

Household Costs for Treatment of Severe Pneumonia in Pakistan

Salim Sadruddin,* Shafqat Shehzad, Abdul Bari, Attaullah Khan, Ibad-ul-Haque, Amanullah Khan, and Shamim Qazi
*Save the Children, Department of Health and Nutrition, Westport, Connecticut; Health Services Academy, Islamabad, Pakistan;
Save the Children Pakistan, Islamabad, Pakistan; Department of Maternal, Newborn, Child and Adolescent Health, WHO,
Geneva, Switzerland*

Abstract. Current World Health Organization (WHO) guidelines for severe pneumonia treatment of under-5 children recommend hospital referral. However, high treatment cost is a major barrier for communities. We compared household costs for referred cases with management by lady health workers (LHWs) using oral antibiotics. This study was nested within a cluster randomized trial in Haripur, Pakistan. Data on direct and indirect costs were collected through interviews and record reviews in the 14 intervention and 14 control clusters. The average household cost/case for a LHW managed case was \$1.46 compared with \$7.60 for referred cases. When the cost of antibiotics provided by the LHW program was excluded from the estimates, the cost/case came to \$0.25 and \$7.51 for the community managed and referred cases, respectively, a 30-fold difference. Expanding severe pneumonia treatment with oral amoxicillin to community level could significantly reduce household costs and improve access to the underprivileged population, preventing many child deaths.

INTRODUCTION

Pneumonia is one of the leading causes of childhood mortality globally, with estimated 1.25 million deaths per year.¹ Of the estimated 150 million new cases of pneumonia reported every year, 7–13% are severe enough to be life threatening and require hospitalization.^{2,3} Globally, care seeking for pneumonia is low and the proportion of children receiving appropriate antibiotics for pneumonia is only 27%.⁴ Pneumonia is a leading cause of death in children in Pakistan,¹ however, only 50% of children with pneumonia receive antibiotics.⁵

Meta-analysis by Sazawal and Black⁶ estimated that community case management (CCM) of suspected pneumonia with oral antibiotics can reduce pneumonia-specific mortality by 35%. Current World Health Organization (WHO) guidelines recommend that health workers refer children with severe pneumonia (chest in-drawing) to a hospital for treatment with an injectable antibiotic.⁷ In many developing countries, this is not feasible or practiced because of poor transportation, cost,⁸ distance, lack of child care at home, or cultural perceptions.^{9,10} Evidence shows that treatment of WHO-defined severe pneumonia on an outpatient basis with oral antibiotics is safe and efficacious.^{11,12} Expanding oral treatment of severe pneumonia to the community level may not only improve access and compliance, but also significantly reduce economic burden on the poor families.

The economic burden of a disease can be viewed from a health system or a household perspective. In addition to the direct medical costs, composed of expenses on medicines, investigations, consultation, and hospital stay, households of sick children incur non-medical expenses for transportation, food, child care, and lost income in the form of caregiver time and/or lost wages. Data from developing countries on cost of severe pneumonia treatment of children < 5 years of age is scant, more so for studies estimating household costs. A study conducted in Northern Pakistan¹³ reported a total cost of \$142 and household cost of \$17.61 for inpatient treatment of one episode of severe pneumonia. Another study in India¹⁴

estimated provider cost of US\$83.89 and US\$146.59 and household cost of \$41.35 and \$134.62 for inpatient treatment of severe pneumonia in secondary and tertiary level hospitals, respectively. In a Kenyan study,¹⁵ mean provider cost for inpatient treatment of pneumonia was \$197.54 at the national hospital, \$135.26 at the mission hospital, and \$76.64 at the district hospital. Within these facilities, household direct and indirect costs amounted to \$27.28, \$18.82, and \$12.54 for national, mission, and district hospital, respectively. The previous findings show the overall high cost of inpatient treatment of severe pneumonia and the financial burden on the families.

Outpatient and community treatment has been found effective and safe in the treatment of severe pneumonia.^{11,12,16,17} Data on cost of community treatment of severe pneumonia and the resulting savings to households would help policymakers to prioritize strategies for severe pneumonia treatment.

The objective of this study was to estimate and compare household costs for current WHO and LHW program recommended management-diagnosis by a community health worker (CHW), give first dose of oral antibiotic, and refer to a health facility versus community treatment by the CHW with oral amoxicillin given for 5 days. We estimated the total and average direct and indirect costs to households for both treatment options.

MATERIALS AND METHOD

Study site. The study was conducted in district Haripur, Khyber Pakhtunkhwa province, Pakistan. Eighty-eight percent of the district's 856,921 people live in rural areas. Haripur has a wide range of topography with plains, mountains, and lakes. Although most people live in the central plain, a sizeable proportion lives in relatively remote mountainous areas. For these communities, travel to health facilities may mean walking for an hour or more to a road, followed by a drive in a vehicle, which may be only occasionally available. The overall literacy rate in Haripur is 53.7%, with a female literacy rate of only 37.4% compared with a male literacy rate of 63.6%. Agriculture is the primary occupation of a majority of the population.

Haripur is located in northern Pakistan comprising 327 villages grouped in 44 union councils (UC), the smallest administrative unit with 15,000–25,000 population. Each UC has at least one primary care health facility called a Basic Health

* Address correspondence to Salim Sadruddin, Department of Health and Nutrition, Save the Children, 54 Wilton Street, Westport, CT 06880. E-mail: ssadruddin@savechildren.org

Unit (BHU) or a Rural Health Center (RHC). Haripur has one district Hospital, 5 RHCs, 41 BHUs, and 14 other health centers in the public sector. There are several hospitals and clinics in the private sector. The LHWs are the most peripheral health providers. In 2009, there were 750 LHWs working in the district.

Lady Health Workers Program. Pakistan's well-established National Program for Family Planning and Primary Health Care, commonly referred to as Lady Health Workers (LHWs) Program was launched in 1994. In 2008, there were ~90,000 LHWs nationwide, serving a population of ~90 million.¹⁸ The LHWs require an 8th grade school attainment and undergo an extensive 3-month classroom training with 12 months of field supervision. Once deployed, LHWs provide preventive, promotive care to children and mothers, and basic curative services for children. Linked to the nearest public health facility, they are clinically supervised by a lady health visitor and administratively supervised by a lady health supervisor. The LHWs visit their assigned health facility every month for supervision, replenishment of supplies, and in-service training. The LHW works from a health house established in her home and serves around 1,000 individuals (150–200 families). She conducts 5–8 household visits per day and visits all the households every month, and is available for sick child visits whenever needed.

Study design and participants. The costing study was nested within a cluster randomized clinical trial conducted (April 2008–December 2009) in district Haripur to determine equivalency in clinical treatment failure rates among children 2–59 months of age with WHO-defined severe pneumonia in the clusters receiving community treatment with oral amoxicillin versus children in the control clusters who received standard of care.¹⁶

For the cluster randomized trial (RCT), the union council was defined as a study cluster. Of the 44 UCs, 28 were randomized to 14 intervention and 14 control clusters. Sixteen UCs were excluded because they were either in urban areas or were inaccessible. Five hundred eleven (511) LHWs from the 28 clusters were enlisted into the study (for a detailed methodology see Bari and others¹⁶). The costing study sample population included all severe pneumonia cases enrolled in the 14 intervention and 14 control clusters in the RCT during December 2009.

For the RCT, LHWs were trained to screen every child 2–59 months of age presenting to her with fast breathing and/or lower chest in-drawing for enrollment. Children who met the study inclusion criteria were enrolled by the LHW (Box 1). In the intervention clusters, LHWs gave oral amoxicillin (80–90 mg/kg per day or 375 mg twice a day to infants 2–11 months of age and 625 mg twice a day for those aged 12–59 months) for 5 days. In the control clusters, LHWs gave one dose of oral co-trimoxazole (age 2–11 months, sulfamethoxazole 200 mg plus trimethoprim 40 mg; 12 months to 5 years of age, sulfamethoxazole 300 mg plus trimethoprim 60 mg), and referred the children to a health facility (standard of care). The primary outcome was the development of clinical treatment failure up to Day 6 with clinical relapse between Day 6 and 14.

Children were followed up by the LHW either at the child's home or the LHW health house on Days 2, 3, 6, and 14 for assessment and recording of clinical outcomes, medicine compliance, change of medicines, visits to health providers,

hospitalization, etc. Data collection assistants (DCA) trained in pneumonia case management and study procedures independently verified each case of severe pneumonia within 48 hours of enrollment by LHWs. In addition, DCAs also conducted follow-up on Days 2, 3, 6, and 14 in both arms to verify her findings.

Data collection. Data for cost of treatment of severe pneumonia episode was collected from a household perspective. For clinical data, sources of care and treatment, case report forms (CRFs) completed by the LHWs and the DCAs as part of the RCT were reviewed. Data on household demographics, income, and out-of-pocket expenses incurred by the households during the treatment of a severe pneumonia episode in the intervention and control clusters was collected through caregiver interviews. Data was collected by a team of 11 DCAs. A structured questionnaire was developed to transcribe information from the CRFs and recording information on costs. Two-day training was organized for the DCAs with field practice in two interventions and two control clusters in November 2009. Appropriate changes in the questions were made after pretesting and piloting.

The DCAs completed the questionnaire on Day 14 follow-up of the enrolled child. They transcribed the data from the case report forms completed on enrollment, and Days 2, 3, 6, and 14 follow-up visits. They interviewed the head of the household or the caregiver to verify the information in the CRFs on provider consultations, services availed (laboratory, radiology, or other tests), hospital stay, medicine prescription filled, and out-of-pocket expenses for each of the previous items. She also asked about the sources of travel to the provider/facility, travel time in minutes, cost of transportation, time spent on child care, and lost wages.

Household costs. We estimated the following costs associated with treatment of a severe pneumonia episode in children < 5 years of age in the intervention and control clusters from a household perspective (Box 2).

Direct medical costs. The actual amount paid by the households for consultation, laboratory test, radiology, and hospital admissions were obtained from the payment receipts for these services. For medicines, the retail price on the label was used for calculating direct costs. In case receipts were not available, retail market rates for previous services and medicines were applied.

Although oral amoxicillin in the intervention clusters and the first dose of cotrimoxazole in the control clusters were provided free of cost to the patients, a cost equivalent was included in calculations for determining household costs.

Direct non-medical costs. Costs incurred for transportation, meals for caregivers at the health facility, and under-the-table payments made for services at the health facility.

Indirect costs. Opportunity cost of caregiver time and foregone wages was measured at the household level. Opportunity cost was estimated as the approximate value of non-wage household activity to account for time spent on care seeking and child care based on the assumption that if the person was working, how much will be the expected earnings. For calculating time cost, lost minutes were recorded and converted into number of working days. Mean monthly income of the head of the household, for the intervention and control clusters, were converted into daily income and opportunity cost in rupees was calculated as—days lost × mean daily income of

Box 1

Definitions of pneumonia, inclusion/exclusion, and treatment failure criteria in a cluster randomized control trial of community treatment of severe pneumonia in children 2–59 months of age in Haripur, Pakistan

Definitions

- **Pneumonia:** Child 2-59 months old having cough and/or difficult breathing with respiratory rate of 50 breaths per minute or more.
- **Severe pneumonia:** Lower chest in-drawing regardless of respiratory rate in children with history of cough and/or difficult breathing
- **Very severe disease:** Presence of any of danger sign (unable to drink/breast feed, convulsions, vomits every thing, abnormally sleepy/difficult to wake) in a child with history of cough and/or difficult breathing

Inclusion Criteria

- Child aged 2 to 59 months presented to LHWs with severe pneumonia
- Residing in the study area (i.e. intervention or control clusters)

Exclusion Criteria

- Very severe disease
- Diarrhea with severe dehydration
- Severely malnourished
- Children who were part of the study in the past two weeks
- Care-taker refusal to participate in the study
- Children who are already on antibiotic treatment

Treatment Failure**Day 3**

- Appearance of a danger sign (unable to drink/breast feed, convulsions, vomits every thing, abnormally sleepy/difficult to wake)
- Temperature ≥ 100 °F and lower chest in-drawing
- Change of antibiotic*

Day 6

- Appearance of a danger sign (unable to drink/breast feed, convulsions, vomits every thing, abnormally sleepy/difficult to wake)
- Temperature ≥ 100 °F
- Lower chest in-drawing
- Change of antibiotic*

Relapse

After child was cured at day 6, reappearance through day 7-14 of any one of the following:

- Temperature ≥ 100 °F
- Lower chest in-drawing

* Self-referral and or medication (antibiotic) by caregivers

the head of the household for the intervention and control groups. Foregone earning was self-reported by the households because of absence from work to take a child to the health facility and for child care.

Data entry. Data were entered and analyzed in SPSS version 15 (SPSS, Inc., Chicago, IL). We used an exchange rate of US\$ 1 equal to 85.30 Pakistani rupees (PKR).

RESULTS

Sample characteristics. A total of 423 (212 intervention, 211 control) cases of severe pneumonia were enrolled in the study. The two treatment groups were similar with regards to gender distribution of patients and educational attainment of parents of the enrolled children. The mean

household monthly income was Pakistani rupees (PKR) 7,844 (median 8,400) and PKR 8,435 (median 9,000) in the intervention and control clusters, respectively. Only six women in the intervention clusters and 16 women in the control clusters reported earnings. Therefore, a majority of household income share was contributed by the head of the households. Approximately 12% households in intervention clusters and 17% in control clusters earned < PKR 3,000 per month.

Source of treatment. Of the 212 severe pneumonia cases enrolled in the intervention group, 198 (93.4%) were successfully treated by LHWs with a 5-day course of oral amoxicillin. The LHWs referred 14 (6.6%) cases to the appropriate health facility for further treatment. Most referred cases sought treatment from private practitioners. No case was hospitalized.

Box 2

Variables for ascertaining direct and indirect out-of-pocket expenses incurred by the household for an episode of severe pneumonia in the intervention and control clusters

Direct Costs
A. Medical Costs
1. Consultations
2. Medicine
3. Lab tests
4. Radiology
5. Hospital admissions
6. Others (Specify)
B. Non-Medical Costs
1. Costs of Transportation
2. Costs of Food
3. Miscellaneous
Indirect Costs
A. Reported loss in earnings (Self, Caregiver)
B. Opportunity cost of time spent on care seeking and child care (Household, Caregiver)

In the control cluster, all 211 cases were referred by LHWs to a health facility after giving the first dose of cotrimoxazole. Caregivers of 131 (62%) children sought treatment from private practitioners, 53 (25%) were treated at government health facilities, and 11 (5.2%) went to other health providers; 6 (2.8%) cases were hospitalized.

Direct costs. The total direct medical cost for the intervention group was PKR 23,464 compared with PKR 86,221 for the control group (Table 1). In the intervention group, medicines constituted the major (98.3%) cost. The only other cost was the consultation fee (1.7%) for the referred patients. There were no costs for hospitalization, laboratory tests, and radiology. Although the cost of the LHW dispensed oral amoxicillin (PKR 21,792) was borne by the health system/research project, it is included in the calculation to reflect cost equivalence in absence of this support in other programs. In the control group, medicines amounted to 74.9% of the direct medical cost, followed by 13.8% for consultation, and 9.3% for hospital bed charges. The total expense for the six hospitalized patients was PKR 16,013. In the control group, households had to pay all the costs (98.2%) out of their own pocket, except the first dose of cotrimoxazole dispensed by the LHW.

Indirect costs. These costs for the households (Table 2) were estimated under two heads: 1) opportunity cost of caregiver

TABLE 2

Indirect household costs for treatment of severe pneumonia episode by treatment group

	Intervention N = 212	Control N = 211
Total time lost minutes	12,707	46,313
Total time lost in days*	8.82	32.16
Opportunity cost of time spent on care seeking and child care† (PKR)	2,276	9,005
Self reported loss of earnings/wages ‡ (PKR)	250	16,313
Total indirect costs (PKR)	2,526	25,318
Average indirect costs (PKR)	10.73	120

*Time lost in days - minutes/60/24.

Mean daily income (PKR) for head of households: control clusters - 8,413/30 = 280; intervention clusters - 7,765/30 = 258.

†Total opportunity cost of time during the severe pneumonia episode for all visits was calculated as - days lost × mean daily income for head of the holds in the treatment groups.

‡Loss of actual wages or earnings reported by the caregiver or a member of the household.

and other household member's time; and 2) loss of wages and earnings for caregiver and other household members for care seeking and child care. The total time lost by households in intervention clusters was 8.8 days and the opportunity cost was PKR 2,276. In the intervention group, only one caregiver reported an earnings loss of PKR 250. For the control group, the total time lost by households was 32.2 days and the opportunity cost was PKR 9,005. Loss of earnings in the control group was PKR 16,313. There was an 11-fold difference (PKR 10.73. versus 120) in average indirect cost for households for the two treatment groups.

Direct and indirect household costs. Cost of transportation, meals, and other expenses incurred during the treatment of a severe pneumonia episode were considered direct non-medical costs. Because 198 (93.4%) cases in the intervention clusters were treated by LHWs, transportation cost was negligible, and the total for the 14 referred cases was only PKR 316 (Table 3). In comparison, the control group households incurred transportation costs of PKR 17,439 for seeking care for the sick children. The average cost of travel for the intervention group was PKR 1.5 compared with PKR 83 for the control group. Only one household reported PKR 20 as cost for food in the intervention clusters, whereas total cost of food in control clusters was PKR 7,415 for cases who sought care from hospital, private practitioners, and public health facilities.

In the intervention group the total household cost for the treatment of 212 severe pneumonia episodes was PKR 26,326 and the average cost was PKR 124.17. Cost of medicines constituted the highest proportion of costs (87.60%). Because

TABLE 1

Direct medical costs for intervention and control group by source and services*

Source of Treatment	Consultation		Medicines		Diagnostics†		Bed charges		Total	
	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control	Intervention	Control
LHW	-	-	21,792	1,596	-	-	-	-	21,792	1,596
Hospitalization	-	210	-	6,874	-	900	-	8,029	-	16,013
Private practitioner	400	10,422	1,070	39,783	-	600	-	-	1,470	50,805
Public facility	2	1,200	200	12,214	-	150	-	-	202	13,564
Homeopath	-	1,200	-	-	-	-	-	-	-	1,200
Chemist	-	50	-	1,052	-	-	-	-	-	1,102
Others	-	9	-	1,932	-	-	-	-	-	1,941
Total (PKR)	402	11,891	23,062	64,581	-	1,650	-	8,029	23,464	86,221

*Numbers in the boxes are cost in Pakistani Rupees (PKR).

†Diagnostics includes laboratory tests and radiology.

Number of cases: intervention = 212; control = 211.

TABLE 3

Breakdown of direct and indirect household cost for severe pneumonia treatment of intervention and control groups

	Intervention PKR (% of total)	Control PKR (% of total)
A. DIRECT COSTS		
1. Medical		
Consultation	402 (1.53)	11,891 (8.70)
Medicines	23,062 (87.60)	64,581 (47.23)
• LHW	21,792 (82.78)	1,596 (1.17)
• Other providers	1,270 (4.82)	62,985 (46.06)
Laboratory and Radiology		1,650 (1.21)
Hospital Admission		8,020 (5.86)
Other		79 (0.058)
Sub-total medical costs	23,464 (89.12)	86,221 (63.05)
2. Non-medical		
Transportation	316 (1.28)	17,439 (12.75)
Food	20 (0.07)	7,415 (5.42)
Other	0	350 (0.26)
Sub-total non-medical costs	336 (1.28)	25,204 (18.43)
Sub-total direct cost (1 + 2)	23,800 (90.40)	111,425 (81.48)
B. INDIRECT COSTS		
Opportunity cost of time	2,276 (8.64)	9,005 (6.58)
Lost wages and earnings	250 (0.95)	16,313 (11.93)
Sub-total indirect costs	2,526 (9.59)	25,318 (18.51)
Total direct and indirect costs (A+B)	26,326	136,743
Average cost for treatment of severe pneumonia episode* (PKR)	124.17	648.07
Average cost for treatment of severe pneumonia episode in US dollars†	1.46	7.60

*Average cost: Sum of direct and indirect costs/number of cases.

†Exchange rate: 1 US \$ = PKR 85.30.

Percentages are based on totals for intervention and control group.

Number of cases: intervention = 212; control = 211.

amoxicillin was provided free to the patients, only 4.82% of the total cost was borne by the households for medicines for the 14 cases that had to be referred by LHWs for further treatment. Deducting PKR 21,792 for the cost of amoxicillin provided by the LHWs from the total cost of PKR 26,326, the average household cost for treatment of one episode of severe pneumonia was PKR 21.39.

In the control group the total household cost for the treatment of 211 severe pneumonia episodes was PKR 136,743 and the average cost was PKR 648.07. Medicines constituted 47.23% of the cost followed by 18.51% for opportunity cost and lost earnings for child care and 18.43% for transportation and food expenses. Because all 211 children were referred by the LHWs for treatment, 98.83% of the cost (except the cost of the first dose of cotrimoxazole) was borne by the household. As a result, the average household cost for treatment of one episode of severe pneumonia was PKR 640.50. The average cost per episode for the six hospitalized patients was PKR 2669, which was 31.64% of the average household monthly income of the control cluster population.

DISCUSSION

To our knowledge, this is the first study to estimate the cost of severe pneumonia treatment at community level from the household perspective. Our findings show a substantial difference in household out-of-pocket expenses for treatment of a severe pneumonia episode by LHWs with oral amoxicillin versus current standard of care.

The average household cost for the community managed cases was PKR 124.17 (\$1.46) compared with PKR 648.07 (\$7.60) for those referred to health facilities. The difference is quite important for poor households with limited resources. The difference was caused by both direct (consultation, medicines, bed charges, and transportation) and indirect (opportunity cost and lost earnings) costs. When cost of medicines provided by the LHW program is excluded from the two treatment group estimates the average cost incurred by the households comes to PKR 21.39 (\$0.25) and PKR 640.50 (\$7.51) for the community managed and referred cases, respectively, a 30-fold difference. The per capita health expenditure in Pakistan in 2009¹⁹ was \$23, of which 32.8% was public expenditure. The rest was (\$15.5) private out-of-pocket expenditure. This means families in the control clusters end up spending 39.9% of their annual per capita expenditure on health for treatment of single episode of severe pneumonia.

The average household cost of \$1.46 for community managed cases in our study is substantially lower than the household cost of \$17.61, \$12.54, and \$41.35 for inpatient treatment of severe pneumonia reported in the earlier studies.¹³⁻¹⁵ The cost of \$7.60 for the control group in our study was less than half of the \$17.61 estimated by Hussain and others¹³ for a severe pneumonia episode in Northern Pakistan. The higher expenditure reported in their study could be caused by the remoteness of the study district with a higher cost of medicines, transportation, and opportunity costs. The average cost of treatment of a severe pneumonia episode in the control group in our study may also be lower because LHWs in the community are available for prompt diagnosis and counseling of care givers to take the child to a nearby appropriate facility. This may have influenced care seeking behavior of families in the control population, thus lowering the cost of treatment.

Mehnaz and others²⁰ reported that 12% of children with pneumonia develop severe pneumonia in Pakistan. Applying this figure to Rudan and others³ estimate of 10 million new pneumonia cases per year in Pakistan, ~1.2 million new cases of severe pneumonia per year would need hospital treatment, with an economic impact on the health system and the households. Hussain and others¹³ estimated that in 2002, Pakistan spent \$236 million for treatment of pneumonia and severe pneumonia. Our study findings show that treatment of severe pneumonia with oral amoxicillin by a first-level health facility and community health workers would reduce the overall economic burden of pneumonia treatment not only in Pakistan but in other countries with a high incidence of pneumonia. Bari and others¹⁶ and Soofi and others¹⁷ found that severe pneumonia patients referred to health facilities were given a variety of oral and injectable antibiotics. Treatment of severe pneumonia at peripheral health facility and community level with standard reference antibiotic, oral amoxicillin will help promote rational use of drugs as well.

Because our research was nested within the larger cluster randomized control trial, it benefited from the rigor and quality of data collection. The information on type and duration of medicine, health facility visits, etc., were collected during a follow-up visit by study personnel for the disease episode, ensuring accuracy and better estimation of direct medical and direct non medical costs. One of the study limitations may have been underestimation of head of household monthly income that was used to calculate indirect costs.

Households in Pakistan often report lower incomes as they are suspicious that this information may be passed on to the revenue department. Because the lower income reporting would be the same in intervention and control groups, we feel that the large difference in average costs found in our study was not affected by under-reporting of household income.

CONCLUSIONS

Pneumonia is one of the major killers of children < 5 years of age in developing countries, including Pakistan. Community case management for non-severe pneumonia is already recommended in the WHO and UNICEF joint statement²¹ and Global Action Plan for Pneumonia Technical Consensus Statement.²² Our study shows that extending severe pneumonia treatment to the community level will not only improve access, and better treatment outcomes,^{16,17} but will decrease economic burden on the families. Extending services to the community will also decrease pressure and cost on the already overburdened public health system.

The LHWs are already providing pneumonia case management in Pakistan. Extending case management to severe pneumonia for in-service training for treating severe pneumonia with oral amoxicillin and ensuring availability of the drug will go a long way in making services available to remote and underprivileged populations, preventing thousands of child deaths and accelerating Pakistan's progress toward achieving MDG 4 goal.

Received April 14, 2012. Accepted for publication September 7, 2012.

Acknowledgments: We thank Ayaz Imran, (National Program of Family Planning and Primary Health Care [NPFPPHC], Khyber Pakhtoonkhawa, Pakistan), Farhat Yasmeen NPFPPHC, Haripur, Pakistan), Habib ur-Rehman (District Head Quarter Hospital, Haripur), Ihsan Turabi (NPFPPHC, Khyber Pakhtoonkhawa), Inamullah Khan (NPFPPHC, Khyber Pakhtoonkhawa), Mohammad Idrees (Executive District Officer Health, Department of Health, Haripur), Ali Asghar Khan (NPFPPHC, Islamabad), Yousaf Ayub Khan (Haripur), Rasheda Parveen (Save the Children, Haripur.), and all the staff of Save the Children, Haripur office and LHWs working in district Haripur.

Financial support: The Department of Maternal Newborn Child and Adolescent Health, WHO, Geneva, Switzerland through a USAID grant and a sub-grant from University of Edinburgh, UK supported through grant 51285 by Bill & Melinda Gates Foundation.

Disclaimer: The opinions expressed are those of the authors and do not necessarily reflect the views of USAID or WHO.

Authors' addresses: Salim Sadruddin, Department of Health and Nutrition, Save the Children, Westport, CT, E-mail: ssadruddin@savechildren.org. Shafqat Shehzad, Health Services Academy, Opposite National Institute of Health (NIH), Chak Shahzad, Islamabad, Pakistan, E-mail: shafqatshehzad@gmail.com. Abdul Bari, Attaullah Khan, Ibad-ul-Haque, Amanullah Khan, Save the Children, Pakistan Country Office, Khayaban-i-Iqbal, Islamabad, Pakistan, E-mails: abdulbari99@hotmail.com, attaulah.khan@savethechildren.org, ibad.haque@savethechildren.org and amanullah.khan@savethechildren.org. Shamim Qazi, Department of Maternal, Newborn, Child and Adolescent Health, World Health Organization, Geneva 1211, Switzerland, E-mail: sqazi@who.int.

REFERENCES

- UNICEF, WHO, The World Bank, United Nations Population Division, 2012. *Levels and Trends in Child Mortality: Report 2012*. New York: UNICEF.
- Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, Rudan I, Campbell H, Cibulskis R, Li M, Mathers C, Black RE; Child Health Epidemiology Reference Group of WHO and UNICEF, 2010. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet* 375: 1969–1987.
- Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H, 2008. Epidemiology and etiology of childhood pneumonia. *Bull World Health Organ* 86: 408–416.
- UNICEF, 2010. *Countdown to 2015 Decade Report (2000–2010): Taking Stock of Maternal, Newborn and Child Survival*. New York: UNICEF.
- NIPS, Macro International, 2008. *Pakistan Demographic and Health Survey 2006–07*. Islamabad, Pakistan: National Institute of Population Studies Islamabad; Calverton, MD: Macro International.
- Sazawal S, Black RE, 2003. Effect of pneumonia case management on mortality in neonates, infants, and preschool children: a meta-analysis of community-based trials. *Lancet Infect Dis* 3: 547–556.
- WHO, UNICEF, 2005. *Handbook: IMCI Management of Childhood Illness*. 2005 edition. Geneva: WHO; New York: UNICEF.
- Marsh DR, Gilroy KE, Weerdt RV, Wansi E, Qazi S, 2008. Community case management of pneumonia: at a tipping point? *Bull World Health Organ* 86: 381–389.
- Peterson S, Nsungwa-Sabiiti J, Were W, Nsabagasani X, Magumba G, Namboozee J, Mukasa G, 2004. Coping with pediatric referral—Ugandan parents' experience. *Lancet* 363: 1955–1956.
- Chowdhury EK, Arifeen SE, Rehman M, Hoque DE, Hossain MA, Begum K, Siddik A, Begum N, Sadeq-ur Rahman Q, Akter T, Haque TM, Al-Helal ZM, Baqui AH, Bryce J, Black RE, 2008. Care at first-level facilities for children with severe pneumonia in Bangladesh: a cohort study. *Lancet* 372: 822–830.
- Hazir T, Fox LM, Nasir YB, Fox MP, Ashraf YP, MacLeod WB, Ramzan A, Maqbool S, Masood T, Hussain W, Murtaza A, Khawar N, Tariq P, Asghar H, Simon JL, Thea DM, Qazi SA; New Outpatient Short-Course Home Oral Therapy for Severe Pneumonia Study Group, 2008. Ambulatory short-course high-dose amoxicillin for treatment of severe pneumonia in children: a randomized equivalency trial. *Lancet* 371: 49–56.
- Addo-Yobo E, Duc Anh D, El-Sayed HF, Fox L, Fox MP, MacLeod W, Saha S, Anh Tuan T, Thea DM, Qazi S, 2011. Outpatient treatment of children with severe pneumonia with oral amoxicillin in four countries: the MASS Study. *Trop Med Int Health* 16: 995–1006.
- Hussain H, Waters H, Khan AJ, Omer SB, Halsey NA, 2008. Economic analysis of childhood pneumonia in northern Pakistan. *Health Policy Plan* 1: 1–5.
- Madsen HO, Hanehøj M, Rani A, Prabhakar D, Winsley M, Mammen R, Flemming P, John K, Anuradha KR, 2009. Costing of severe pneumonia in hospitalized infants and children aged 2–36 months at a secondary and tertiary level hospital of a not-for-profit organization. *Trop Med Int Health* 14: 1315–1322.
- Ayeiko P, Akumu AO, Griffiths UK, English M, 2009. The economic burden of inpatient pediatric care in Kenya: household and provider costs for treatment of pneumonia, malaria and meningitis. *Cost Eff Resour Alloc* 7: 3.
- Bari A, Sadruddin S, Khan A, Haque I, Khan A, Lehri I, MacLeod WB, Fox MP, Thea DM, Qazi S, 2011. Community case management of severe pneumonia with oral amoxicillin in children aged 2–59 months in Haripur district, Pakistan: a cluster randomized trial. *Lancet* 378: 1796–1803.
- Soofi S, Ahmed S, Fox MP, MacLeod WB, Thea DM, Qazi SA, Bhutta ZA, 2012. Effectiveness of community case management of severe pneumonia with oral amoxicillin in children aged 2–59 months in Matiari district, rural Pakistan: a cluster-randomized controlled trial. *Lancet* 379: 729–737.
- Oxford Policy Management, 2009. *Lady Health Worker Programme External Evaluation of the National Programme for Family Planning and Primary Health Care Quantitative Survey Report*. Oxford, UK: Oxford Policy Management.

19. The World Bank, 2012. Available at: <http://data.worldbank.org/indicator/SH.XPD.PCAP/countries>. Accessed February 10, 2012.
20. Mehnaz A, Billo G, Yasmee T, Nankani K, 1997. Detection and management of pneumonia by community health workers: A community intervention study in Rehri village, Pakistan. *J Pak Med Assoc* 47: 42–45.
21. UNICEF/WHO, 2004. *Management of Pneumonia in Community Settings*. UNICEF/WHO joint statement. Available at: http://whqlibdoc.who.int/hq/2004/WHO_FCH_CAH_04.06.pdf. Accessed October 3, 2010.
22. WHO, UNICEF, 2009. *Global Action Plan for Prevention and Control of Pneumonia (GAPP): Technical Consensus Statement*. Geneva: World Health Organization and United Nations Children's Fund.