| Father's occupation, n (%) | | | |
| Farmer | 106 (7.2) | 1 (0.1) | 104 (20.4) |
| Informal worker | 151 (10.2) | 116 (12.1) | 35 (6.8) |
| Transport worker | 211 (14.4) | 143 (14.9) | 69 (13.4) |
| Salaried employee | 516 (35.0) | 384 (40.3) | 131 (25.4) |
| Business | 343 (23.3) | 233 (24.5) | 107 (20.9) |
| Other | 145 (9.8) | 77 (8.0) | 68 (13.2) |
| Average household monthly income (US\$), mean (±SD) | 277.1 (275.5) | 321.3 (315.9) | 194.9 (145.9) |
| Average household monthly expenditure (US\$), mean (±SD) | 213.3 (151.6) | 249.5 (165.7) | 146.2 (87.8) |
| Household's average health expenditure in the past 3 months (US\$), mean (±SD) | 41.4 (96.5) | 39.2 (80.2) | 45.3 (121.0) |
| Wealth quintile, n (%) | | | |
| Poorest | 236 (16.0) | 25 (2.6) | 210 (40.9) |
| Poorer | 221 (15.5) | 70 (7.3) | 158 (30.8) |
| Middle | 263 (17.8) | 151 (15.9) | 110 (21.3) |
| Richer | 325 (22.1) | 293 (30.7) | 31 (6.0) |
| Richest | 421 (28.6) | 415 (43.5) | 5 (1.0) |

Resources used, distribution of average COI by type of facility and average household costs

Table 2 shows the resources used and the average costs by type of facility and the distribution of household costs per episode for each parameter. The most commonly used resources were

medicines, admission fees, medical consumables and transportation. The mean household cost per episode was US\$147 (SD ±114.6) (median US\$116, IQR 95.3), comprising 35% direct costs (US\$51) and 65% (US\$96) indirect costs. The mean cost per episode was highest for households using private facilities (US\$268) and lowest for those using upazila health complex (US\$90). Overall, the mean cost was significantly higher among households that received treatment from urban health facilities (US\$177) compared with rural health facilities (US\$92) (online supplemental material 4 figure S1).

Distribution of household cost per episode of severe childhood pneumonia across income quintiles

Figure 1 shows the mean household COI per episode and its distribution across income quintiles. Overall, the costs were higher for higher income quintiles ($p<0.001$). The direct cost was US\$24 for the poorest households, while it was about three times higher for the richest households. Similarly, the indirect cost was also higher (US\$126) for the richest households.

We assessed COI as a percentage of household monthly income. OOP expenditure differed significantly across income groups and facility location ($p<0.001$). Although the mean household cost per episode was higher for the richest quintiles, the poorest households spent more as a percentage of their monthly income compared with the richest households (urban: 43% vs 13%; rural: 20% vs 5%) (online supplemental material 5 figure S2).

Households' coping strategies for managing costs

Most households financed their child's treatment expenses from regular income (67%), while 37% of the households required spending from their savings and 19% reported borrowing to cover treatment costs. Regular income was the primary cost management strategy for both rural and urban residents (77% vs 62%), while urban households borrowed more than rural households (23% vs 10%) (supplemental material 6 figure S3).

Predictors of household costs per episode of childhood severe pneumonia

Bivariate and multivariate logged linear regression models found that LoS, income quintile, type of healthcare facility and age of the child were significant predictors of household COI for childhood severe pneumonia. For instance, an additional day in the hospital was associated with a 13% increase in log-transformed total cost per household ($p<0.001$), and being in the richest income quintile was associated with a 24% increase relative to the poorest quintile ($p<0.001$). Children from urban areas had higher COI compared with children from rural areas (33%, $p<0.001$) (table 3).

Sensitivity analysis

Household mean COI per episode was most sensitive to changes in average LoS and caregivers' income loss. A 1-day reduction in hospital LoS reduced household COI by 25%, and a 20% increase in caregivers' time cost increased COI by 13% (figure 2).

DISCUSSION

In general, COI studies are used to define the economic burden of disease and to recommend policy for decision-making in order to efficiently allocate healthcare resources. The current study estimates household COI covering both direct and indirect costs at a highly detailed level. We also compared the distribution of costs across facility type and location, determined the

Table 2 Resources used, unit costs by types of care, and distribution of average household costs for one episode of severe childhood pneumonia in US\$ (n=1,472), 2019 price year

| Parameters | Cost per each parameter by type of facility | | | | | | | | | | Overall cost of treatment in US\$ | |
|--|---|-------------|-------------|-------------|--|---|---------------|-------------|-------------|--|-----------------------------------|--------------|
| | Resource used | | | | | Cost per each parameter by type of facility | | | | | Overall cost of treatment in US\$ | |
| | Urban | | Rural | | | Urban | | Rural | | | Overall cost of treatment in US\$ | |
| | SpH/AH (n=741) | PH (n=220) | DH (n=145) | UHC (n=368) | | SpH/AH (n=736) | PH (n=218) | DH (n=147) | UHC (n=371) | | Mean (SD) | Median (IQR) |
| | n (%) | n (%) | n (%) | n (%) | | Mean (SD) | Mean (SD) | Mean (SD) | Mean (SD) | | | |
| Diagnostic tests | 611 (83.0) | 210 (95.5) | 73 (50.3) | 20 (5.4) | | 7.2 (7.7) | 13.5 (17.9) | 2.0 (4.8) | 0.3 (3.0) | | 5.9 (10.1) | 3.8 (8.1) |
| Medicine | 738 (99.7) | 220 (100.0) | 129 (89.0) | 338 (91.6) | | 19.9 (15.6) | 27.3 (28.2) | 10.3 (17.2) | 10.2 (6.5) | | 17.6 (17.1) | 13.8 (12.5) |
| Consultation/physician fee | 198 (26.7) | 132 (61.8) | 46 (31.7) | 33 (9.0) | | 1.1 (2.3) | 7.7 (16.9) | 1.6 (2.7) | 0.4 (3.9) | | 2.0 (7.4) | 0.0 (1.3) |
| Registration/admission fee | 734 (99.1) | 217 (98.6) | 144 (99.3) | 352 (95.7) | | 0.5 (1.0) | 2.9 (2.4) | 0.1 (0.1) | 0.2 (0.4) | | 0.8 (1.5) | 0.3 (0.3) |
| Medical consumables (eg, syringe) | 630 (85) | 217 (98.6) | 119 (82.1) | 219 (59.5) | | 3.1 (1.6) | 6.9 (6.0) | 1.8 (1.1) | 2.6 (1.9) | | 3.4 (3.1) | 3.4 (2.7) |
| Bed/cabin charge | 87 (11.7) | 204 (92.7) | 2 (1.4) | 5 (1.3) | | 2.3 (12.4) | 22.7 (37.9) | 0.2 (1.5) | 0.4 (4.4) | | 4.5 (18.8) | 0.0 (0.0) |
| Nebulisation | 610 (82.3) | 201 (91.4) | 2 (1.4) | 30 (8.2) | | 1.9 (5.3) | 16.6 (12.1) | 0.1 (0.3) | 0.2 (2.5) | | 3.5 (8.3) | 0.0 (1.3) |
| Oxygen | 11 (1.5) | 66 (30.0) | 0 (0.0) | 2 (0.5) | | 0.5 (1.2) | 3.6 (12.2) | 0.4 (1.0) | 0.2 (0.8) | | 0.9 (4.9) | 0.0 (0.0) |
| Therapeutic diet | 23 (3.1) | 13 (5.9) | 9 (6.2) | 11 (3.0) | | 0.1 (0.4) | 0.1 (0.9) | 0.1 (0.4) | 0.1 (0.4) | | 0.1 (0.5) | 0.0 (0.0) |
| Direct medical cost | 704 (95.6) | 219 (99.6) | 145 (100.0) | 363 (98.6) | | 36.6 (26.1) | 101.1 (96.10) | 16.4 (12.2) | 14.5 (15.6) | | 38.7 (50.7) | 24.9 (31.1) |
| Transportation | 421 (57.5) | 93 (42.3) | 1 (0.7) | 36 (9.8) | | 5.9 (7.4) | 10.6 (8.4) | 3.8 (4.3) | 3.6 (3.6) | | 5.8 (7.0) | 4.2 (6.2) |
| Informal payment | 540 (72.9) | 190 (86.4) | 137 (94.5) | 277 (75.3) | | 0.6 (0.9) | 1.0 (2.5) | 0.0 (0.1) | 0.1 (0.3) | | 0.5 (1.1) | 0.0 (0.6) |
| Expenditure for caregivers | 41 (5.5) | 31 (14.1) | 4 (2.8) | 45 (12.2) | | 0.4 (0.7) | 1.3 (4.7) | 0.4 (1.0) | 0.4 (1.4) | | 0.5 (2.1) | 0.3 (0.0) |
| Others | – | – | – | – | | 12.3 (9.7) | 22.6 (17.5) | 6.3 (7.1) | 8.2 (6.0) | | 12.5 (11.3) | 10.0 (8.5) |
| Direct non-medical cost | – | – | – | – | | – | – | – | – | | – | – |
| Length of hospital in days, mean (±SD) | 5.7 (2.4) | 5.7 (3.1) | 3.1 (1.4) | 3.8 (2.3) | | – | – | – | – | | – | – |
| Total direct cost | – | – | – | – | | 49.0 (29.7) | 123.7 (107.4) | 15.2 (15.4) | 22.6 (19.2) | | 15.2 (15.7) | 34.5 (37.4) |
| Caregiver's waiting time | – | – | – | – | | 0.4 (0.5) | 1.5 (5.1) | 0.8 (3.1) | 0.6 (1.6) | | 0.8 (2.4) | 0.4 (0.6) |
| Caregiver's productivity loss | – | – | – | – | | 99.8 (69.1) | 142.6 (105.1) | 68.6 (36.9) | 67.0 (43.6) | | 94.9 (72.6) | 75.9 (59.4) |
| Total indirect cost | – | – | – | – | | 100.2 (69.2) | 144.1 (106.6) | 69.5 (37.7) | 67.5 (44.1) | | 95.8 (73.5) | 76.3 (59.8) |
| Total household cost | – | – | – | – | | 149.2 (84.9) | 267.8 (188.4) | 95.2 (48.3) | 90.1 (53.7) | | 147.1 (114.6) | 116.6 (95.3) |

SpH/AH n=4; PH n=8; DH n=1; UHC n=3.

Direct medical cost: Summation of all direct medical expenses; Direct non-medical cost: Summation of all direct expenses not related to medical costs (e.g. travel); Total direct cost: Summation of total direct medical and non-medical costs; Total household cost: Summation of total direct and total indirect costs. AH, autonomous hospital; DH, district hospital; PH, private hospital; SpH, specialised hospital; UHC, upazila health complex.

Distribution of mean household costs per episode by income quintiles

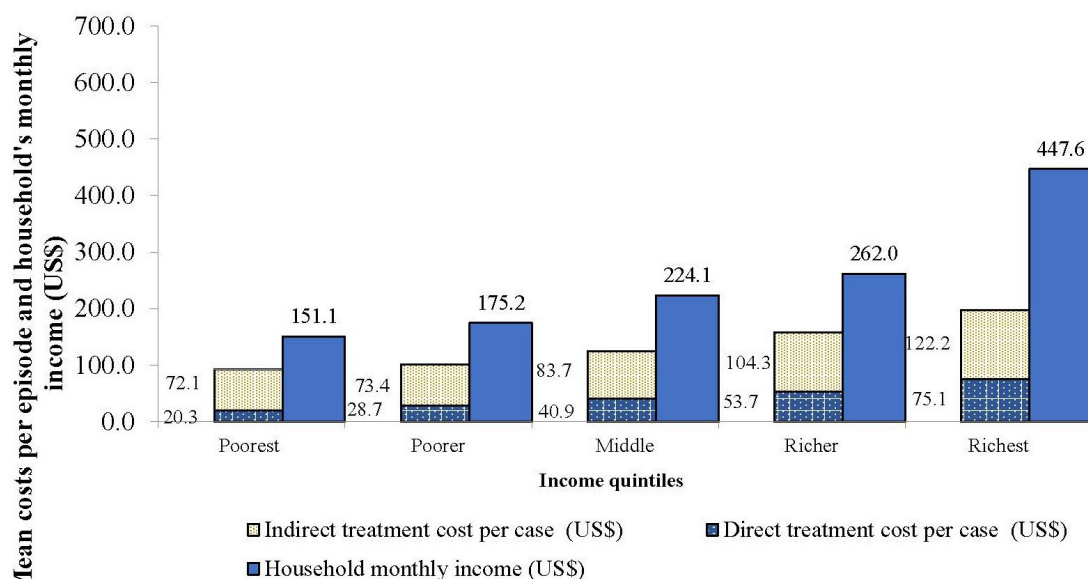


Figure 1 Distribution of mean household cost per episode of childhood severe pneumonia by wealth quintiles.

predictors of cost and performed a sensitivity analysis. Overall, our study provides a more detailed characterisation that indicates management of childhood severe pneumonia poses a substantial economic burden to households, particularly to the poorest socioeconomic groups and if treatment is provided by urban hospitals.

It is evident that household costs pose a substantial burden particularly to inpatient care.¹² Findings from other LMICs reported household cost per patient ranged from US\$21 to US\$326 (2019 inflation-adjusted), although most studies reported only direct cost and therefore underestimated the total cost burden.^{18 19 27–30} Our estimated per patient household costs are comparatively lower than the reported costs (2019 inflation-adjusted) for other LMICs, such as Kenya (US\$260),³¹ India (US\$212)³² and Jordan (US\$616),³³ but higher compared with Pakistan (US\$103).³⁴ The cross-country cost variation may be explained by differences in the health system, in particular the contribution of OOP payment to health expenditure, as well as by methodological variation between studies in cost estimation, disease severity and type of facility providing care (community management, outpatient care and inpatient care). Our study also demonstrates that the cost of medicine constituted the major proportion of direct inpatient care costs. Consistent with our findings, several previous studies conducted in other LMICs also reported similar costs, in which the cost of medications was the major cost driver of the total OOP expense from households.^{23 27 30 31}

High OOP expenditure can be largely attributed to the fact that there is a lack of public inpatient care facilities in Bangladesh, many with insufficient supply of required resources such as personnel, medicines and other medical consumables to treat children optimally. Health insurance would probably be the better solution to lower OOP cost, but these are limited in most LMICs including Bangladesh.^{20 35} Earlier studies also reported unofficial or informal fees to gain access to public healthcare facilities, which increase the total cost of treatment.^{19 30}

Our findings demonstrate that OOP expenditure is a substantial burden particularly for poor socioeconomic groups, where

health expenditure is comparatively lower in absolute terms compared with richer groups but higher in relative terms, as a proportion of monthly household income. OOP expenditure per episode was about one-third of the monthly household income of the poorest group, which would classify these households as facing catastrophic health expenditure (over 40% of the household income net of subsistence expenditure).³⁶ OOP expenditure in this study was mainly sourced from regular income, followed by savings and borrowing. Likewise, other studies conducted in similar settings, including Bangladesh, revealed use of income, savings and borrowing with interest to manage treatment cost.^{20 31}

In Bangladesh, catastrophic healthcare expenditure pushes about six million people towards poverty.³⁷ To mitigate this challenge, moving towards achieving universal health coverage, Bangladesh has health financing strategies to create health insurance schemes. For instance, a health insurance scheme for populations below the poverty line has been piloted in three subdistricts.³⁷ Findings from this study underline the importance of effective and affordable health insurance for vulnerable families to protect children from pneumonia-specific mortality.

Our findings show that indirect costs are significantly higher than previously documented and constitute more than half of the mean household cost per episode. Detailed estimation of indirect costs has not previously been available for Bangladesh. An earlier study conducted in Germany reported 38% indirect cost for pneumonia management.³⁸ This difference might be due to the dissimilarity in healthcare systems in LMICs compared with those in high-income countries, since continuous caregiving is required from the family for inpatient services, particularly for children, in resource-poor settings. These findings reveal and emphasise the extent to which severe pneumonia interrupts household income and productivity. Consistent with our findings, several other studies conducted in LMIC settings including Bangladesh reported indirect costs as a major cost contributor for other infectious diseases, including cholera (75%),¹⁶ malaria (72%–94%)^{39 40} and visceral leishmaniasis (53%).⁴¹

Table 3 Bivariate and multiple logged linear regression models (N=1472)

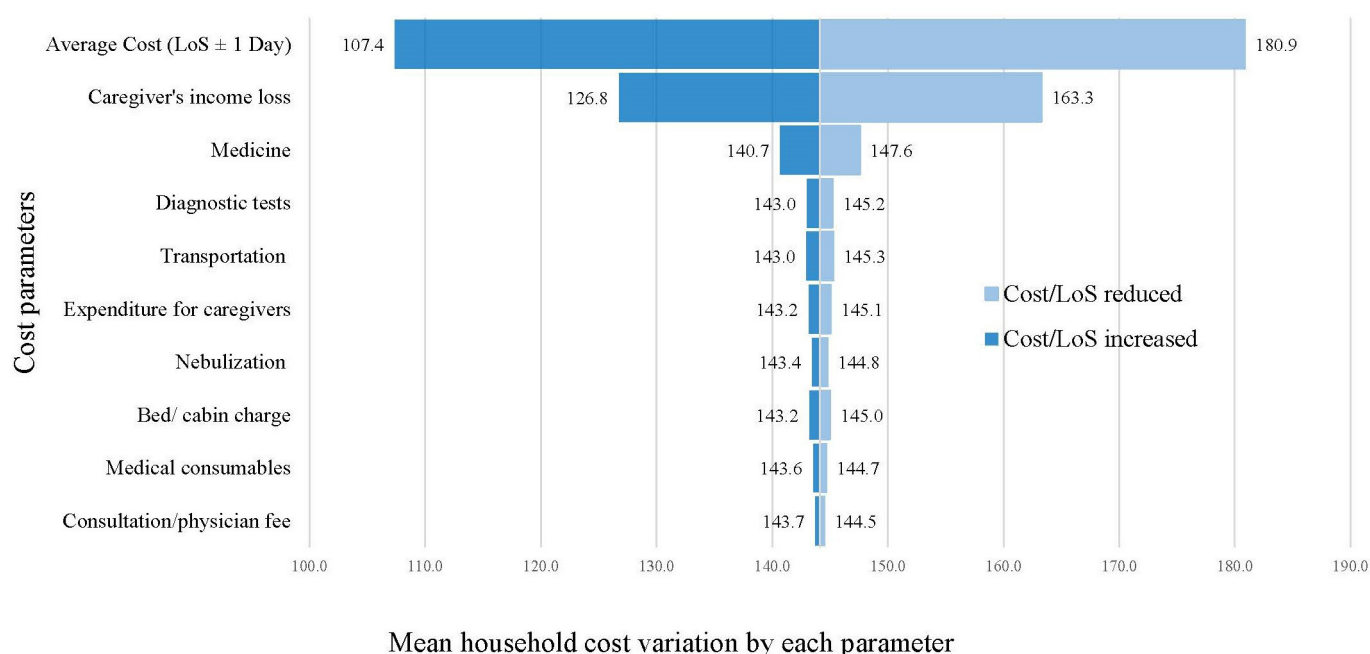
| Variables | Unadjusted model | | Adjusted model | |
|-------------------------------------|------------------------|---------|-----------------------|---------|
| | Coefficient (95% CI) | P value | Coefficient (95% CI) | P value |
| Length of stay | 0.15 (0.01 to 0.13) | <0.001 | 0.13 (0.11 to 0.15) | <0.001 |
| Patient age in months | -0.01 (-0.02 to -0.01) | <0.001 | -0.1 (-0.01 to -0.01) | <0.01 |
| Mother's education | | | | |
| No formal education (ref) | | | | |
| Up to primary | -0.21 (-0.3 to -0.1) | <0.001 | -0.01 (-0.09 to 0.07) | 0.83 |
| Secondary | -0.11 (-0.23 to 0.00) | 0.05 | 0.04 (-0.03 to 0.12) | 0.27 |
| Higher | 0.1 (-0.05 to 0.24) | 0.19 | 0.09 (-0.01 to 0.19) | 0.08 |
| Father's education | | | | |
| No formal education (ref) | | | | |
| Up to primary | -0.19 (-0.3 to -0.09) | <0.001 | -0.04 (-0.1 to 0.03) | 0.3 |
| Secondary | -0.09 (-0.19 to 0.02) | 0.1 | -0.03 (-0.1 to 0.04) | 0.41 |
| Higher | 0.12 (0.0 to 0.24) | 0.05 | -0.01 (-0.09 to 0.07) | 0.82 |
| Wealth quintile | | | | |
| Poorest (ref) | | | | |
| Poorer | 0.13 (0.04 to 0.23) | 0.01 | 0.02 (-0.05 to 0.09) | 0.61 |
| Middle | 0.32 (0.22 to 0.42) | <0.001 | 0.09 (0.01 to 0.17) | 0.02 |
| Richer | 0.52 (0.43 to 0.62) | <0.001 | 0.14 (0.05 to 0.23) | <0.001 |
| Richest | 0.73 (0.64 to 0.82) | <0.001 | 0.24 (0.014 to 0.34) | <0.001 |
| Place of residence | | | | |
| Urban | 0.61 (0.55 to 0.66) | <0.001 | – | – |
| Rural (ref) | | | | |
| Father's occupation | | | | |
| Transport worker (ref) | | | | |
| Informal worker | 0.27 (0.15 to 0.40) | <0.001 | -0.09 (-0.18 to 0.00) | 0.06 |
| Farmer | 0.32 (0.2 to 0.44) | <0.001 | -0.11 (-0.2 to -0.02) | 0.02 |
| Salaried employee | 0.43 (0.33 to 0.53) | <0.001 | -0.06 (-0.14 to 0.02) | 0.16 |
| Business | 0.43 (0.32 to 0.53) | <0.001 | 0.0 (-0.09 to 0.09) | 0.98 |
| Others | 0.36 (0.21 to 0.50) | <0.001 | -0.08 (-0.18 to 0.02) | 0.12 |
| Type of facility | | | | |
| Autonomous/specialised hospital | 0.5 (0.44 to 0.56) | <0.001 | 0.14 (0.06 to 0.22) | <0.001 |
| Private hospital | 1.06 (0.97 to 0.14) | <0.001 | 0.68 (0.59 to 0.76) | <0.001 |
| District hospital | 0.08 (-0.01 to 0.17) | 0.07 | 0.17 (0.11 to 0.24) | <0.001 |
| Upazila health complex (ref) | | | | |
| Constant | – | – | 3.93 (3.78 to 4.08) | <0.001 |
| N | 1472 | | | |
| Probability > F | <0.001 | | | |
| R-squared | 0.63 | | | |
| Root MSE | 0.37 | | | |
| Mean VIF | 2.67 | | | |

MSE, mean square error; ref, reference; VIF, variance inflation factor.

Costs varied between urban and rural areas, with household COI significantly greater when care was sought from urban-located hospitals. An earlier study reported higher treatment costs if care was sought from tertiary level hospitals compared with secondary level, and this finding was reaffirmed in Zhang *et al*'s review.^{12 27} This difference in costs might be due to the relative availability of secondary level public healthcare facilities in rural areas, which provide highly subsidised healthcare for pneumonia treatment-related costs, while tertiary hospitals have expensive resources.^{27 31}

Findings reveal that households face a substantial economic burden to manage treatment cost. Although Bangladesh has introduced *Haemophilus influenzae* type b (Hib) in 2009 and 10-valent pneumococcal conjugate vaccine (PCV-10) vaccine in 2015 to prevent vaccine-preventable pneumonia, this study reveals the continuing considerable economic burden of child pneumonia despite successful (84%) immunisation coverage.⁴² Further research is needed to assess the contribution of vaccine-preventable pneumonia to the health and economic burden in Bangladesh. In the multivariate analysis, LoS, income quintile,

type of facility and age of the child are identified as important predictors of household cost for severe childhood pneumonia management. Household costs in our study were most sensitive to hospital LoS. The average LoS was about 5 days, which is similar to the LoS described in studies conducted in low-resource settings such as Bangladesh, Kenya, Zambia, Jordan and Colombia.^{31 32 35 43} The negative association between age and COI may well reflect disease severity, with relatively more severe disease due to the immature immune status of young children <2 years old.¹⁴ With respect to the impact of income quintile, it is well reported that the wealthiest households consumed more healthcare services than the poorest counterparts in Bangladesh.^{14 15 41 44} The higher COI for wealthier households is likely to reflect affordability in contexts like Bangladesh, where households need to pay OOP fees for most healthcare services. In addition, the skew in our sample towards the upper income quintiles suggests that a large proportion of households in the lower income quintile do not seek care, likely due to economic burden. Strong policy initiatives are therefore essential to ensure the affordability and accessibility of healthcare services for



Mean household cost variation by each parameter

Figure 2 Tornado diagram of one-way sensitivity analysis using important cost parameters. Each bar represents the influence of variation on each parameter in relation to the base case results through the vertical line in the middle, with the most cost-sensitive parameters arranged from top to bottom. LoS, length of stay.

childhood pneumonia, particularly for poorer groups, to reduce inequality.

Strengths and limitations

This study presents detailed household COI estimation including indirect costs and cost variation among socioeconomic groups and households' coping strategies and determined the predictors of cost using primary data with a large sample size. Despite these strengths, this study has several limitations. First, indirect costs to households for severe pneumonia management might be underestimated because we valued unpaid time with the minimum wage rate. Second, since cost data were collected retrospectively, the study is subject to some recall bias because the interviewees needed to recall expenses. However, to reduce recall bias, they were asked to review prescriptions and receipts to complete the questionnaire. Finally, given the study perspective, we did not incorporate any costs borne by the provider, which might contribute to the underestimation of the total economic cost.

CONCLUSIONS

Severe pneumonia in young children is associated with substantial economic burden for households in Bangladesh. Costs varied significantly across facility type and location. In addition to ensuring Hib and PCV vaccine coverage, the findings highlight the potential efficiency and equity concerns to improve accessibility and affordability, particularly for poorer socioeconomic groups, to reduce household economic burden.

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Contributors MS and LG conceptualised and designed the study. MS, NHA, ASGF, GJF, NG, MJC and TA designed the study, data collection instruments, supervised the data collection and drafted the initial manuscript. MS and NA supervised the data

collection and analysed the data. LG supervised each stage of drafting the initial manuscript. NHA, NA, ASGF, GJF, NG, MJC, TA and LG critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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Supplementary material 1

Table S1: Household cost categories, included variables and description of measurement

| Cost category | Cost items | Cost Description | Cost unit | Time of collection & data source | Indicators/measures |
|-----------------------|-------------------------|--|--|--|--|
| Direct medical | Consultation | Any type of spending regarding consultation such as appointments with physicians, nurses, SACMOs, health workers or any other health professionals | - Exact amount spent per visit, number of visits per personnel type) -Total OOPE for all visits | Day of recruitment, day of discharge, day after discharge, follow-up cost through face-to-face interviews with either parents or relevant caregivers (in both intervention and control arms) | - Average cost per household for consultation for one episode of severe pneumonia, proportion of total cost for consultation |
| | Diagnostic test | Tests such as x-ray, blood glucose, CBC or any if carried out by the OOP of the households | - Direct spent by OOP, number of tests with names -Total OOPE for all diagnosis | | - Average cost per household, proportion of total cost for diagnostic tests |
| | Medicines | Any prescribed or non-prescribed drug bought by the households | - Name, quantity, price, amount spent per drug - Total OOPE for all medicines | | - Average cost and proportion of the total cost per household for medicines |
| | Other medical equipment | Any other items if bought by the households (syringe, needle, gloves, micropore etc.) | - Name, size, no. and price of each item with actual OOPE) -Total OOPE for all items | | - Average cost per household for any medical items and proportion of the cost among total. |
| | Therapeutic food | Any special food or micronutrient as per suggestion and borne by the households | - Name, amount, price of each item - Total OOPE | | - Average cost per household for any therapeutic food |
| Direct | Food items | Any type of food items purchased for children or for caregivers during | - Name, amount, price of food items -Total OOPE | | - Average cost for food items and proportion of total cost per household |

| Cost category | Cost items | Cost Description | Cost unit | Time of collection & data source | Indicators/measures |
|----------------------|------------------------|---|---|----------------------------------|---|
| non-medical | | seeking treatment | | | |
| | Hotel/lodging | Direct expenses borne by the households for staying in other places by any caregiver(s) | - Per night expense for renting any place or hotel per person, no. of days -Total OOPE | | - Average cost and proportion of the total expenses |
| | Transportation | All types of vehicle used with cost accounting the whole treatment period by all caregivers | - Type of vehicles, time involvement, actual fare, no. of trips throughout treatment period by each vehicle type and OOPE -Total transportation cost | | - Average cost per households for transportation |
| | Tips/informal payments | Any tips provided by the household for any type of services taken during the treatment period | - Total amount given by each type of service, actual OOPE -Total spending | | - Average cost per households and the proportion of the total cost |
| Indirect cost | Waiting time | Capturing the real time taken for any visits or any services regarding treatment of every caregivers (opportunity cost/wage/income/productivity loss) | -Time spent by each care givers (in minutes, for each type of waiting regarding treatment) - Productivity /wage loss | | - Average wage loss or productivity loss experienced by the household |

| Cost category | Cost items | Cost Description | Cost unit | Time of collection & data source | Indicators/measures |
|---------------|------------------------------------|---|---|----------------------------------|---|
| | Time involvement of the caregivers | For caring of the children for the entire treatment period (opportunity cost) | -Time spent by each care givers (in minutes, for each type of waiting regarding treatment) - Productivity /wage loss | | - Average wage loss or productivity loss experienced by the household |

Note: OOPE = Out-of-pocket expenditure; SACMO = Sub-Assistant Community Medical Officers; CBC= Complete blood count

Supplementary material 2

Q. No: | | | | |

C. : | | | | |

Survey tool

Household Questionnaire

Study Title

Effectiveness trial of day-care versus usual care management of severe pneumonia with malnutrition in children using the existing health system of Bangladesh

International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b)

Section 1. Identification information

1. Name of the Hospital/facility:
2. Address of the hospital:
3. Number of bed:
4. Patient ID: | | | | | | | |
5. Name of the Disease:
6. Type of care: Day Care Approach (DCA) ... (1) Existing Treatment (ET) ... (2) | |
7. Admission date and time for DCA patient (24 hours)
Date | | | | | | | | (Day-Month-Year) Time: | | | | | | | |
8. Admission date and time for ET patient (24 hours)
Date | | | | | | | | (Day-Month-Year) Time: | | | | | | | |
9. Discharge date and time for ET patient (24 hours)
Date | | | | | | | | (Day-Month-Year) Time: | | | | | | | |
10. Name of the patient:
11. Name of the respondent:
12. Age of the respondent (in years): | | | | |
13. Relation with patient (Use code): | | | | |

Relationship code: Mother (01), Father (02), Brother (03), Sister (04), Uncle/Aunt (05), Grandparents (06), Neighbor (07), Other (Please specify)..... (77)

14. **Contact No** (Mobile/Telephone):
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
15. Home Address (in briefly)
.....
16. Interviewer ID: | | | | | | | |
17. Interview date and time (24 hours):
Date: | | | | | | | | (Day-Month-Year)
Time: | | | | | | | |
18. Interview end date and time (24 hours):
Date: | | | | | | | | (Day-Month-Year)
Time: | | | | | | | |

| Section 2. Background information | | | | | | | | | |
|---|---|--|--|--|--|-----------------|--|--|-----|
| 1.Age of the patient | | | Year | | | Month | | | Day |
| 2. Gender | Male. . . .(1) Female. . . . (2) <input type="checkbox"/> | | | | | | | | |
| 3. Mother's education (schooling year) | Schooling year <input type="text"/> <input type="text"/> Able to signature..... (44) Illiterate..... (55) Don't know (66) | | | | | | | | |
| 4. Father's education (schooling year) | Schooling year <input type="text"/> <input type="text"/> Able to signature..... (44) Illiterate..... (55) Don't know (66) | | | | | | | | |
| 5. Mother's occupation (Please use the code) | <input type="text"/> <input type="text"/> | | <u>Occupation code:</u> Farmer (01), Day labor (02), Rickshaw pular (03), Driver (04), Garments worker (05), waterman/boatman (06), Govt. employee (07),Private employee (08), Business (09), Teacher (10), Housewife (11), Immigrant (12), Student (13),Unemployee (14), Retired (15), Maidservant (16), Beggar (17), Don't know (66), Not applicable (99), Other (88)_____ | | | | | | |
| 6. Father's occupation (Please use the code) | <input type="text"/> <input type="text"/> | | | | | | | | |
| 7.Household member | Total members (in number) <input type="text"/> a. Members aged 14 years and below <input type="text"/> b. Members aged 15 to 64 years <input type="text"/> c. Members aged 64 years and above <input type="text"/> | | | | | | | | |
| 8. Total monthly income of the household | <input type="text"/> (BDT) | | | | | | | | |
| 9. Total monthly expenditure of the household (BDT) (in last month) | Name of the cost | | | | | Amount (In BDT) | | | |
| | 1.Food | | | | | | | | |
| | 2.House rent | | | | | | | | |
| | 3.Electricity bill | | | | | | | | |
| | 4.Water bill | | | | | | | | |
| | 5.Gas bill | | | | | | | | |
| | 6.Phone/mobile bill | | | | | | | | |
| | 7.Internet/dish bill | | | | | | | | |
| | 8.Education | | | | | | | | |
| | 9.Transportation | | | | | | | | |
| | 10.Healthcare/treatment | | | | | | | | |
| | 11. Wear clothes | | | | | | | | |
| | 12.Money sent to home/village | | | | | | | | |
| | 13.Others (i.e. cosmetics, cleaning) | | | | | | | | |
| | 14. Total cost | | | | | | | | |

| | | | |
|--|--|----------------------|-------------------------------------|
| 10. Did you have any healthcare related cost for household members in last three months? | Yes (1) <input type="text"/> No (2) <input type="text"/> → Q.12 | | |
| 11. Costs for healthcare | Indicators | Amount (BDT) | |
| | Registration fee | | |
| | Consultant fee | | |
| | Drug | | |
| | Hospital bed fee | | |
| | Investigation | | |
| | Food | | |
| | Transportation | | |
| | Tips | | |
| | Other (please specify) | | |
| | Total | | |
| 12. List of Items/assets for patients household. | Name of items/assets | Yes-(1) No-(2) | Functioning -(1) Not-functioning-2) |
| | Electricity | <input type="text"/> | <input type="text"/> |
| | Radio/tap-recorder | <input type="text"/> | <input type="text"/> |
| | Television | <input type="text"/> | <input type="text"/> |
| | DVD/VCD player | <input type="text"/> | <input type="text"/> |
| | Mobile/Telephone | <input type="text"/> | <input type="text"/> |
| | Refrigerator | <input type="text"/> | <input type="text"/> |
| | Almirah/Weardrop | <input type="text"/> | <input type="text"/> |
| | Table | <input type="text"/> | <input type="text"/> |
| | Chair | <input type="text"/> | <input type="text"/> |
| | Watch (wall/table) | <input type="text"/> | <input type="text"/> |
| | Bycycle | <input type="text"/> | <input type="text"/> |
| | Motorcycle/tempu | <input type="text"/> | <input type="text"/> |
| | Rickshaw/Van | <input type="text"/> | <input type="text"/> |
| | Autorickshaw/CNG | <input type="text"/> | <input type="text"/> |
| | Motor car/Track/Micro-bus | <input type="text"/> | <input type="text"/> |
| | Cart/horse cart | <input type="text"/> | <input type="text"/> |
| | Boat | <input type="text"/> | <input type="text"/> |
| | Engine powered boats | <input type="text"/> | <input type="text"/> |
| | Sewing machine | <input type="text"/> | <input type="text"/> |
| | Fan | <input type="text"/> | <input type="text"/> |
| | Water pump | <input type="text"/> | <input type="text"/> |
| | Sofa set | <input type="text"/> | <input type="text"/> |
| Other (Please specify | <input type="text"/> | <input type="text"/> | |

| 13. What is the main element of the floor? | Concrete floor.....(01) Semi concrete floor.....(02) Mud floor (03) <input type="text"/> <input type="text"/> Tiles.....(04) Other (specify).....(77) | | | | | | | | | | | | | | | | | |
|--|--|--|---|--|------------------------|------|---------------------|---|------------------|---|--------------|---|----------|---|------------------------------|---|------------------|---|
| 14. What is the main element of the Roof? | Cement/Concrete.....(01) Tin(02) Bamboo (03) <input type="text"/> <input type="text"/> Polythene(04) Other (specify).....(77) | | | | | | | | | | | | | | | | | |
| 15. What is the main element of the wall? | Cement/Concrete.....(01) Tin(02) Bamboo (03) <input type="text"/> <input type="text"/> Polythene(04) Other (specify).....(77) | | | | | | | | | | | | | | | | | |
| Comments: | | | | | | | | | | | | | | | | | | |
| Section 3. Cost incurred before the current facility | | | | | | | | | | | | | | | | | | |
| 1. Before this current facility, did patient receive any treatment from any other facility for this pneumonia episode? | | Yes(1) <input type="text"/> No (2) → go to section-4 | | | | | | | | | | | | | | | | |
| 2. How many facility/provider visited? | | <input type="text"/> | | | | | | | | | | | | | | | | |
| 3. Where did patient receive treatment? | 1 st visit <input type="text"/> 2 nd visit <input type="text"/> 3 rd visit <input type="text"/> 4 th visit <input type="text"/> | | <table border="1"> <thead> <tr> <th>Name of the facilities</th> <th>code</th> </tr> </thead> <tbody> <tr> <td>Government facility</td> <td>1</td> </tr> <tr> <td>Private facility</td> <td>2</td> </tr> <tr> <td>NGO facility</td> <td>3</td> </tr> <tr> <td>Pharmacy</td> <td>4</td> </tr> <tr> <td>Traditional healer/homeopath</td> <td>5</td> </tr> <tr> <td>Other (sepecify)</td> <td>6</td> </tr> </tbody> </table> | | Name of the facilities | code | Government facility | 1 | Private facility | 2 | NGO facility | 3 | Pharmacy | 4 | Traditional healer/homeopath | 5 | Other (sepecify) | 6 |
| Name of the facilities | code | | | | | | | | | | | | | | | | | |
| Government facility | 1 | | | | | | | | | | | | | | | | | |
| Private facility | 2 | | | | | | | | | | | | | | | | | |
| NGO facility | 3 | | | | | | | | | | | | | | | | | |
| Pharmacy | 4 | | | | | | | | | | | | | | | | | |
| Traditional healer/homeopath | 5 | | | | | | | | | | | | | | | | | |
| Other (sepecify) | 6 | | | | | | | | | | | | | | | | | |
| 4. Travel time to and from facility used before the current hospital? | 1 st visit <input type="text"/> (hour:minute) | 2 nd visit <input type="text"/> (hour:minute) | 3 rd visit <input type="text"/> (hour:minute) | 4 th visit <input type="text"/> (hour:minute) | | | | | | | | | | | | | | |
| 5. How much time you had to wait to get the service in the facility? | 1 st visit <input type="text"/> (hour:minute) | 2 nd visit <input type="text"/> (hour:minute) | 3 rd visit <input type="text"/> (hour:minute) | 4 th visit <input type="text"/> (hour:minute) | | | | | | | | | | | | | | |
| 6. Did the patient admit in these facility? (if yes, Length of stay (LOS)) | Yes (1) No (2) <input type="text"/> | | | | | | | | | | | | | | | | | |
| | 1 st visit <input type="text"/> (hour:minute) | 2 nd visit <input type="text"/> (hour:minute) | 3 rd visit <input type="text"/> (hour:minute) | 4 th visit <input type="text"/> (hour:minute) | | | | | | | | | | | | | | |

| | Description | Total spending (in BDT) | | | |
|---|--|---|---|---|-----------------------|
| | | 1 st visit | 2 nd visit | 3 rd visit | 4 th visit |
| 7. Total amount spent for service (BDT). | Registration | | | | |
| | Consultant fee | | | | |
| | Investigation | | | | |
| | Medicine | | | | |
| | Hospital bed fee | | | | |
| | Food cost | | | | |
| | Transportation | | | | |
| | Tips | | | | |
| | Other (specify) | | | | |
| | Total cost | | | | |
| 8. Were there caregivers in the hospital for taking care during the illness of the patient? (if yes, specify relation code, age, occupation, monthly income and wage/income loss) Relationship code: Mother (01), Father (02), Brother (03), Sister (04), Uncle/Aunt (05), Grandparents (06), Neighbor (07), Other (Please specify)(77) Occupation code: Farmer (01), Day labor (02), Rickshaw pular (03), Driver (04), Garments worker (05), waterman/boatman (06), Govt. employee (07), Private employee (08), Business (09), Teacher (10), Housewife (11), Immigrant (12), Student (13), Unemployed (14), Retired (15), Maidservant (16), Beggar (17), Don't know (66), Not applicable (99), Other (88)_____ | Yes (1) No(2) <input type="checkbox"/> | | | | |
| | Visit | Caregiver 1 | Caregiver 2 | Caregiver 3 | |
| | 1 st visit | Relation <input type="text"/> | Relation <input type="text"/> | Relation <input type="text"/> | |
| | | Age <input type="text"/> | Age <input type="text"/> | Age <input type="text"/> | |
| | | Time (day-hour-minute) <input type="text"/> | Time (day-hour-minute) <input type="text"/> | Time (day-hour-minute) <input type="text"/> | |
| | | Occupation code <input type="text"/> | Occupation code <input type="text"/> | Occupation code <input type="text"/> | |
| | | Monthly income <input type="text"/> | Monthly income <input type="text"/> | Monthly income <input type="text"/> | |
| | | Income loss- <input type="text"/> | Income loss- <input type="text"/> | Income loss- <input type="text"/> | |
| | 2 nd visit | Relation <input type="text"/> | Relation <input type="text"/> | Relation <input type="text"/> | |
| | | Age <input type="text"/> | Age <input type="text"/> | Age <input type="text"/> | |
| | | Time (day-hour-minute) <input type="text"/> | Time (day-hour-minute) <input type="text"/> | Time (day-hour-minute) <input type="text"/> | |
| | | Occupation code <input type="text"/> | Occupation code <input type="text"/> | Occupation code <input type="text"/> | |
| | | Monthly income <input type="text"/> | Monthly income <input type="text"/> | Monthly income <input type="text"/> | |
| | | Income loss- <input type="text"/> | Income loss- <input type="text"/> | Income loss- <input type="text"/> | |
| | 3 rd visit | Relation <input type="text"/> | Relation <input type="text"/> | Relation <input type="text"/> | |
| | | Age <input type="text"/> | Age <input type="text"/> | Age <input type="text"/> | |
| | | Time (day-hour-minute) <input type="text"/> | Time (day-hour-minute) <input type="text"/> | Time (day-hour-minute) <input type="text"/> | |
| | | Occupation code <input type="text"/> | Occupation code <input type="text"/> | Occupation code <input type="text"/> | |
| | | Monthly income <input type="text"/> | Monthly income <input type="text"/> | Monthly income <input type="text"/> | |
| | | Income loss- <input type="text"/> | Income loss- <input type="text"/> | Income loss- <input type="text"/> | |

| | | | | |
|---|------------------------------------|----------------------------|----------------------------|----------------------------|
| | Visit | Caregiver 1 | Caregiver 2 | Caregiver 3 |
| | 4 th visit | Relation | Relation | Relation |
| | | Age | Age | Age |
| | | Time (day-hour-minute) | Time (day-hour-minute) | Time (day-hour-minute) |
| | | Occupation code | Occupation code | Occupation code |
| | | Monthly income | Monthly income | Monthly income |
| | | Income loss- | Income loss- | Income loss- |
| 9. Was there caregiver hotel rent? (If yes, how amount?) | Yes (1) No (2) | | | |
| | Visit | Caregiver 1 | Caregiver 2 | Caregiver 3 |
| | 1 st visit | | | |
| | 2 nd visit | | | |
| | 3 rd visit | | | |
| | 4 th visit | | | |
| 10. Was there caregiver food cost? (If yes, how amount?) | Yes (1) No (2) | | | |
| | Visit | Caregiver 1 | Caregiver 2 | Caregiver 3 |
| | 1 st visit | | | |
| | 2 nd visit | | | |
| | 3 rd visit | | | |
| | 4 th visit | | | |
| 11. Was there any tips related cost? (If yes, how amount?) | Yes (1) No (2) | | | |
| | Visit | Caregiver 1 | Caregiver 2 | Caregiver 3 |
| | 1 st visit | | | |
| | 2 nd visit | | | |
| | 3 rd visit | | | |
| | 4 th visit | | | |
| 12. Other cost for caregiver's in the hospital. (e.g. bowl, mosquito coil) If yes, how amount? | Yes (1) No (2) | | | |
| | Visit | Caregiver 1 | Caregiver 2 | Caregiver 3 |
| | 1 st visit | | | |
| | 2 nd visit | | | |
| | 3 rd visit | | | |
| | 4 th visit | | | |
| Comments: | | | | |

| Section 4. Cost incurred while staying in the current facility | | | | | | |
|---|--------------------|---|--|-----|---------------------------------|-----|
| 1. How did patient get in this hospital? How long it took? Code: 01 = Rickshaw / van 02 = Bus 03 = CNG/Taxi 04 = Private car 05 = Walking 77 = Other (Specify) | | Type of transport | 1. <input type="text"/> <input type="text"/> 2. <input type="text"/> <input type="text"/> 3. <input type="text"/> <input type="text"/> | | | |
| | | Total time | <input type="text"/> : <input type="text"/> : <input type="text"/> (Hour : minute) | | | |
| 2. a) Was money spent for transportation for visit? If yes, how much was spent? | | Yes. . . . (1) No (2) <input type="text"/> <input type="text"/> <input type="text"/> (BDT) | | | | |
| 2.b) If not, reason for no travel cost? Own vehicle..... (01) Did not take money (02) Walk on foot (03) Other (Specify)..... (77) | | <input type="text"/> <input type="text"/> | | | | |
| 3. How much time did patient need to wait (waiting time) in the facility to get treatment? | | Total time | <input type="text"/> : <input type="text"/> : <input type="text"/> (Hour : minute) | | | |
| 4. Did you pay for admission/registration in the hospital/facility? If yes, how amount? | | Yes. . . (1) No.....(2) <input type="text"/> <input type="text"/> <input type="text"/> (BDT) | | | | |
| 5. Has the patient been paid for hospital bed charge? If yes, how amount? | | Yes. . . (1) No.....(2) <input type="text"/> <input type="text"/> <input type="text"/> (BDT) | | | | |
| 6. Did you pay for the consultation? If yes, how amount? | | Yes. . . (1) No.....(2) <input type="text"/> <input type="text"/> <input type="text"/> (BDT) | | | | |
| 7. How long time the health staff examined or provided individual service for the patient? | | Staff | Number of visit | | Total time of visit (in minute) | |
| | | Doctor | | | | |
| | | Nurse | | | | |
| | | SACMO | | | | |
| | | Other | | | | |
| 8. Did you spend for any diagnostic tests? If yes, mention quantity and cost by household and hospital. | | Yes. . . (1) No.....(2) <input type="text"/> | | | | |
| | Name of diagnostic | Total number | Household | | Hospital | |
| | | | Quantity | BDT | Quantity | BDT |
| | | Chest X-ray | | | | |
| | | RBS | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | Total | | | | | |

| | | | | | | | |
|--|--|--------------------------------|-----------------------------------|-----------|----------|----------|-----|
| 9. Did you spend for any drug/medicine and infusion? If yes, mention medicine code, quantity and cost. | | Yes. . . . (1) No (2) | | | | | |
| Medicine code | | Medicine code | Total quantity (File /Tablet /ml) | Household | | Hospital | |
| | | | | Quantity | BDT | Quantity | BDT |
| Inj:Ceftriaxon 500mg/750mg/1gm-(01) | Tab: Prednisolone-(19) | | | | | | |
| Syp:Multivitamin-(02) | Inj.Diazepam-(20) | | | | | | |
| Tab: Folic acid-(03) | 25% Glucose-(21) | | | | | | |
| Tab: Zinc-(04) | Norsol Drop-(22) | | | | | | |
| Cap:Vitamin-A-(05) | Syp.Kitotifen-(23) | | | | | | |
| ORS-(06) | Syp. Potassium chloride-(24) | | | | | | |
| Anti helminthes-(07) | Syp. Levosalbutamol-(25) | | | | | | |
| Syp:Salbutamol-(08) | Syp. Ambroxol hydrochloride(26) | | | | | | |
| Inf:Normal Saline-(09) | Inj. hydrocortisone sodium succinate(Cotson)(27) | | | | | | |
| Meconazole oral suspension(10) | Syp.Cefixime(28) | | | | | | |
| Syp:Paracetamol-(11) | Inj. Gentamicin (29) | | | | | | |
| Paracetamol suppository-(12) | Nystatin Oral Suspension(30) | | | | | | |
| Salbutamol solution for nebulization-13 | Syp. Azithromycin(31) | | | | | | |
| Ipratropium Bromide (Iprex) Solution-(14) | Clotrimazole cream(32) | | | | | | |
| syp:Amoxycillin-(15) | Cefuroxime Sodium(33) | | | | | | |
| cap:Amoxycillin 250mg-(16) | Inj. Ceftazidime(34) | | | | | | |
| Syp. Zinc-(17) | Inj. Ondansetron Hydrochloride(Emistat)(35) | | | | | | |
| Syp: Flucloxacillin-(18) | | Total | | | | | |
| 10. Did you spend for buying any materials during taking treatment for severe pneumonia? If yes, mention quantity and amount. | | Yes. . . . (1) No (2) | | | | | |
| Name of disposable items | | Total quantity | Household | | Hospital | | |
| | | | Quantity | BDT | Quantity | BDT | |
| Butterfly needle (22G/23G/24G/25G) | | | | | | | |
| Syringe (1CC/3CC/5CC/10CC) | | | | | | | |
| Micropore (1 inche/ 2 inche) | | | | | | | |
| Canula (22G/24G) | | | | | | | |
| IV set for saline | | | | | | | |
| Other (specify) | | | | | | | |
| Total | | | | | | | |
| 11. Was there need pulse oximeter for the patients? If yes, how many times. | | Yes (1) No (2) | | | | | |
| Total quantity | | | | | | | |

| | | | | | | |
|--|------------------------------------|-----------------------------|-------------------|---------------------|------------|-----|
| 12. Did you spend money for oxygen? If yes, how many times? | Yes . . . (1) No(2) | | | | | |
| | Total quantity | Household | | Hospital | | |
| | | Quantity | Total time | Quantity | Total time | |
| | | | | | | |
| 13. Did you spend money for nebulizer? If yes, how many times. | Yes. . . (1) No(2) | | | | | |
| | Total quantity | Household | | Hospital | | |
| | | Quantity | Total time | Quantity | Total time | |
| | | | | | | |
| 14. Did you spend for therapeutic diet for treating malnutrition? If yes, mention quantity and amount. | Yes. . . (1) No(2) | | | | | |
| | Name of dietary food | Total quantity | Household | | Hospital | |
| | | | Quantity | BDT | Quantity | BDT |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Total | | | | | | |
| 15. Did you spend any money for stay in hotel/for lodging? If yes, how amount? | | Yes . . . (1) No(2) | | | | |
| | | | | (BDT) | | |
| 16. Did you spend for food? If yes, than mention the amount. | | Yes . . . (1) No(2) | | | | |
| | | | | (BDT) | | |
| 17. Did you spend for tips (intentional or unintentional)? If yes, how amount? | | Yes . . . (1) No(2) | | | | |
| | | | | (BDT) | | |
| 18. Did you spend any other cost during stay in hospital? (i.e. bowl, mosquito coil) If yes, how amount? | | Yes . . . (1) No(2) | | | | |
| | | | | (BDT) | | |
| 19. a) Coping mechanism used by household for healthcare cost and amount of cost (BDT)? (Multiple answer is Accepted) | Source of money for treatment | | Yes (1) No (2) | If yes, hou amount? | | |
| | 1. | Regular income | | | | |
| | 2. | Savings | | | | |
| | 3. | Borrowing | | | | |
| | 4. | Donations /help | | | | |
| | 5. | Sell the home appliances | | | | |
| | 6. | Sell the property | | | | |
| | 7. | Placing property mortgages | | | | |
| | 8. | Others | | | | |
| 9. | The family did not spend any money | | | | | |
| 19. b) If the family did not pay for the treatment, how managed the cost? | | | | | | |

| | | | |
|---|--------------------------------|---|--|
| 20. Did anybody take care of patient during illness in the hospital? (if yes, specify relation code, age, occupation, monthly income and wage loss) <u>Relationship code:</u> Mother (01), Father (02), Brother (03), Sister (04), Uncle/Aunt (05), Grandparents (06), Neighbor (07), Other (Please specify)..... (77) <u>Occupation code:</u> Farmer (01), Day labor (02), Rickshaw pular (03), Driver (04), Garments worker (05), waterman/boatman (06), Govt. employee (07), Private employee (08), Business (09), Teacher (10), Housewife (11), Immigrant (12), Student (13), Unemployee (14), Retired (15), Maidservant (16), Beggar (17), Don't know (66), Not applicable (99), Other (88)_____ | Yes (1) No (2) | | |
| | Caregiver | Relation , Time , Occupation and Monthly income | |
| | Caregiver 1 | Relation | |
| | | Age | |
| | | Time (day-hour-minute) | |
| | | Occupation code | |
| | | Monthly income- | |
| | Caregiver 2 | Income loss- | |
| | | Relation | |
| | | Age | |
| | | Time (day-hour-minute) | |
| | | Occupation code | |
| | Caregiver 3 | Monthly income- | |
| | | Income loss- | |
| | | Relation | |
| Age | | | |
| Time (day-hour-minute) | | | |
| 21. Treatment outcomes of the patients. | Code | Outcome of the treatment | |
| | 1 | Given the discharge clearance after being fully cured | |
| | 2 | Referred due to bad condition | |
| | 3 | Discharge clearance has been taken without being completely healthy by own choice | |
| | 4 | Left hospital by own choice | |
| | 5 | Has gone away from the hospital did not say anything | |
| | 77 | Other (specify) | |
| Comments: | | | |
| Section 5: Cost during/just after discharge (over the phone before first follow up) | | | |
| 1. Do you feel that your child is cured/healthy during discharge? | | Yes. . . . (1) No (2) | |
| 2. How did patient go back to home? How long it took? Duration of transport time. Code: 01 = Rickshaw / van 02 = Bus 03 = CNG/Taxi 04 = Private car 05 = Walking 77 = Other (Specify) | Type of transport | 1. 2. 3. | |
| | Total time | : (Hour : minute) | |

| | | | | | | | |
|--|--|---|-----------------------------------|----------------------|----------------------|----------------------|----------------------|
| 3. Was money spent for transportation? If yes, how much was spent? | | Yes. . . . (1) No (2) <input type="text"/> | | | | | |
| | | <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> (BDT) | | | | | |
| 3. b) If not, reason for no travel cost? Own vehicle..... (01) Did not take money (02) Walk on foot (03) Other (Specify)(77) | | <input type="text"/> <input type="text"/> | | | | | |
| 4. Did you spend for any drug/medicine during/after discharge? If yeas, mention medicine code, quantity and cost. | | Yes. . . . (1) No (2) | | | | | |
| | | Medicine code | Total quantity (File /Tablet /ml) | Household | | Hospital | |
| | | | | Quantity | BDT | Quantity | BDT |
| Medicine code | | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Inj:Ceftriaxon 500mg/750mg/1gm-(01) | Syp: Flucloxacillin-(18) Tab: Prednisolone-(19) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Syp:Multivitamin-(02) | Inj.Diazepam-(20) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Tab: Folic acid-(03) | 25% Glucose-(21) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Tab: Zinc-(04) | Norsol Drop-(22) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Cap:Vitamin-A-(05) | Syp.Kitotifen-(23) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| ORS-(06) | Syp. Potassium chloride- (24) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Anti helminthes-(07) | Syp. Levosalbutamol- (25) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Syp:Salbutamol-(08) | Syp. Ambroxol | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Inf:Normal Saline-(09) | hydrochloride(26) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Meconazole oral suspension-(10) | Inj. hydrocortisone sodium succinate(Cotson)(27) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Syp:Paracetamol-(11) | Syp.Cefixime(28) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Paracetamol suppository-(12) | Inj. Gentamicin (29) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Salbutamol solution for nebulization-13 | Nystatin Oral Suspension(30) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | Syp. Azithromycin(31) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Ipratropium Bromide (Iprex) Solution-(14) | Clotrimazole cream(32) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | Cefuroxime Sodium(33) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| syp:Amoxycillin-(15) | Inj. Ceftazidime(34) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| cap:Amoxycillin 250mg-(16) | Inj.Ondansetron | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Syp. Zinc-(17) | Hydrochloride(Emistat)(35) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | | Total | | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| 5. Did you spend for buying any materials during taking treatment for severe pneumonia? If yeas, mention name of items, quantity and cost. | | Yes. . . . (1) No (2) | | | | | |
| | | Name of disposable items | Total quantity | Household | | Hospital | |
| | | | | Quantity | BDT | Quantity | BDT |
| | | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| | | Total | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

| | | | | | | |
|--|--------------------------------|----------------|-----------|-----|----------|-----|
| 6. Did you spend for therapeutic diet for treating malnutrition? If yeas, mention name of items, quantity and cost. | Yes (1) No (2) | | | | | |
| | Name of food | Total quantity | Household | | Hospital | |
| | | | Quantity | BDT | Quantity | BDT |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Total | | | | | | |
| Comments: | | | | | | |

Thank you very much for your time.

Name of interviewer:

Name of supervisor:

Signature:

Signature:

Date:

Date:

Name of the PI:

Signature:

Date:

Supplementary material 2 : Complete case analysis

Table S2. Resources used, unit costs by types of care, and distribution of average household costs for one episode of severe childhood pneumonia in US\$ (n=1,442), 2019 price year

| Parameters | Resource used (n, %) | | | | Average costs per each parameter by type of facilities (US\$) | | | | | | | | Overall costs of treatment in US\$ (n=1,442) | | | | % of mean household costs |
|---|-----------------------|-------------|-------------|--------------|---|------|------------|------|------------|-----|--------------|-----|--|-------|--------|------|---------------------------|
| | Urban | | Rural | | Urban | | | | Rural | | | | | | | | |
| | SpHs/AHs(n=721) | PHs (n=206) | DH (n=145) | UHCs (n=370) | SpHs/AHs (n=721) | | PH (n=206) | | DH (n=145) | | UHCs (n=370) | | Mean | SD | Median | IQR | |
| | n (%) | n (%) | n (%) | n (%) | Mean | SD | Mean | SD | Mean | SD | Mean | SD | | | | | |
| Diagnostic tests | 598 (83.0) | 196 (95.5) | 73 (50.3) | 20 (5.4) | 8.1 | 5.8 | 13.4 | 17.9 | 1.7 | 4.7 | 0.3 | 3.0 | 5.6 | 10.1 | 3.2 | 8.1 | 3.9 |
| Medicine | 721 (100) | 206 (100.0) | 129 (89.0) | 338 (91.6) | 19.9 | 15.6 | 27.3 | 28.2 | 8.4 | 7.4 | 9.7 | 6.7 | 17.3 | 17.2 | 13.3 | 12.9 | 12.0 |
| Consultation/physician fee | 192 (26.7) | 125 (61.8) | 46 (31.7) | 33 (9.0) | 3.9 | 3.8 | 7.6 | 16.9 | 1.5 | 2.7 | 0.4 | 3.9 | 1.9 | 7.5 | 0.0 | 1.3 | 1.3 |
| Registration/admission fee | 714 (99.1) | 203 (98.6) | 144 (99.3) | 352 (95.7) | 0.5 | 0.3 | 2.9 | 2.4 | 0.1 | 0.0 | 0.2 | 0.4 | 0.8 | 1.5 | 0.3 | 0.3 | 0.5 |
| Medical consumables (e.g. syringe, cannula) | 614 (85.2) | 203 (98.6) | 119 (82.1) | 219 (59.5) | 3.1 | 2.9 | 6.7 | 5.3 | 1.2 | 1.0 | 1.7 | 2.0 | 2.9 | 3.2 | 2.2 | 3.6 | 2.0 |
| Bed/ Cabin charge | 84 (11.7) | 190 (92.7) | 2 (1.4) | 5 (1.3) | 18.0 | 12.6 | 22.7 | 37.9 | 0.1 | 1.5 | 0.4 | 4.4 | 4.6 | 18.8 | 0.0 | 0.0 | 3.2 |
| Nebulization | 593 (82.3) | 188 (91.4) | 2 (1.4) | 30 (8.2) | 10.0 | 6.4 | 16.5 | 12.2 | 0.0 | 0.1 | 0.2 | 2.5 | 3.4 | 8.3 | 0.0 | 0.0 | 2.4 |
| Oxygen | 11 (1.5) | 61 (30.0) | 0 (0.0) | 2 (0.5) | 1.2 | 0.8 | 3.1 | 12.2 | 0.0 | 0.0 | 0.0 | 0.4 | 0.5 | 4.8 | 0.0 | 0.0 | 0.3 |
| Therapeutic diet | 22 (3.1) | 12 (5.9) | 9 (6.2) | 11 (3.0) | 1.4 | 1.2 | 0.1 | 0.9 | 0.1 | 0.4 | 0.0 | 0.4 | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 |
| Direct Medical | - | - | - | - | - | - | - | - | - | - | - | - | 37.0 | 50.9 | 22.7 | 31.7 | 25.7 |
| Transportation | 689 (95.6) | 205 (99.6) | 145 (100.0) | 363 (98.6) | 6.2 | 5.1 | 10.6 | 8.4 | 3.8 | 4.3 | 3.6 | 3.6 | 5.8 | 7.0 | 4.2 | 6.2 | 4.0 |
| Informal payment | 414(57.5) | 88 (42.3) | 1 (0.7) | 36 (9.8) | 1.1 | 0.7 | 1.0 | 2.5 | 0.0 | 0.1 | 0.1 | 0.3 | 0.5 | 1.2 | 0.0 | 0.6 | 0.3 |
| Expenditure for caregivers | 525 (72.9) | 177 (86.4) | 137 (94.5) | 277 (75.3) | 5.8 | 5.1 | 9.0 | 9.8 | 4.8 | 3.5 | 3.2 | 3.3 | 4.7 | 5.9 | 3.3 | 5.7 | 3.3 |
| Others | 39 (5.5) | 29 (14.1) | 4 (2.8) | 45 (12.2) | 2.0 | 0.6 | 1.1 | 4.7 | 0.1 | 1.1 | 0.2 | 1.5 | 0.3 | 2.1 | 0.0 | 0.0 | 0.2 |
| Direct Non-Medical | - | - | - | - | - | - | - | - | - | - | - | - | 11.3 | 11.7 | 8.7 | 9.6 | 7.8 |
| LoS (Mean, ±SD) | 5.7 (2.4) | 5.7 (±3.1) | 3.1 (±1.4) | 3.8 (±2.3) | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Total direct cost | - | - | - | - | - | - | - | - | - | - | - | - | 48.3 | 58.2 | 31.3 | 38.3 | 33.5 |
| Total indirect cost | - | - | - | - | - | - | - | - | - | - | - | - | 95.8 | 73.5 | 76.3 | 59.8 | 66.5 |
| Total household cost | - | - | - | - | - | - | - | - | - | - | - | - | 144.1 | 115.2 | 113.9 | 96.4 | 100.0 |

SpH- Specialized hospitals/ AH-autonomous hospitals (n=4); PH- Private hospitals (n=8); DH- District Hospital (n=1); UHC- Upazila Health Complex (n=3)

Table S3. Bi-variate and multiple logged linear regression model (n=1,442)

| Variables | Unadjusted model | | | | | Adjusted model | | | | |
|--------------------------------|------------------|------|--------|-------|---------|----------------|------|--------|-------|---------|
| | Coef. | SE | 95% CI | | P-value | Coef. | SE | 95% CI | | P-value |
| | | | Lower | Upper | | | | Lower | Upper | |
| Length of stay (LoS) | 0.16 | 0.01 | 0.13 | 0.19 | <0.001 | 0.14 | 0.01 | 0.12 | 0.16 | <0.001 |
| Patient's age in months | -0.01 | 0.00 | -0.01 | 0.00 | <0.001 | 0.00 | 0.00 | -0.01 | 0.00 | 0.01 |
| Mother's education | | | | | | | | | | |
| No formal education (ref) | - | - | - | - | | - | - | - | - | |
| Upto primary | -0.20 | 0.07 | -0.33 | -0.07 | <0.001 | 0.00 | 0.04 | -0.08 | 0.09 | 0.94 |
| Secondary | -0.10 | 0.07 | -0.23 | 0.03 | 0.14 | 0.06 | 0.04 | -0.02 | 0.15 | 0.17 |
| Higher | 0.12 | 0.08 | -0.04 | 0.28 | 0.13 | 0.11 | 0.05 | 0.00 | 0.22 | 0.05 |
| Father's education | | | | | | | | | | |
| No formal education (ref) | - | - | - | - | | - | - | - | - | |
| Upto primary | -0.18 | 0.06 | -0.30 | -0.07 | <0.001 | -0.02 | 0.04 | -0.09 | 0.06 | 0.68 |
| Secondary | -0.07 | 0.06 | -0.19 | 0.04 | 0.21 | -0.02 | 0.04 | -0.09 | 0.06 | 0.68 |
| Higher | 0.14 | 0.07 | 0.01 | 0.27 | 0.03 | 0.01 | 0.05 | -0.08 | 0.10 | 0.84 |
| Wealth quintile | | | | | | | | | | |
| Poorest (ref) | - | - | - | - | | - | - | - | - | |
| Poorer | 0.19 | 0.05 | 0.10 | 0.28 | <0.001 | 0.07 | 0.04 | -0.01 | 0.14 | 0.08 |
| Middle | 0.44 | 0.05 | 0.34 | 0.54 | <0.001 | 0.15 | 0.05 | 0.06 | 0.25 | <0.001 |
| Richer | 0.62 | 0.05 | 0.52 | 0.71 | <0.001 | 0.20 | 0.05 | 0.10 | 0.30 | <0.001 |
| Richest | 0.79 | 0.05 | 0.69 | 0.89 | <0.001 | 0.31 | 0.05 | 0.21 | 0.42 | <0.001 |
| Place of residence | | | | | | | | | | |
| Urban | 0.62 | 0.03 | 0.56 | 0.68 | <0.001 | - | - | - | - | - |
| Rural (ref) | | | | | | | | | | |
| Father's occupation | | | | | | | | | | |
| Transport workers (ref) | - | - | - | - | | - | - | - | - | |
| Informal workers | -0.03 | 0.07 | -0.16 | 0.10 | 0.67 | 0.05 | 0.04 | -0.04 | 0.13 | 0.31 |
| Farmer | -0.32 | 0.07 | -0.46 | -0.18 | <0.001 | 0.12 | 0.05 | 0.02 | 0.23 | 0.02 |
| Salaried employees | 0.12 | 0.06 | 0.00 | 0.23 | 0.04 | 0.05 | 0.04 | -0.03 | 0.13 | 0.21 |
| Business | 0.12 | 0.06 | 0.00 | 0.24 | 0.05 | 0.12 | 0.04 | 0.04 | 0.20 | <0.001 |
| Others | 0.04 | 0.08 | -0.12 | 0.19 | 0.62 | 0.02 | 0.05 | -0.08 | 0.13 | 0.65 |
| Facility type | | | | | | | | | | |

| | | | | | | | | | | |
|---------------------------------|------|------|-------|------|--------|-------|------|------|------|--------|
| Autonomous/Specialized hospital | 0.50 | 0.03 | 0.43 | 0.57 | <0.001 | 0.09 | 0.05 | 0.00 | 0.19 | 0.04 |
| District hospital | 0.05 | 0.05 | -0.05 | 0.15 | 0.30 | 0.15 | 0.04 | 0.08 | 0.23 | <0.001 |
| Private | 1.08 | 0.04 | 1.00 | 1.17 | <0.001 | 0.67 | 0.05 | 0.57 | 0.76 | <0.001 |
| Upazila Health Complex (ref) | | | | | | - | | | | |
| Constant | - | - | - | - | - | 3.71 | 0.08 | 3.55 | 3.87 | 0.00 |
| N | | | | | | 1,442 | | | | |
| <i>Prob > F</i> | | | | | | 0.00 | | | | |
| <i>R-squared</i> | | | | | | 0.60 | | | | |
| <i>Root MSE</i> | | | | | | 0.41 | | | | |
| <i>Mean VIF</i> | | | | | | 2.30 | | | | |

Coef., Coefficient; *SE*, Standard Error; *CI*, Confidence Interval; *VIF*, Variance Inflation Factor;

Supplementary 3

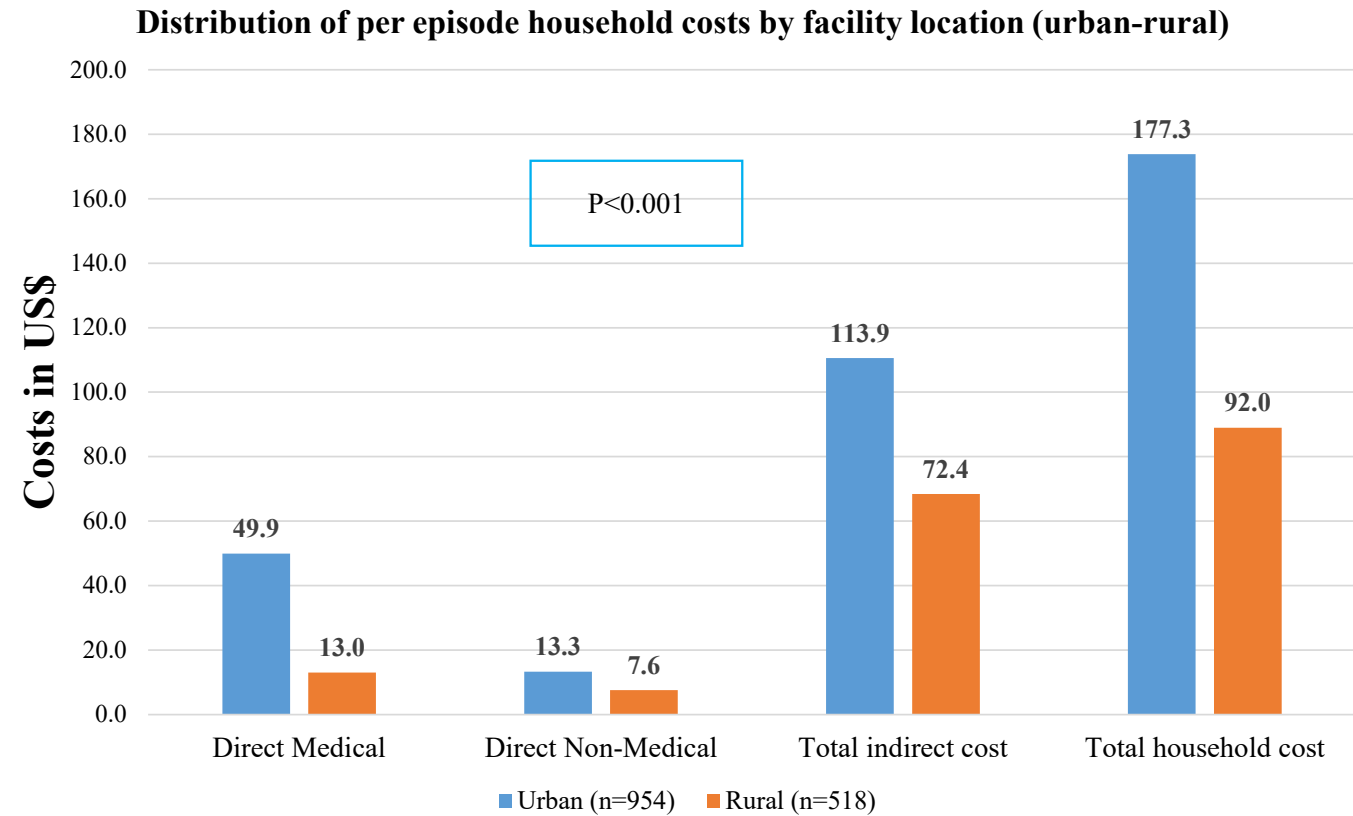


Fig. S1. Distribution of household costs per episode by facility location (urban-rural) (N=1,472)

Supplementary material 4

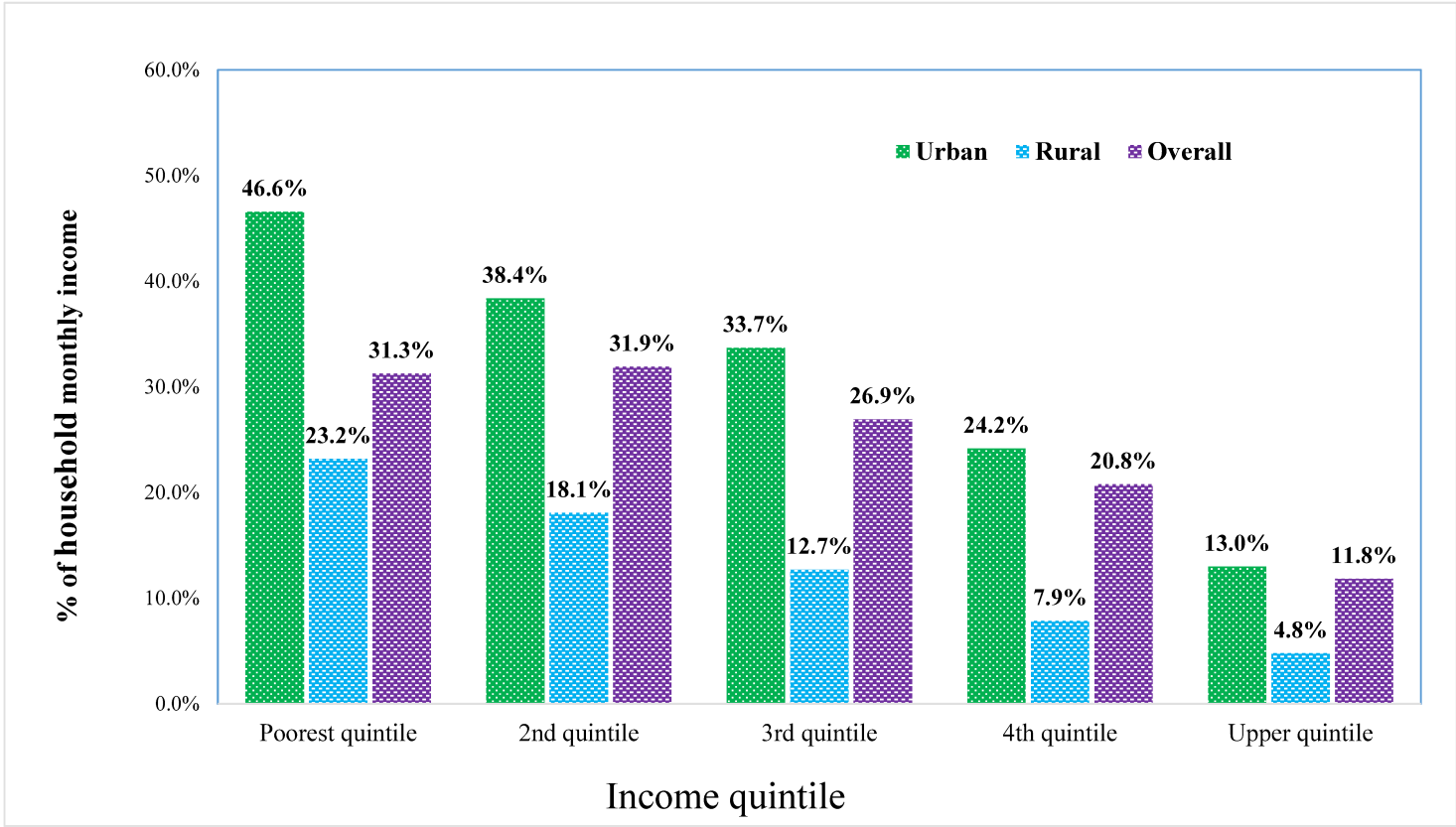


Fig. S2. Out-of-pocket (OOP) expenditure per episode of childhood severe pneumonia as a percentage of household’s monthly income

Supplementary material 5

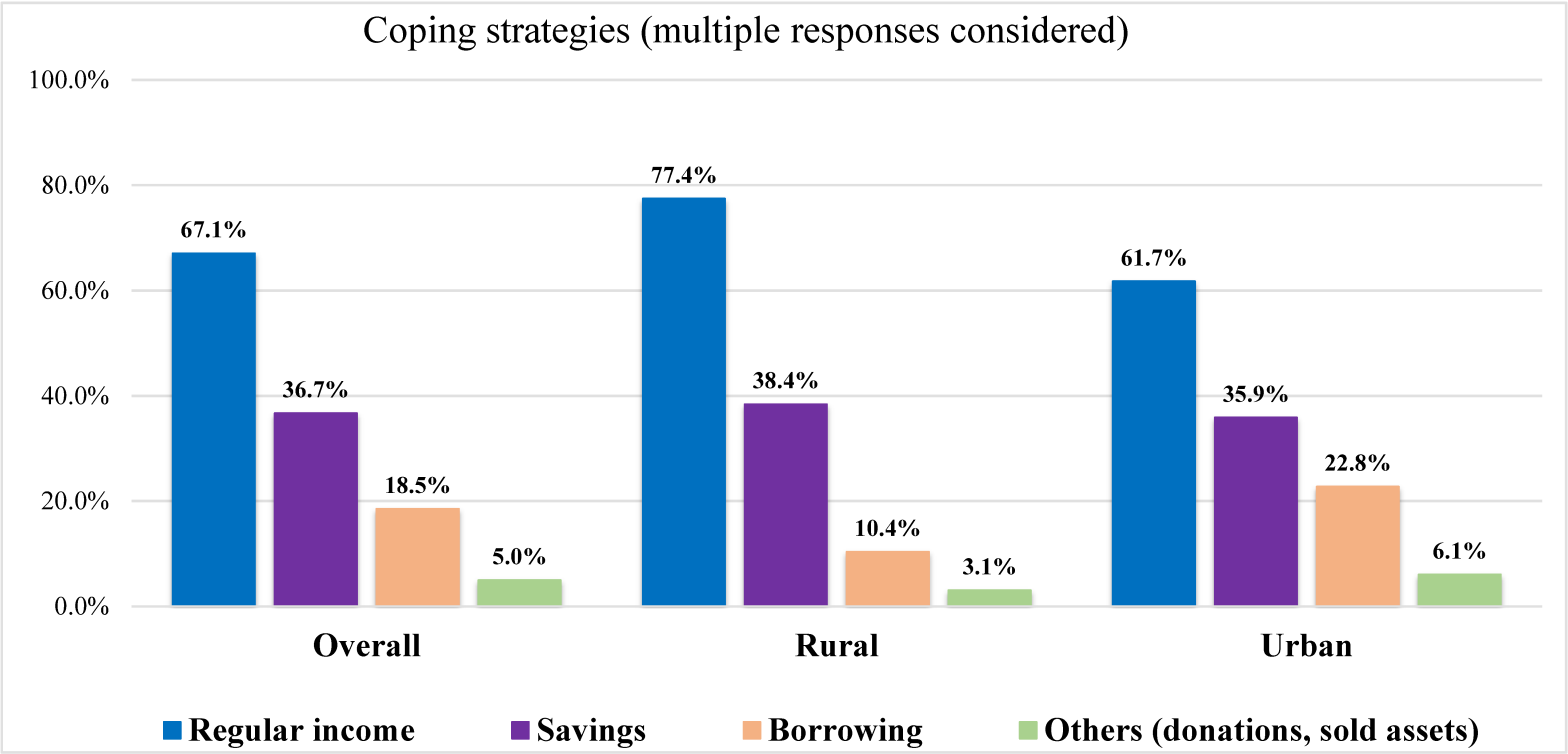


Fig. S3. Household strategies to cope expenses for severe childhood pneumonia treatment