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Fauziah Rabbani
Aga Khan University, fauziah.rabbani@aku.edu

Aysha Zahidie
Aga Khan University, aysha.zahidie@aku.edu

Chapter 1

Recent Strategies to Improve Community Case Management of Diarrhea among Children under Five in Developing Countries

Fauziah Rabbani MBBS, MPH, FCPS, FRCP, PhD and Aysha Zahidie* MBBS, FCPS

Department of Community Health Sciences, Aga Khan University, Karachi, Pakistan

***Corresponding Author:** Aysha Zahidie, Department of Community Health Sciences, The Aga Khan University Hospital, Stadium Road, Karachi, Pakistan, Tel: 021-34864919/ 0092-332-3307724; Fax: (9221) 34934294/ 3493-2095; Email: aysha.zahidie@aku.edu

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Extent of Problem

Globally, 1 in 9 childhood deaths are associated with diarrheal diseases, thus making diarrhea the second leading cause of death among children under five years of age [1]. It is estimated that in 2013, 9.9% of the 6.9 million deaths among under five were due to diarrheal diseases killing around 760,000 children across the globe [2]. Major proportion of these deaths occurs in the resource scarce settings of South Asia and Sub-Saharan Africa [3].

India heads the list of countries with highest proportion of child mortality due to diarrheal diseases followed by Pakistan while Sri Lanka and Bangladesh have been exemplary in overcoming burden of diarrheal diseases by successfully implementing community based preventive measures [4].

A recent study has investigated proportion of under five deaths due to diarrhea in seven developing countries of the world. The proportion of all deaths in infants aged 1 to 11 months that were due to diarrhea varied from less than 3% in Bangladesh and Tanzania to between 24% and 30% in India, Pakistan and Ethiopia [5].

Estimates show that each child under 5 years of age encounters three episodes of diarrhea per year in developing countries [2-5]. Situation is even worse in Africa where a child suffers five annual episodes of diarrhea leading to 800,000 child deaths annually [6]. In Latin America and the Caribbean, rotavirus alone accounts for 15,000 deaths,

75,000 hospital admissions and two million health facility visits of children below five years of age [7].

Table 1 shows UNICEF's global estimates of under-five mortality among developing and under developed regions.

Table 1: UNICEF 2012 estimates of under-five mortality across three regions of the globe.

Region	Country	Total population (thousands) 2012	Population Under Five (thousands)	Annual under-5 deaths (thousands) 2012	Under Five mortality rate per thousand live births	Under five mortality ranking	Deaths attributed to diarrhea	Diarrhea Treatment with oral rehydration salts (ORS)
South Asia	*India*			1414	56	49	13%	26%
	Pakistan			409	86	26	11%	41.1%
	Bangladesh			127	41	60	6%	77.6%
	Sri Lanka		1874	4	10	136	3%	50.4%
Sub Saharan Africa	*Ethiopia*			205	68	40	14%	26.3%
	Uganda		6939.1	103	69	39	10%	43.5%
	Tanzania		8487.2	98	54	51	3%	44%
Latin America & the Caribbean	*Bolivia*		1264.4	11	41	60	9%	34.9%
	Haiti		1249.7	20	76	31	7%	52.9%

Available Options to Treat and Prevent Diarrhea

Ending the loss of millions of lives from preventable causes such as diarrhea is an accessible goal which can be realistically achieved in a decade's duration through simple community based interventions without need of high technological advancements. The Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD) proposes an integrated approach to end preventable deaths among children under five. It unifies services and interventions to create healthy environments, promotes practices already proven to protect children from disease and ensures that every child has accessibility to prevention and cure.

Overall effective and cost effective set of interventions to combat diarrheal diseases through simple community based interventions can be grouped as:

- Child health interventions (Breastfeeding, immunization, ORS and micronutrient supplementation)
- Individual; behavior change (Hand washing)
- Infrastructure provision (safe water and sanitation)

Research reveals that child deaths could be cut by 63% worldwide if coverage rates of effective prevention and treatment interventions were to increase from current levels to 99% [8]. However, even these simple interventions are often not available, accessible or affordable to poor segments of developing countries who are the most often victims of diarrhea. During last fifteen years only 4% of childhood deaths were averted in Africa because of poor access to diarrhea prevention interventions. The last decade has also been stagnant in terms of improving the

coverage of essential commodities like ORS and zinc as less than 50% cases with diarrhea received ORS in developing world [9]. Cost effective intervention like continued breast feeding was also found to be low with coverage rate of only 39% in countries with major burden of diarrheal diseases [10].

Health Systems in Implementing Diarrhea Prevention Strategies

Weak and fragile health systems in developing countries face issues in quality service delivery through inadequately trained and poorly qualified health workforce deployed in rural areas [11]. Low access and scarcity of trained human resource in primary health setups at community level essentially deprive the poorest of the populations to simple and effective interventions like ORS or awareness of simple measures such as washing hands with soap and water. Inequity in distribution of health work force may be explained by weak planning and governance of health systems along with unfair financing not based on reliable data and principles of fairness and equity [12]. Inadequate planning and poor monitoring capacity also produce opportunities of misusing resources and interfering with supply chains of simple life saving commodities and essential medicines.

An integrated approach is needed to improve the overall efficiency and responsiveness of health systems against

diarrhea related morbidity and mortality by improving coverage and utilization by the most vulnerable groups of the population. This would require strategic planning and effective evidence based measures to provide services through community platforms like home visits and community based service delivery mechanisms.

There is already a global understanding that primary care constitutes the first element of a continuing health care process and includes the community outreach component of health promotion, disease prevention and management of locally endemic ailments through community health workers (CHWs). CHWs can play an important role as first line community caregivers as compared to health facilities as they are geographically closer and more readily available [13].

Community Case Management of Diarrhea by Community Health Workers

The concept of community case management (CCM) of childhood illnesses revolves around community health workers (CHWs) and cultivates into a strategy to deliver lifesaving curative interventions for the most common childhood killers. This strategy is particularly effective where there is low access to facility-based services [14].

This concept has been expanded to the idea of Integrated Community Case Management (iCCM) of childhood illnesses [15]. It includes a joint strategy to increase

access to effective case management for young children suffering from major childhood illnesses like malaria, pneumonia and diarrhea, through CHWs. Deployment of these CHWs is recommended in hard to reach areas and among vulnerable populations with limited access to facility based care. There is a room for integration of CCM and iCCM models into health systems of low and middle incomes countries (LMICs) which already have well established community outreach services as a part of their formal health systems.

In rural settings of India, Pakistan, Bangladesh and Nepal, deployment of CHWs has been one of the key strategies to improve child health. CHWs are trained to assess, classify and treat diarrhea and dehydration adequately in the community [16]. These countries have a large network of health service delivery infrastructure from primary to tertiary care levels. Covering 60% of rural population and working through 130,000 Lady Health Workers (LHWs), the Lady Health Worker's Program (LHW-P) of Pakistan represents the outreach community based component of health system [17]. Each lady health worker (LHW) is responsible for approximately 1000 people, which makes around 100-150 homes. LHWs receive basic training of fifteen months to provide health education, promotion of healthy behaviors, preventive services such as vaccination, referrals for antenatal and postnatal care, as well as some basic treatment services. LHWs treat childhood ailments by dispensing ORS and zinc for diarrhea, antibiotics for

suspected ARI and anti-malarial medicines for suspected cases of malaria. They also provide vaccination services, participate in nutritional awareness activities and offer nutritional counseling [18,19].

Angan wadi workers hold similar position in Indian outreach health system. The BRAC CHWs known as Shasthya Shebika (health sisters) are perceived to have a considerable contribution to Bangladesh's notable progress in reducing under five mortality [16,17].

Iranian CHW, called *behvarz* in Persian language, is a full time employee of the health system. National, provincial and district health systems are responsible for planning and implementing policies and programs related to *behvarz* [20]. Similarly Kenya has utilized CHWs in the community based initiatives for better child survival. Among other low income African countries like Malawi, outreach community-based health workers are recruited and salaried by the Ministry of Health as Health Surveillance Assistants (HSAs) [21]. This post was originally created for smallpox vaccination in the 1960s and continued to serve growing needs of the health system. In 2008, the Government of Malawi trained HSAs, to provide integrated community case management of childhood illness (iCCM), becoming one of the first sub-Saharan African countries to implement iCCM at full scale for common childhood illnesses. Ethiopia has also extensively involved CHWs in delivering iCCM [22].

WHO and UNICEF have emphasized the need for CCM in countries that have exceeded the MDG 4 child mortality target for the region (60 per 1,000 live births) and had less than 23 physicians, nurses and midwives per 10,000 population [14,15]. Importantly Child Health Epidemiology Reference Group has revealed that CCM of childhood diarrhea through Oral Rehydration Salts (ORS) and zinc can prevent 70–90% of deaths caused by acute watery diarrhea. Studies from different countries reveal that CCM improves coverage and equitable distribution of services to the remote and far flung rural areas of developing countries.

Components of Community Case Management

WHO and UNICEF have produced an integrated package to train CHWs to manage illness in children 2 to 59 months of age. *Integrated Management of Childhood Illness: Caring for Newborns and Children in the Community* is the 'gold standard' training package for iCCM. The interventions require the use of four low-cost medicines and one test: an antibiotic, an antimalarial, ORS, zinc treatment and malaria rapid diagnosis tests (RDTs). The order to be followed by the CHWs is based on the code that 'one observation leads to one action', and does not depend on individual judgment (Table 2).

Table 2: Current treatment recommendations by WHO.

If **diarrhea** (less than 14 days AND no blood in stool)	**Give oral rehydration salts (ORS).** Help caregiver give child ORS solution in front of you until child is no longer thirsty. **Give caregiver two ORS packets to take home.** Advise to give as much as child wants, but at least half cup of ORS solution after each loose stool **Give Zinc supplement.** Give one dose daily for ten days: • Age 2 to 6months- 1/2 tablet (total 5 tabs) • Age 6 months to 5 years- 1 tablet (total 10 tabs)
If **fever** (less than 7 days) in a malaria endemic region	**Do a rapid diagnostic test (RDT)** • Positive/ Negative **If RDT is positive, give oral anti-malarial artemether-lumefantrine (AL)** Give twice daily for 3 days: • Age 2 to 3 years- 1 tablet (total 6 tabs) • Age 3 to 5 years- 2 tablet (total 12 tabs)
If **Fast breathing**	**Give oral antibiotic** (250mg amoxicillin tablet) Give twice daily for 5 days: • Age 2 to 12 months- 1 tablet (total 10 tabs) • Age 12 months to 5 years- 2 tablet (total 20 tabs)
Source: *Adapted from World Health Organization, Integrated MAANGAMENGEMT OF Childhood illnesses: Caring for newborns and Children in the Community, WHO, Geneva, 2011.*	

Evidence of Efficiency and Effectiveness of CCM by CHWs

Evidence shows that adequately trained, supervised, and well supported CHWs can timely identify and cure most of the preventable causes of under-five mortality at community level. However, an uninterrupted supply chain of medicines and equipment is also mandatory for

CHW based programs. Studies also provide evidence that CHWs can correctly and safely manage malaria, pneumonia, and diarrhea in children through integrated community based service delivery.

Nepal is the most remarkable example of effectiveness of CCM for poor rural population where childhood mortality due to preventable causes such as diarrhea and pneumonia has been significantly reduced in last 20 years and 69% children under five have access to treatment services at community level [23].

An ongoing cluster randomized trial in rural Pakistan showed that strengthening supportive supervision by Lady Health Supervisors (LHS) through household supervisory visits and provision of written feedback to LHWs could significantly improve LHWs knowledge and skills for managing childhood diarrhea and pneumonia at community level [24].

A study in Malawi demonstrated that 68% classifications of common illnesses by health surveillance assistants were in accordance with verifications performed by physicians, while 63% of children were suggested appropriate medication as per disease classification [25]. Another study carried out in eight districts of Uganda with iCCM implementation showed that use of oral rehydration solution (ORS) and zinc for treatment of diarrhea increased in the intervention area [26]. Ethiopia is another example where child survival interventions were well implemented during 1997-2006. Evaluation of these interventions by the

end of the project showed that community health workers saw 2.5 times more cases of childhood fever, pneumonia and diarrhea than all the health facility staff combined. Quality of care was also scored well [22].

A recent systematic review carried out to estimate the effect of community based interventions including community case management on the coverage of various commodities and on mortality due to diarrhea and pneumonia showed that CCM based interventions were associated with significant increase in care seeking behaviors with 13% and 9% increase in care seeking for pneumonia and diarrhea respectively. These interventions led to 160% increase in the use of ORS and 80% increase in the use of zinc for diarrhea. There was a decline of 75% in the inappropriate use of antibiotics for diarrhea and a 40% reduction in treatment failure for pneumonia [27,28].

Strengths and Challenges to CCM & iCCM Implementation

Global evidence shows that CCM and iCCM are highly effective strategies for increasing coverage of quality health services to vulnerable communities. Health care delivered through community health workers makes it people centered bringing services closer to the communities. Such package of care relocates the entry point to the health system from hospitals and specialists to primary health care providers and gives them responsibility for the health of a defined population. This is in close spirit

to primary health care (PHC) service and coverage reforms as suggested by WHO in 2008. CHWs are capable of managing diarrhea, pneumonia and malaria adequately at household level, using simple guidelines for disease classification. Thus, CCM and iCCM assures access to treatment for those who are beyond the reach of health facilities. Availability of a comprehensive diagnostic and treatment package for multiple diseases eventually promotes appropriate care seeking behaviors.

The majority of governments in South Asia and sub-Saharan Africa have policies supporting CCM of diarrhea and other common childhood ailments [29]. A WHO report shows that considering country needs for CCM, 34 out of 40 (85%) country offices reported existence of government policy for community level treatment of diarrhea through CHWs. However, even when supportive CCM policies exist, CCM programs are not always implemented, and just fewer are implemented to the full potential [21].

An implementation research conducted in Pakistan identified several challenges at policy level for successful CCM program implementation. Engaging stakeholders particularly policy makers was perplexing. Culture of ad hoc decision making was common where policy makers relied more on personal influence or relationships to resolve program level issues instead of efforts towards system strengthening. The same study also identified poor system of accountability within the LHW-P leading to

poor case reporting by LHWs to their supervisors. Logistic issues such as lack of transport and absence of a mandatory written feedback provision also acted as barriers in achieving desirable program outcomes [28,30].

Other studies also show that effective implementation of CCM to combat major causes of childhood mortality through an effective CCM or iCCM strategy would require adequate initial training of CHWs, regular re-supply of essential commodities and ongoing supportive supervision [14,15]. Research findings from Ethiopia and Malawi have also pointed out that there were frequent stock outs of medicines. Moreover, limited district budget and capacity for forecasting needs and corruption within the system have led to important breakdowns in service provision [22,25].

In countries like Pakistan, iCCM is currently considered to be in a stage of expansion. However, LHWs are not well integrated into the broader public health sector and cases referred by LHWs receive little priority at facility level. Low salary and lack of integration into national health system universally affects quality of services delivered by health workers [23,24,27]. It is therefore not surprising that there have been negligible improvements in the coverage of essential interventions. According to an estimate, only 38% cases with diarrhea received ORS and antibiotics were administered to 41% pneumonia patients. The experience in Malawi also shows that supervision and drug supply were suboptimal. Less than 40% of HSAs included in the sample had received an iCCM-specific su-

pervisory visit in the previous 3 months and only 16% received a visit that included clinical observation of case management. Almost all studies indicated that community health workers were available only one or two times per week to deliver CCM or iCCM due to additional work assignments. Hence, services may not be available when a child needs them. Sometimes they were deployed in far flung areas with no provision of transport or assigned with additional tasks such as polio campaigns in Pakistan. This concern seems to be less of an issue when the iCCM-trained workers reside in the community, but it was a seriously limiting factor to service availability in communities where health workers did not live in their catchment area [23-26].

An important barrier in effective care delivery is also related to the lack of trust and connectivity between the health workers and the health center for timely referral, improved monitoring and supervision. To improve coordination between LHWs and LHSs in district Badin of Pakistan, the LHSs were given mobile phones for real-time communication with LHWs. Upon case identification, LHWs relayed information using text messages and arranged appropriate follow-up with LHSs. Study findings show that mobile phones have the potential to improve supportive supervision by enhancing coordination among health workers for timely case reporting and appropriate follow-ups. This could be a useful strategy for strengthening health system [18].

Future Directions and Recommendations

Recent literature reveals CCM as an effective option for investment in PHC system. It can effectively reduce disease burden and cost of treatment. Initial deployment of health workers would require huge investments in training for supportive supervision and conducting performance evaluations of the workers. CCM requires appropriate guidelines for clinical assessment, diagnosis, management and referral from community to higher levels of health system [31,32].

CCM interventions can be added incrementally, if full integration is not possible. Programs often begin with a combination of CCM interventions for two conditions and then add others. A gradual approach often allows for initial success, contributing to sustainability [21,27].

Clear and well-articulated roles and responsibilities for community health workers would be required through careful needs assessment in context of identified disease burden for individual countries [32].

Community health workers would need assistance in maintaining and enhancing their skills to assess and manage childhood illnesses. Refresher training should be undertaken at intervals, and supportive supervision needs to be planned and carried out on a regular basis.

Regularizing health workers as a permanent part of country's outreach health services would improve motivation of health workers on one hand and community recognition and utilization of their services on the other. Governments and donors should avail opportunities to strengthen integrated CCM by building on existing health initiatives and community health worker programs. Consolidating referral chains between communities and health facilities are an important aspect of successful CCM implementation [27,32].

Appropriate provision and maintenance of medicines and other supplies to health workers require development of standard procurement and audit procedures.

Monitoring and evaluation systems are at the center of program management. Managers and decision makers need information to establish whether performance of CHWs is according to the expectations. Overall monitoring and evaluation framework for CCM should be built on assessment of social and policy environment enabling CCM, improvement in access to and availability of life-saving interventions and services and upgrading of service quality. Demonstration of enhanced community demand for CHW services is also required [32,33].

Additionally, innovative use of mobile technology has already contributed to promote health care services in developing countries like Pakistan, India, Bangladesh and Botswana. Mobile health (m health) based interventions enhance efficiency of service delivery ensuring timely

feedback and supervision by the health managers through effective communication. With this growing body of evidence it is time to invest in wide scale deployment of mobile technology in developing countries where access to good quality health care remains an unachievable goal for the poor and marginalized [23,31].

Conclusion

Today, it's already established that in most countries, with high incidence of diarrhea related mortality, facility-based services alone cannot provide reasonable access to treatment and particularly not within the crucial window of 24 hours after onset of the symptoms. If child mortality is to be equitably reduced, the challenge of access must be overcome by the health systems through community based programs. CCM is the best solution especially where there are no doctors and where 60-70 percent population lives in rural areas devoid of basic amenities. The existing outreach programs in various developing countries therefore have a high potential to effectively incorporate CCM strategies for management of childhood diarrhea.

References

1. Liu L, Johnson HL, Cousens S, Perin J, Scott S, et al. Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. Lancet. 2012; 379: 2151-2161.

2. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? The Lancet. 2003; 361: 2226-2234.

3. Bhutta ZA, Das JK. Global burden of childhood diarrhea and pneumonia: what can and should be done? Pediatrics. 2013; 131: 634-636.

4. Liu L, Oza S, Hogan D, Perin J, Rudan I, et al. Global, regional, and national causes of child mortality in 2000-2013, with projections to inform post-2015 priorities: an updated systematic analysis. The Lancet. 2015; 385: 430-440.

5. Rahman AE, Moinuddin M, Molla M, Worku A, Hurt L, et al. Childhood diarrhoeal deaths in seven low- and middle-income countries. Bull World Health Organ. 2014; 92: 664-671.

6. Tambe AB, Nzefa LD, Nicoline NA. Childhood Diarrhea Determinants in Sub-Saharan Africa: A Cross Sectional Study of Tiko-Cameroon. Challenges. 2015; 6: 229-243.

7. Grimwood K, Lambert SB. Rotavirus vaccines: opportunities and challenges. Hum Vaccin. 2009; 5: 57-69.

8. O'Donnell O. Access to health care in developing countries: breaking down demand side barriers. Cad Saude Publica. 2007; 23: 2820-2834.

9. Cairncross S, Hunt C, Boisson S, Bostoen K, Curtis V, et al. Water, sanitation and hygiene for the prevention of diarrhoea. Int J Epidemiol. 2010; 39 Suppl 1: i193-205.

10. Wilson SE, Morris SS, Gilbert SS, Mosites E, Hackleman R, et al. Scaling up access to oral rehydration solution for diarrhea: Learning from historical experience in low and high performing countries. J Glob Health. 2013; 3: 1.

11. Bangdiwala SI, Osegbeaghe Okoye MBBS MP. Workforce resources for health in developing countries. Public Health Reviews. 2010; 32: 296.

12. Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health: final report of the commission on social determinants of health. 2008.

13. Van Lerberghe W. The world health report 2008: primary health care: now more than ever. World Health Organization. 2008.

14. Young M, Wolfheim C, Marsh DR, Hammamy D. World Health Organization/United Nations Children's Fund joint statement on integrated community case management: an equity-focused strategy to improve access to essential treatment services for children. The American journal of tropical medicine and hygiene. 2012; 87: 6-10.

15. Aboubaker S, Qazi S, Wolfheim C, Oyegoke A, Bahl R, et al. Community health workers: A cru-

cial role in newborn health care and survival. J Glob Health. 2014; 4: 020302.

16. Management of sick children by community health workers: intervention models and programme examples: World Health Organization and UNICEF. 2006.
17. Case studies of large scale community health worker programs: Examples from Afghanistan, Bangladesh, Brazil, Ethiopia, India, Indonesia, Iran, Nepal, Pakistan, Rwanda, Zambia, and Zimbabwe USAID, MCHIP and maternal and child survival program. 2014.
18. Zahidie A , Sangrasi K , Iqbal S, Perveen S, Aftab W, et al. Strengthening Health System: using mobile phones for coordinated Community Case Management of childhood Diarrhea and Pneumonia in District Badin, Pakistan. Health Syst Policy Res. 2016; 3: 2.
19. Rabbani F, Zahidie A, Sangrasi K. Combating Childhood Pneumonia and Diarrhea at Community Level: Potential of m Health to improve interaction among health workers. Infectious Diseases Journal of Pakistan (IDJ). 2015; 24: 836-837.
20. Javanparast S, Baum F, Labonte R, Sanders D, Rajabi Z, et al. The experience of community health workers training in Iran: a qualitative study. BMC Health Serv Res. 2012; 12: 291.

21. George A, Young M, Nefdt R, Basu R, Sylla M, et al. Community health workers providing government community case management for child survival in sub-Saharan Africa: who are they and what are they expected to do? Am J Trop Med Hyg. 2012; 87: 85-91.
22. Degefie T, Marsh D, Gebremariam A, Tefera W, Osborn G, et al. Community case management improves use of treatment for childhood diarrhea, malaria and pneumonia in a remote district of Ethiopia. Ethiopian Journal of Health Development. 2009; 23.
23. Dawson P, Pradhan Y, Houston R, Karki S, Poudel D, et al. From research to national expansion: 20 years' experience of community-based management of childhood pneumonia in Nepal. Bull World Health Organ. 2008; 86: 339-343.
24. Rabbani F, Mukhi AA, Perveen S, Gul X, Iqbal SP, et al. Improving community case management of diarrhoea and pneumonia in district Badin, Pakistan through a cluster randomised studyâ€"the NIGRAAN trial protocol. Implementation Science. 2014; 9: 1.
25. Cardemil CV, Gilroy KE, Callaghan-Koru JA, Nsona H, Bryce J, et al. Comparison of methods for assessing quality of care for community case management of sick children: an application with-community health workers in Malawi. The Amer-

ican journal of tropical medicine and hygiene. 2012; 87: 127-136.

26. Mubiru D, Byabasheija R, Bwanika JB, Meier JE, Magumba G, et al. Evaluation of Integrated Community Case Management in Eight Districts of Central Uganda. PLoS One. 2015; 10: e0134767.

27. Das JK, Lassi ZS, Salam RA, Bhutta ZA. Effect of community based interventions on childhood diarrhea and pneumonia: uptake of treatment modalities and impact on mortality. BMC Public Health. 2013; 13: S29.

28. Rabbani F, Helping children reach their fifth birthday in Sindh, Pakistan, SCIENTIA, Knowledge Translation Media. 2015.

29. Gupta GR. Tackling pneumonia and diarrhoea: the deadliest diseases for the world's poorest children. Lancet. 2012; 379: 2123-2124.

30. Rabbani F, Perveen S, Aftab W. Investing in universal health coverage for childhood diarrhoea and pneumonia: Lessons learnt from the NIGRAAN implementation research. Pak J Public Health. 2015; 5: 28-30.

31. Nsona H, Mtimuni A, Daelmans B, Callaghan-Koru JA, Gilroy K, et al. Scaling up integrated community case management of childhood illness: update from Malawi. Am J Trop Med Hyg. 2012; 87: 54-60.

32. McGorman L, Marsh DR, Guenther T, Gilroy K, Barat LM, et al. A health systems approach to integrated community case management of childhood illness: methods and tools. The American journal of tropical medicine and hygiene. 2012; 87: 69-76.

33. Guenther T, Laínez YB, Oliphant NP, Dale M, Raharison S, et al. Routine monitoring systems for integrated community case management programs: Lessons from 18 countries in sub-Saharan Africa. J Glob Health. 2014; 4: 020301.