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Overview, methods and results of multi-country community-based maternal and newborn care economic analysis

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Abstract

Home visits for pregnancy and postnatal care were endorsed by the WHO and partners as a complementary strategy to facility-based care to reduce newborn and maternal mortality. This article aims to synthesise findings and implications from the economic analyses of community-based maternal and newborn care (CBMNC) evaluations in seven countries. The evaluations included five cluster randomized trials (Ethiopia, Ghana, South Africa, Tanzania, Uganda) and programmatic before/after assessments (Bolivia, Malawi). The economic analyses were undertaken using a standardized, comparable methodology the 'Cost of Integrated Newborn Care' Tool, developed by the South African Medical Research Council, with Saving Newborn Lives and a network of African economists. The main driver of costs is the number of community health workers (CHWs), determined by their time availability, as fixed costs per CHW (equipment, training, salary/stipend, supervision and management), independent from the level of activity (number of mothers visited) represented over 96% of economic and financial costs in five of the countries. Unpaid volunteers are not necessarily a cheap option. An integrated programme with multi-purpose paid workers usually has lower costs per visit but requires innovative management, including supervision to ensure that coverage, or quality of care are not compromised since these workers have many other responsibilities apart from maternal and newborn health. If CHWs reach 95% of pregnant women in a standardized 100 000 population, the additional financial cost in all cases would be under USD1 per capita. In five of the six countries, the programme would be highly cost-effective (cost per DALY averted $<$ GDP/capita) by WHO threshold even if they only achieved a reduction of 1 neonatal death per 1000 live births. These results contribute useful information for implementation planning and sustainability of CBMNC programmes.

Keywords: Community-based, community health workers, newborn, maternal health, economic analysis, cost analysis, costing tool, health systems, developing country, effectiveness threshold

Key Messages

- Standardised economic analyses of CBMNC are lacking with no multi-country comparisons especially including community health worker time, supervisory systems and commodities. This series summarizes new analyses from seven countries with varying context, content of care and cadres of CHW. We used comparable inputs and methods with the aid of the 'COIN Care' Tool.
- The main cost drivers included training and incentives for CHW obviously influenced by whether the worker is a 'volunteer' CHW or a paid extension worker. Supervisory systems and costs for commodities varied substantially. Cost per home visit ranged from $7 in Tanzania to $37 in Bolivia, largely determined by the number of home visits per CHW.
- Time spent per CHW was relatively consistent for a given home visit (median of 23–45 min, except for Ghana where it was 80 min) and even for travel time (30–45 min). However, the total time spent on this CBMNC ranged from 3 to 13 h a week depending on whether the CHW was volunteer or employed or whether they were single or multi-purpose worker.
- The annualized set-up and running financial costs standardized per 100 000 population was relatively low at <$1 per capita per year for six of the seven countries, even in study settings and in rural, hard to reach populations. Reaching higher coverage would lead to greater efficiency.
- Cost-effectiveness threshold ratios: According to WHO definition of cost per DALY averted < the GDP per capita, this investment in CBMNC would be highly cost-effective even if resulting in a very achievable reduction of 1 neonatal deaths per 1000 live births (<5% of neonatal mortality) in Ethiopia, Ghana, Malawi, South Africa, Tanzania and Bolivia.
- Comparison across the seven countries and implications: Our multi-country analyses show that the incremental cost and sustainability may be lower with a multi-purpose paid extension worker, but that these workers may struggle to reach higher coverage of care as they have many other responsibilities. More complex clinical assessment interventions or those targeting hard to reach populations (e.g. Bolivia) also have higher running costs.

Introduction

In the Millennium Development Goals era (2000–15), maternal mortality was halved and child mortality decreased by more than half (United Nations 2015). However, progress was much slower for neonatal mortality rate (NMR) and hence by 2015 almost half of deaths in children under 5 were during the neonatal period (UNICEF and UN Inter-agency Group for Child Mortality Estimation 2015). The majority (98%) of neonatal deaths occur in low- and middle-income countries and many of these newborn babies are born and die at home (Lawn *et al.* 2014).

There is momentum towards a second primary health care revolution. Studies, mainly from Asia, have shown that community-based maternal and newborn care (CBMNC), with home visits resulted in a 30–60% reduction in the NMR (Bang *et al.* 1999; Baqui *et al.* 2008; Kumar *et al.* 2008). These findings prompted the World Health Organisation (WHO) and United Nations Children's Fund (UNICEF) joint statements on home visits as a strategy to improve newborn survival (UNICEF & WHO 2009) (Box 1) and on postnatal care for the mother and newborn (WHO 2013). Decision-makers have since been planning for CBMNC, in most cases as additions to national primary health care and existing community-based programmes, but in some cases as pilots with a new worker and more rigorous evaluation.

An overview of the range of CBMNC packages are outlined in Figure 1. A defined set of interventions (e.g. birth preparedness planning, clean delivery, exclusive breastfeeding, thermal care and in some settings, infection case management) can be integrated into existing community health delivery systems and be an effective way to deliver services (Lassi *et al.* 2010) that are known to reduce neonatal mortality (Darmstadt *et al.* 2005). Many of these CBMNC packages also include a component of community or women's group mobilisation. Several cluster randomized control trials (cRCTs) showed that women's group strategies as a separate strategy reduced NMR, and to some extent, stillbirths and maternal mortality (Prost *et al.* 2013).

Estimating both the cost of CBMNC programmes and the time spent by community health workers (CHWs) and supervisors on maternal and newborn care is important for sustainable financial and logistical planning. Yet, at the inception of this study, few effectiveness studies or trials had provided estimates of the costs, cost-effectiveness or human resources implications, three in Asia (Bang *et al.* 1999; Manandhar *et al.* 2004; Borghi *et al.* 2005) and one in Africa (Lewycka *et al.* 2013). Some studies have modelled costs suggesting that CHW home visits packages may be both low-cost and cost-effective (Darmstadt *et al.* 2005; McCord *et al.* 2013). However, use of different methodologies and metrics prevents comparability across them.

Purpose of the supplement

Since limited comparable information regarding the CBMNC programmes in Africa and their cost was available, Save the Children's Saving Newborn Lives programme commissioned large effectiveness and cost evaluations in seven countries, in partnership with research institutions and local and international partners in Bolivia (Barger *et al.* 2017a) Ethiopia (Mathewos *et al.* 2017), Ghana (Kirkwood *et al.* 2013; Pitt *et al.* 2016), Malawi (Greco *et al.* 2008; Save The Children 2011; Zimba *et al.* 2012; Greco *et al*, 2017), South Africa (Tomlinson *et al.* 2014; Daviaud *et al.* 2017), Tanzania (Penfold *et al.* 2010; Hanson *et al.* 2015; Manzi *et al.* 2017) and Uganda (Waiswa *et al.* 2015; Ekirapa-Kiracho *et al.* 2017). (Box 2)

This supplement presents economic analyses of seven CBMNC programmes with emphasis on the health system implications of integrating activities within a wider community-based platform. It covers differences in the packages' design and scope across countries and the resulting implications on time spent and costs of integrating CBMNC. It also assesses the reductions in neonatal mortality that such programmes would need to achieve to be considered cost-effective. Specific costing and health systems issues emerging from individual countries are analysed to inform key policy and

Box 1. Key United Nations policy guidance on community-based programming for maternal and newborn care

2009

Home visits for the newborn child: a strategy to improve survival

WHO/UNICEF Joint Statement

- The report states that a strategy that promotes universal access to antenatal care, skilled birth attendance and early postnatal care will contribute to sustained reduction in maternal and newborn mortality
- While both mothers and newborns need care during the period after birth, this statementfocuses on the care ofthe newborn child, and the evidence for the same. Studies have shown that home-based newborn care interventions can prevent 30–60% of newborn deaths in high mortality settings under controlled conditions
- Therefore, WHO and UNICEF now recommend home visits during pregnancy and in the baby's first week of life to improve newborn survival. http://www.who.int/

2013

WHO recommendations on postnatal care of the mother and newborn

- A Steering Group and Guidelines Development Group (GDG) was taken up during 2011–2. Systematic reviews were commissioned to address the timing and content of postnatal care contacts for the mother and newborn following normal childbirth.
- Home visits in the first week after birth are recommended for care of the mother and newborn.
- Number and timing of postnatal contacts recommended:
  - If birth is in a health facility, mothers and newborns should receive postnatal care in the facility for at least 24 hours after birth. If birth is at home, the first postnatal contact should be as early as possible within 24 hours of birth.
  - At least three additional postnatal contacts are recommended for all mothers and newborns, on day 3 (48–72 hours), between days 7–14 after birth, and six weeks after birth.

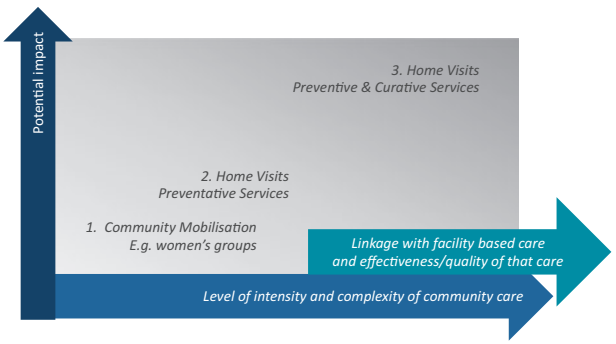


Figure 1. Overview of the scope and potential impact range of community based maternal and newborn care. Note community care packages are not necessarily independent of each other and all three components could be incorporated in a single setting

operational questions regarding community health systems for maternal and newborn care, and more generically for community-based care. Finally, this supplement aims to identify factors that may influence the feasibility of scaling up the programmes.

Aim and objectives of this article

In this article, we aim to synthesize findings and lessons learned across the seven CBMNC economic analyses conducted in parallel to the effectiveness trials and studies. Our objectives are to provide:

1. *Comparable economic methods and analyses*: We describe the development and use of the 'Cost of Integrated Newborn Care (COIN Care)' Tool, which was designed specifically to facilitate and standardize data collection and reduce the variability in costing methods. We outline the steps taken to standardize the methods used in these studies and reflect on the challenges faced and lessons learned.
2. *Comparative overview of results*: We present an overview and the economic findings from seven CBMNC evaluations with implications for programmes and future research.

Methods

While full economic evaluations include provider and household costs (Drummond *et al.* 2005), the scope of the studies in this supplement focused on community-based provider costs, both financial and opportunity costs for health services, as our main aim was on the health system to inform programme planning and budgeting. In addition, costs to households were likely to be very low: the programme was free for recipients and was based essentially on home visits, removing transport costs and reducing significantly the time implication for families, and therefore we did not assess opportunity costs to recipients. Only in Tanzania, household costs associated with additional facility deliveries as a consequence of the programme were analysed.

Development and use of the COIN Care Tool

A significant gap existed at the inception of the project in the use of a standard approach and methodology to collect and compare cost

Box 2. Overview of the papers included in this Community-Based Care Economic analysis supplement, noting the main economic evaluation question in each study

Paper	Title	Economic evaluation question
1	Overview, methods and results of multi-country community-based maternal and newborn care economic analysis	Analysis of cost drivers, sources of variation, average economic and additional financial cost of community health package across seven countries, six of them in sub-Saharan Africa—with sensitivity analysis, health system implications, feasibility of original design of intervention, home visits within a set of interventions. Develop, refine and test a standardised approach to economic and programmatic evaluation, with a particular focus on community level and CHW time assessment. Comparison of neonatal mortality reduction required to make the programme cost-effective
2	Community-Based Interventions for Newborns in Ethiopia (COMBINE) trial: Economic and threshold-effectiveness analysis	Home visit package by existing HSAs in routine setting. Question: what is the cost and the time feasibility of integrating CBMNC package into HSAs work?
3	Improving Newborn Survival in Southern Tanzania (INSIST): Community based maternal and newborn care economic analysis	cRCT: Home visit package and sepsis management at health post HEW supported by volunteers Question: can the addition of sepsis management to community-based package be cost-effective?
4	Uganda Newborn Study (UNEST) trial: Community-based maternal and newborn care economic analysis	cRCT: Home visit package by paid CHWs in dense peri-urban area with high HIV prevalence Question: what are the costs and time implications in the perspective of integration in the new SA PHC system with multi-purpose workers
5	South Africa (Goodstart III trial): Community-based maternal and newborn care economic analysis	cRCT: Home visit volunteer CHW package linked to quality improvement in large rural area Question: what are the providers and household costs of the intervention, including that of the additional deliveries in facilities. How does its costs effectiveness compares to other CBMNC interventions? Can efficiency be increased?
6	Malawi three district evaluation; Community-based maternal and newborn care economic analysis	cRCT: Home visit volunteer CHW package in rural area. Question: What are the providers costs and their drivers? What are the time implications and can efficiency be increased?
7	Bolivia programme evaluation of a package to reach an underserved community: Community-based maternal and newborn care economic analysis	Home visit volunteer CHW package in hard to reach areas. Question: What are the cost given the lower coverage, what are the implications for scale up? Can efficiency be increased in these areas?
8	Multi country analysis of the cost of community health worker kits and commodities: Community-based maternal and newborn care	Comparison of content and costs of CHWs kits, in the context of varying scopes of work Question: How and why is there such variations in cost? What are the implications for scale up in terms of upfront investment and running costs

and person time inputs related to community-based health services. A costing tool, Microsoft Excel-based COIN Care, was developed to support data collection and analysis (see Supplementary Web Annex, Supplementary data are available at *HEAPOL* online) for use for budgeting and for Cost Effectiveness Analysis. The tool was designed to be useable by those with little to no economic training and little experience with Excel. Originally developed by the South African Medical Research Council in collaboration with Saving Newborn Lives, it was then adapted based on experiences and feedback from economists from Makerere University (Uganda), Ifakara Health Institute (Tanzania) and from the London School of Hygiene & Tropical Medicine (UK). The tool was accompanied by a manual and technical support from the economists involved in its design to assist with adaptation and use. The COIN Care Tool integrates community-level and facility-level information, as well as CHW and supervisor time, and calculates providers' financial and economic costs (Box 2).

Financial costs, for budgeting purposes, covered the cost of all additional expenditures (including cost of donations, since these items may not be donated in the future or in other districts). As such, costs of existing capacity, which varied between countries, were excluded (Figure 2).

Economic costs, reflected opportunity costs with the value of all resources used, including the value of the time devoted by employed staff and/or volunteers. Time on the programme (home visits and other programme-related activities) was calculated as described

Box 3. Rationale, development and utilization guidelines for the COIN Care Tool

Why?

Since 2007 to develop a standardised tool for tracking costs that would be relevantto policy and health management decision makers, Saving Newborn Lives/Save the Children has worked with the South African MRC Health System Strengthening Unit and a network of economists atthe LSHTM and across Africa. Existing cost data collection tools were reviewed and an Excel-based tool was developed with some automated outputs and a linked manual. The COIN Care Tool has been used to collect data and conduct economic analyses in programme and research settings in Africa, Asia and Latin America at both the community and facility level.

What evidence gaps to address?

The COIN Care tool was developed to facilitate analyses to address gaps in the following areas:

- **Packages**: Often only single interventions are costed even though service delivery is through health system packages (Haws et al., 2007)
- **Community level**: Although there is a clear need for costing atthe community level and the community-facility interface, most existing costing tools are designed for facility level (Walker and Jan, 2005b)
- **Newborn care**: No studies have been conducted on the marginal cost of adding newborn care to existing health systems care atfacility or community level
- **Comparability across sites**: There are few multi-site, comparable studies atthe facility or community level, with notable exceptions– e.g. the malaria IPTi consortium or the multi-country Evaluation of IMCI (Bryce et al., 2004, Bryce et al., 2005b). However, none have analysed the additional cost ofincluding newborn care

How was the tool developed?

Phase I

Development of a generic cost input and analysis tool, after review of relevant literature and other cost tools

- **Sep 2007:** Costing tools presented & key assumptions reviewed by selected peers (London)
- **Nov 2007:** COIN Tool presented to 80 policymakers/researchers and further revised (African Newborn Network Research Workshop, Blantyre)

Phase II

Adaptation of the tool in various country settings and data collection for set-up phase

- **Mar 2008:** Draft Tool & manual revised (South Africa)
- **Jul 2008:** COIN Tool presented with 50 policymakers/researchers and further revised (Asian regional meeting, Bangkok)

Phase III

Implementation and comparable data collection with technical support

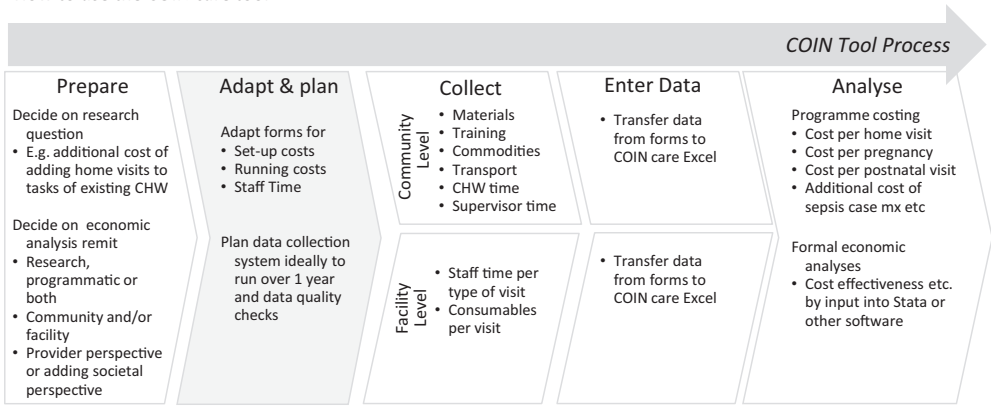
- **2009 – 2012:** Use of tool in at least 8 countries.
- **Jan 2010:** Interim analysis of first data (10 economists) - standardise

Phase IV

Analysis, publication and dissemination at national and international levels, data for district planning

- ***2013 – Current:*** Analysis, publication and dissemination of multi country analysis

How to use the COIN care tool



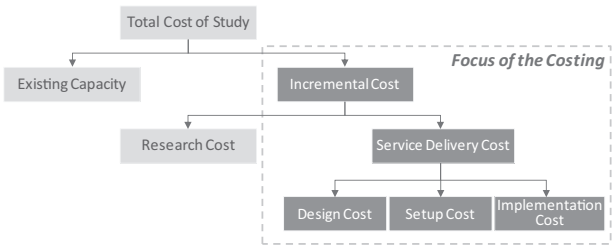


Figure 2. Scope of the Cost of Integrated Newborn Care (COIN Care) Tool

below and converted in Full-Time Equivalent (FTEs). FTEs were applied to salaries of already employed staff. Volunteer time value was estimated by applying FTEs to either the minimum wage or to the salary of an agricultural worker, depending on study setting, more details are presented in each country paper. Costs directly related to research activities were excluded. In many settings, CBMNC programmes were accompanied by health systems strengthening measures (e.g. one-off in-service training for facility health workers or equipment and supplies). The tool was also designed to capture these costs and those associated with the additional facility visits which might arise as a consequence of the community intervention.

To help inform scale-up, the COIN Care Tool approach divides cost into three categories: design costs (one-off costs), set-up costs (repeatable in each new implementation area) and ongoing implementation costs. To assist with customization while maintaining standardization for comparability, the COIN Care Tool allows the user to define possible values and names where relevant: e.g. districts, phase, types of activity and categories of staff. These populate drop-down menus, which facilitate data entry and validation. Analysis can be made by health system tier (e.g. community, facility), type of activity (e.g. CHW home visits, supervision and training) and type of input (equipment, staff, drugs . . .).

Cost analyses

All equipment with over 1 year useable life was considered as capital. Annualization for financial costs was made on the basis of straight depreciation and for economic costs a 3% discount rate was used.

We calculated total cost of the programme as:

Annualized design cost + annualized set-up cost + 1 year implementation cost

Unit costs (cost per mother and cost per home visit) were calculated from:

Annualized set-up cost + 1 year implementation cost (excluding design costs)

We identified costs incurred for each CHW, independently from the coverage or number of home visits, which we called the CHW fixed cost. Typically, these were the cost of training, supervision, payments of stipends, allowances or salaries to CHWs, materials and supplies included in the CHW kits, and bicycles, where relevant. In the analysis of training and meeting costs, we attempted to identify allowance costs. These cover different expenses (e.g. transport, accommodation, food) in different countries, and include 'incentives.' We calculated the cost per mother visited and per home visit. We estimated the cost of the programme per capita total population in the study area and expressed this per capita cost as a percentage of the country public health expenditure per capita, as an indication of affordability. All costs were adjusted for inflation in the local currency and converted to constant 2015 United States dollar (USD) values. Detailed methods specific to each country are presented in the individual papers of this supplement.

Activity data were extracted from the programmes monitoring systems. A significant challenge in several countries was the difference in coverage between that provided from the project monitoring system and the results of the endline survey. We opted for the project routine monitoring system to line up period of costs and period of activity, apart from the Ghana Newhints trial which used the survey data. Coverage was defined as the number of mothers who received at least one home visit (pregnancy or postnatal) during the year of implementation analysed as a proportion of the number of births in the study area during that year. Coverage needs to be read in conjunction with the average number of visits per mother and the target number of visits.

With the exception of Ghana and Bolivia, CHWS time on the CBMNC programme was estimated through forms completed by CHWs that differentiated type of activity, like home visits (travel time and time spent in client homes), supervision meetings, other meetings and administrative tasks. In the Newhints trial in Ghana CHW time in homes was assessed through supervisor observation. Applying the observed average number of home visits per CHW per month and the time on meetings and administration, monthly CHW time on the programme could be assessed, expressed as time per week per CHW. Monitoring of direct supervisor time was also carried out through self-completion forms and interviews, and supervision time was expressed as a percentage of FTE.

Analysis of thresholds for cost-effectiveness

As most of the CBMNC strategies did not measure changes in mortality, cost-effectiveness was only assessed directly for the Newhints strategy in Ghana (Pitt *et al.* 2016) and for the COMBINE programme in Ethiopia (Mathewos *et al.* 2017). We therefore sought to consider all the CBMNC strategies' potential for cost-effectiveness by conducting threshold analyses, which could give a broad indication of the newborn mortality reduction that the these CBMNC strategies would need to achieve to be considered cost-effective and allow the plausibility of such impact to be considered in light of other evidence. Adapting the methodology described in Pitt *et al.* (2016), we considered four different thresholds.

The first two thresholds are 'attractive' (<$150/DALY averted in 1993 $, $247 in US$2015) and 'very attractive' (<$25/DALY averted 1993 $, $41 in US$2015) (World Bank 1993). The third and fourth thresholds are linked to the country GDP per capita: 'cost-effective' (<3 times GDP per capita) and 'highly cost-effective' (<GDP per capita) (World Health Organization 2012). We calculated the protective effectiveness (PE, i.e. % reduction in the NMR) and the absolute number of deaths avoided that each strategy would need to achieve to be considered cost-effective. PE was calculated for each threshold, as follows:

$$\mathrm{PE} = \frac{C_t}{N * \mathrm{NMR}_c * T * \frac{1}{d} * (1 - e^{-Ld})}$$

where C_t is the total economic cost of the programme, including recurrent economic costs and annualised economic costs of set-up; N is the number of live births in the intervention area; NMR_b is the neonatal mortality rate in the absence of intervention, in CRCTs NMR of control area; T is the ceiling threshold indicating the maximum cost per DALY averted that would be considered cost-effective; d is the discount rate: 3% (Drummond *et al.* 2005); and L is the

life expectancy at birth in the country or in control areas in case of cRCTs

This approach only considers the strategy's potential to reduce neonatal mortality and does not consider any potential effect (positive or negative) on morbidity. It also only accounts for the cost of the home visits strategies and not for the costs of potential additional health service facility utilisation resulting from the home visits, such as facility-based care of a sick newborn following referral.

Sensitivity analysis and modelling scale-up scenarios

We developed three scenarios (Figure 3) to model the financial costs, excluding design costs, and time implications of varying coverage in a routine set-up, varying the number of visits per mother and the population by CHW. To reflect the costs of the strategies when integrated into routine health service delivery, the scenarios used local salaries. We varied the coverage of pregnant women reached with home visits in the study areas (50, 75 and 95%) and set the average number of visits per mother to four. We assessed the number and fixed costs of CHWs required as well as the cost of mothers supplies. We then standardized the analysis to a 100 000 total population, using the national crude birth rates. This scale-up was completed for all studies except Ghana due to unavailable information on CHW time on the program.

Given the important fixed costs per CHW, even volunteers, we also included an efficiency component by reducing the number of CHWs when the population per CHW is very low and two CHWs were available per village (i.e. in Uganda, Tanzania). We assumed the maximum time on the programme which could be expected from a volunteer to be 6 h per week and modelled reducing from two volunteers per village to one in Uganda and Tanzania. We also applied an efficiency scenario to South Africa where the paid CHWs were spending only 52% of their available time on the programme. We modelled the number of home visits per week, which can be carried out given the working time available and calculated the number of CHWs required. We used the same approach for the volunteer CHWs in Bolivia but within the 6 h a week limit. Efficiency scenarios could not be applied to Ethiopia and Malawi where the number of CHWs was determined by district level decisions on design of primary care services. The cost of the program is then expressed as the additional financial cost per capita total population. This is then calculated as a percentage of public health sector expenditure per capita.

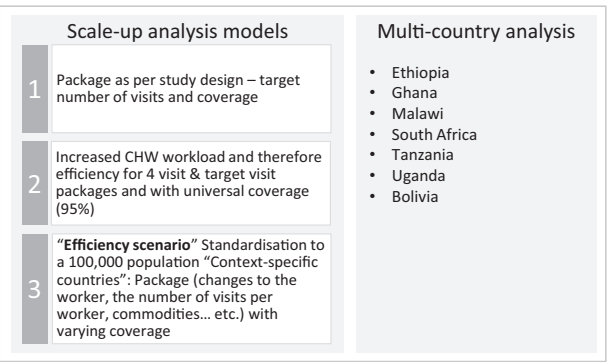


Figure 3. Standard modelling approach to scaling up the implementation costs - a summary of the three scenarios developed to model the financial costs and time implications of scale-up in a routine set-up, and countries with comparable data

Results

Context

The programmes and research studies reported in this supplement were developed and implemented in different contexts. Of the seven studies, five were cluster randomized control trials (Table 1). Baseline or control group NMR ranged from 33 per 1000 live births in Ghana, 27 in Malawi, between 21 and 23 in Tanzania, Uganda, Bolivia and Ethiopia, down to 10 in South Africa. Types of CHWs and supervision models differed as well. In the Bolivian highlands, volunteers were recruited to deliver home visits that reached a dispersed rural, underserved population. These CHWs were not connected to nurses from the health centres but rather were supervised by non-clinical staff recruited and paid by Saving Newborn Lives Bolivia. CHWs in rural central Ghana were recruited amongst existing community surveillance volunteers as per the prevailing national guidelines and supervised by staff hired by the research team, but linked with the district health management teams. In Ethiopia, the programme was implemented in a context of very low access to health facilities, with home visits by volunteers and Health Extension Workers (HEWs) linked to village health posts. The multi-purpose HEWs were government-paid CHWs supervised by local health centre staff, and with additional supervisors employed for the study. In Malawi, the programme relied on existing government-paid multi-purpose CHWs and supervisors within a rural setting. In the South Africa study in a densely populated peri-urban setting with easy access to health facilities CHWs and supervisors were locally recruited and paid by the study. In a mixed rural and urban setting in southern Tanzania, single purpose volunteers were recruited for the programme and supervised by existing nurses from health centres who received a small amount of additional support from the programme through a linked quality improvement project. In rural eastern Uganda, volunteers from existing Village Health Teams were recruited specifically for maternal and newborn home visits, but were later integrated into the district health system and were supervised by existing nurses from health centres. In all studies, training, kits and review meetings were paid by the project or study rather than through existing government systems. Table 1 presents a summary of the pay and incentives for CHWs per country, together with a description of the training received for the programme. CHW general training and specific CBMNC training varied from 9 months government training plus 14 days specifically on CBMNC in Ethiopia to 6 days total in Tanzania and Uganda. The ratio of CHWs to population ranged from 1 CHW to 500 total population in Bolivia and Ghana and to 1 CHW to 2903 population in South Africa.

CHW home visit commodities and transport (seven countries)

In the final paper of this supplement (Barger *et al.* 2017b) we focus on the resources used by CHWs to conduct home visits, coined 'home visit kits'. We estimated the annual equivalent cost (AEC) 'home visit kits' per CHW in constant 2015 USD and present comparative cost profiles. The content of these home visit kits varied, even for those carrying out similar functions. The annual cost per CHW kit ranged from $15 in Tanzania to $116 in South Africa. For health promotion and preventive care, between 82 and 100% of the cost of CHW commodities did not vary with the number of home visits conducted; however, in Ethiopia, the majority of consumable costs associated with curative care varied with the number of visits conducted. In South Africa, where CHWs were charged with health

Table 1. Summary of the programmes and research studies with data collected using COIN Care Tool analysed

Country/Package	Scope of Package	Evaluation Design and Data Collection	Health Worker - Cadre, Pay & Incentives		Recruitment	Training	Supervision
							
Ethiopia (COMBINE)	Preventive & curative	Cluster randomised trial	Health Extension Worker (Government paid worker)	Pay: *CHW: $891/yr* *vCHW: $74/yr* Training/meetings: *N/A*	Pre-existing/centrally	HEW: Already received basic training. 1.5 days within the 6 days training for ICCM. 1 extra day in intervention arm. Supervisors received same training and allowance. VCHW training on neonatal care as part of their recruitment	HEWs—monthly supervision from supervisors at health centre as part of routine HEP. 38 Project Officers 2–4 health posts 2 visits per month
Malawi (CBMNC)	Mobilisation & preventive	Government tracking data supplemented by before and after survey of coverage	Health Surveillance Assistant (Government paid worker)	Pay: *$1445/yr* Training/meetings: *$205 (avg)*	Centrally recruited. Pre-existing with 10–12 weeks training	Facility level 21 day in service training in integrated maternal and newborn care Community level 10 days CBMNC. 75% received additional community mobilization training	HSAs were selected for supervision visits based on theory performance and reporting (Callaghan-Koru 2013)
South Africa (Goodstart II)	Preventive	Cluster randomized controlled trial	Goodstart CHW (Study recruited paid worker)	Pay: *$35 714/yr* Training/meetings: *$3890 CHW* *$6602 Supervisor*	Locally recruited	Intervention CHWs trained over 10 days	
Tanzania # (INSIST)	Mobilization	Cluster randomized controlled trial	Mtunze CHW (Volunteer)	Pay: *N/A* Training/meetings: *$12/day training* *$12 each QRM*	Centrally—selected from villages in the intervention wards	Four female CHWS from each village were trained for 5 days by government health staff + 1 field day, 2 then selected based on performance, other two in reserve	March to December 2010 a single person from RCH section of health facility supervised each volunteer. January 2011, Village leaders responsible for community supervision and support and facility staff for technical input

(Continued)

Table 1. (Continued)

Country/Package	Scope of Package	Evaluation Design and Data Collection	Health Worker - Cadre, Pay & Incentives		Recruitment	Training	Supervision
Uganda # (UNEST)	Preventive	Cluster randomized controlled trial	Village Health Team (Volunteer recruited through UNEST)	Pay: *N/A* Training/meetings: *CHT: $5.40/meeting HWS = $5.4 (DOS) $8.10 attend group meeting*	Recruited by the community following MoG guidelines	VHT: trained for 5 days	Overall supervision by DHTs, led by DHVs with UNEST support. Super VHTs coordinate the work of fellow VHTs
Bolivia	Mobilization	Government tracking data supplemented by before and after survey of coverage	CHW (Government volunteer)	Pay: *N/A* Training/meetings: *N/A*	Pre-existing	One week training for general maternal and child health + 3 day update to implement postnatal mother and newborn care	One part-time supervisor from APROSAR was assigned to support approximately 35 vCHWs in each municipality by reinforcing maternal and newborn care messages
Ghana * (Newhints)	Preventive but with clinical assessment at home	Cluster randomized controlled trial	Newhints Community-based surveillance volunteer (study recruited volunteer)	Pay: *N/A* Training:?? Incentive: *$3.49/month*	Pre-existing	3 days initial training, followed by 4 days with practicals. 2 day refresher (8 days total)	District Project Supervisors (DiPS)—home visit once a month. Group meeting every 2–3 months, meetings with community leaders + equipment checks

Table 2. Time each CHW spends on the country programme or research study per visit and per week

CHW time per home visit	Ethiopia	Malawi	South Africa	Tanzania	Uganda
Median time per home visit (min)	58	65	57	75	72
Contact time in home/travel time	23 min/35 min	45 min/20 min	27 min/30 min	30 min/45 min	40 min/32 min
CHW time per week					
Average # hours on the programme per week per CHW	4.0	5.1	13.0	3.3	3.2
% Time spent on home visits	50%	27%	38%	70%	53%
Supervisors time per week					
Direct supervisors hours per week	5	3	19	Not recorded	4

N.B. in Ghana the reported median time in home per home visit was 80 min. In Bolivia supervisors spent 7 h a week on the programme—no other time data were available for Ghana and Bolivia.

promotion activities exclusively, the health promotional materials given to mothers were estimated at $6.20 per mother. Bicycles were provided to CHWs performing home visits in the Bolivian highlands due to relatively low population density, representing the main driver of equipment and supply costs per CHW.

Time spent by CHWs and supervisors (six countries)

Reported median time in home per home visit, ranged from 23 to 30 min in Ethiopia, South Africa and Tanzania, 40–45 min in Malawi and Uganda and 80 min in Ghana. No significant time difference was observed between antenatal and postnatal visits in any of the study settings. Travel time per home visit ranged from 20 to 45 min. A significant amount of time was spent on programme-related activities beyond home visits, i.e. preparation of visits, administration, meetings, and identifying new pregnancies. This 'non-home visits' time ranged from 73% of programme time in Malawi to 30% in Tanzania, and its length, by opposition to proportion of time, does not change significantly if the number of home visits increases. Time on programme activities averaged between 3 and 13 h a week (Table 2). The number of CHWs per supervisor ranged from 4 to 10 in 4 countries, but 25 in Malawi. Large differences in supervisors' time were observed, from 3 to 19 h a week.

Coverage of home visits

The percentage of pregnant and newly delivered women in the study area who had received at least one home visit, was over 90% in Ethiopia, South Africa and Uganda, 80% in Tanzania, 77% in Ghana but 35% in Malawi and 18% in Bolivia. In all settings, CHWs achieved higher coverage of the pregnancy visits than the postnatal ones, and the crucial early postnatal visit (within 48 h of birth) tended to have lower coverage. The number of home visits per mother visited averaged between 7 in Bolivia (target 7), 5.2 (1.2 by HEW and 4 by volunteers) in Ethiopia for combined home visits and health posts visits (target was 9 visits, respectively, 3 and 6), 3.2 in Ghana (target 5), 2.8 in Malawi (target 5), 4.1 in South Africa (target 7), 3.3 in Tanzania (target 5) and 3 in Uganda (target 5). The average number of visits per week per multi-purpose paid CHW was 1.3 in Malawi and 1.8 in Ethiopia (0.4 for volunteers in Ethiopia), it was 5.4 for single purpose paid CHW in South Africa. For volunteer CHWs it stood at 1 in Ghana, 1.5 in Uganda, 1.8 in Tanzania and 0.3 in Bolivia.

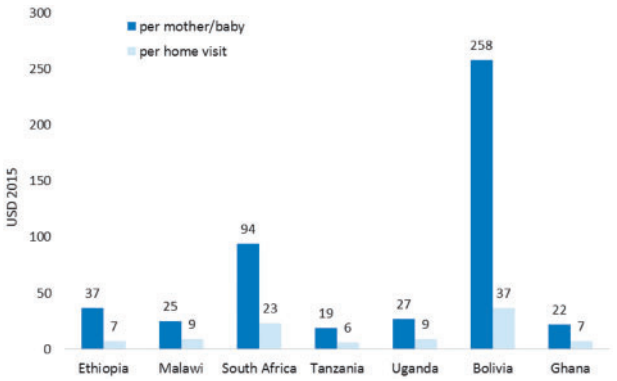


Figure 4. Economic costs per mother and baby pair and per home visit, for community based newborn care packages evaluated in seven countries in USD 2015

Costs and cost drivers

Excluding the one-off design costs, the economic cost per mother and baby pair visited ranged from $19 in Tanzania, $22 in Ghana, $25 in Malawi, $27 in Uganda and $37 in Ethiopia, to $94 in South Africa and $258 in Bolivia (Figure 4). The higher costs per mother in South Africa reflects higher stipend for CHWs and the cost of the cell phones. In Bolivia the higher cost per mother is due to the small number of mothers visited by CHWs, related to the challenges of hard-to-reach rural areas.

Considering national affordability, the additional annualized financial costs of implementing the CBMNC programmes as observed in the study setting, amounted to around $0.4 per capita total population in the study areas in Ghana, Malawi and Tanzania, or 1, 1.3 and 2.1% of public health expenditure per capita, respectively. These financial costs amounted to $1 per capita total population in Ethiopia, Uganda and Bolivia, representing 5.5. 1.8 and 0.7% of public health expenditure per capita, respectively (Table 3).

Fixed costs per CHW, independent from the number of mothers seen or home visits made, represented at least 97% of financial costs in four countries and 63% in South Africa. Supervision related costs (supervisors training, transport and meetings allowances and CHWs allowances for supervision meetings) amounted to around 15% of financial costs in Malawi, Uganda and Bolivia, 20% in South Africa, 42% in Tanzania and 91% in Ethiopia.

Table 3. Costs in study setting and in the scale up efficiency scenario in routine setting by country

For the community-based programme	Ethiopia	Malawi	South Africa	Tanzania	Uganda	Bolivia	Ghana
Economic cost (excl household cost)							
Per mother/baby	$37	$25	$94	$19	$27	$258	$22
Per home visit	$7	$9	$23	$6	$9	$37	$7
Additional financial cost study							
per capita	$1.0	$0.3	$2.3	$0,4	$1,0	$1,0	0,4
as % public health exp./capita	5.5	1.3	0.9	2.1	1.8	0.7	1.0
% fixed costs	98	98	63	97		97	
supervision as % annualized costs	91	12	20	42	15	16	
Scale-up scenario: routine set-up—standardized for 100 000 total population, 95% coverage, 4 visits per mother							
Additional Financial Cost routine set-up							
Per mother/baby	1.8	6.6	36.5	6.9	13.0	29.0	
Per home visit	0.5	1.6	9.1	1.7	3.2	7.0	
Per capita	0.06	0.23	0.93	0.26	0.53	0.86	
As % public health exp./capita	0.3	1.30	0.4	1.30	0.90	0.5	

Table 4. Number of deaths per 1000 live births which would need to be averted for the program or research study to be considered cost-effective per country

	Ethiopia	Malawi	South Africa	Tanzania	Uganda	Bolivia	Ghana
Background NMR in year of study	23	27	10	21	22	23	32
Cost-effective	0.3	0.2	0.2	0.2	0.5	0.1	0.3
Very Cost-effective	0.9	0.7	0.5	0.5	1.5	0.2	0.8
Attractive	1.7	0.8	14.5	1.4	3.7	6.8	2.5
Very attractive	10.2	4.9	87.6	8.4	22.6	40.9	15.0
% Reduction in NMR for cost-effective	1.3	0.9	1.6	0.7	2.3	0.3	0.9
% Reduction in NMR for highly cost-effective	3.9	2.7	4.7	1.2	6.9	1.0	2.5

Cost-effectiveness threshold analysis

For the programmes to be highly cost-effective as per WHO threshold (cost per DALY averted less than GDP per capita), programmes in all countries presented, with the exception of Uganda, would have to avert <1 additional neonatal death per 1000 live births. In Uganda, 1.5 additional neonatal deaths per 1000 live births would need to be averted for the programme to be considered highly cost-effective (Table 4). In Ethiopia, the addition of management of newborn infections at health posts was estimated to have reduced the number of neonatal deaths by an additional 1.8 per 1000 live births compared with the control arm (Degefie *et al.* 2017)

In Ghana, the mother/newborn home visits programme had a cost per capita total population of US$0.53 in 2009. With a baseline NMR of 32.7 per 1000 live births, the cost by discounted Life Year Saved amounted to $352, and the programme had a 99% probability of being considered highly cost-effective (Pitt *et al.* 2016).

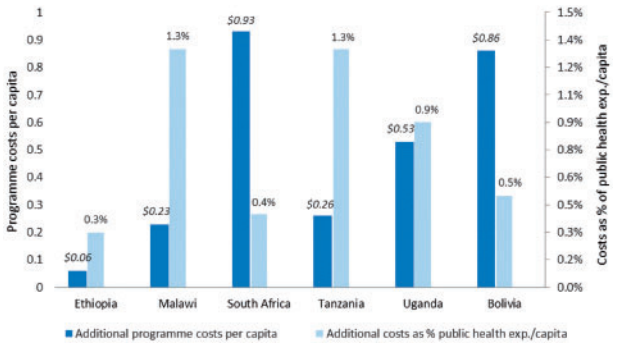


Figure 5. Additional financial cost (USD 2015) of programme per capita and as % of public health expenditure per capita, for scale up scenario 3 (100 000 population and a 95% coverage with an average of four visits per mother), for community based newborn care packages evaluated in six countries in USD 2015. Note: The scale up scenario could not be done for the Ghana study as elements of CHW time use were not available

Sensitivity analysis scenarios

Increased efficiency (scenario 3) decreased the number of required CHWs—increasing productive CHW time on the programme in South Africa to reach their terms of employment, and in Tanzania and Uganda by reducing the number of CHWs per village from 2 to 1, due to low workload, would cut programme financial costs by 39% in South Africa, and by 45% in Uganda and Tanzania.

In a population of 100 000 people with 95% of expectant mothers receiving an average of four visits, the financial cost per mother would average between $2 in Ethiopia to $37 in South Africa. The programme cost expressed as cost per capita total population would be under $1 for all countries, from $0.06 in Ethiopia to $0.93 in South Africa. It would represent between 0.3% of public health expenditure per capita in Ethiopia and 1.3% in Malawi and Tanzania (Figure 5).

For the Ethiopia programme, and given the importance of transport to ensure supervision, we made a crude estimation of running costs and motorbike maintenance for a year for a currently existing dedicated health post supervisor based at the health centre, and standardized it to the number of supervisors and recurrent transport cost for a total population of 100 000 (supplement with (Mathewos *et al.* 2017)). The yearly running costs of motorbikes for supervisors would be equivalent to the yearly salary package of three CHWs in Ethiopia.

Discussion

Prior to this set of seven evaluations, the few existing impact assessments of CBMNC programmes had mostly been conducted in Asia and these applied different methodologies. This supplement synthesises results from economic analysis of CBMNC strategies in six countries in sub-Saharan Africa, and one in Latin America, covering varying contexts, intervention scopes and levels of the health system, while applying consistent methods. To our knowledge, this is the first multi-country study to model the cost of integrating CBMNC programmes into a routine health service, and to provide detailed information on time spent by CHWs on different types of activities.

Previous cost-effectiveness and cost-utility studies have focused on neonatal deaths and DALYs averted through reduced mortality. While the mortality and morbidity impact has not been quantified in most of the studies presented here, we modelled this and for six of the seven studies, <1 additional neonatal birth avoided would make the programme highly cost-effective. Applying the effectiveness threshold analysis to various levels of NMR, Pitt *et al.* (2016) emphasize that cost per DALY averted would be lower in countries with higher NMR, and higher in countries with lower NMR, but that for the majority of LMICs, peri-natal community-based programmes are likely to be cost-effective with a small reduction in NMR. This is an important point as it implies that while reductions in NMR might not be found to be statistically significant, the programme may be highly cost-effective using WHO thresholds.

In addition to mortality impact, the intervention is likely to also have an effect on morbidity and later mortality due to changes in healthy behaviours and increased recognition of illness and care-seeking. Therefore, selecting a single unit of impact to calculate cost-effectiveness has its limitations as expressing the cost of a complex multi-faceted intervention in terms of a one single change of behaviour (e.g. cost per baby exclusively breastfed for 6 months) is likely to vastly understate the cost effectiveness of the intervention. Published results showed significant changes in practices and behaviours even when mortality change was not detected or not measured (Kirkwood *et al.* 2013; Tomlinson *et al.* 2014; Hanson *et al.* 2015; Waiswa *et al.* 2015).

If a programme is cost-effective, and a decision is made to scale it up, what are the operational issues which can ensure organisational and financial sustainability? The combined information on cost and time use is essential to better understand the affordability and time feasibility of increasing coverage as would be the case in programmatic scale up (Gogia *et al.* 2011), as well as providing information on how to improve deployment of CHWs. One concern must be to ensure that a new programme does not displace existing activities (Marchal *et al.* 2009) or, on the contrary, that CHWs work too few hours, and that incentives are aligned across activities.

The studies took place mostly in rural areas, as such no comparison of rural versus urban could be carried out.

Given the impact of workload on scalability, especially for multi-purpose workers, we specifically focused on time use analysis. The breakdown of time spent on the programme (time spent in home, on travel, on supervision and other meetings and on administration), showed that time for activities other than home visits themselves can represent a significant share of time on the programme, and calculation of possible workload must take such time into consideration. Analysis of CHWs' time in homes suggested no differences between postnatal and pregnancy home visits length.

Defining the number of CHWs required for the community-based care interventions is challenging since this is context-specific. Many factors influence the CHW time spent on the programme and availability of time is defined by the type of cadre and their existing workload. In Uganda, with members of the Village Health Team dedicated to the programme, and Tanzania, single-purpose CHWs, CHWs were allocated on the basis of two volunteers per village with an average total population of ~1000, each spending <3.5 h a week on the programme. Reducing the number of volunteers to one per village, the CHW could achieve 95% coverage of pregnant mothers with an average of four visits per mother in <6 h a week on the programme, a time that we set as a maximum which could be expected from a volunteer without threatening other personal income-generating activities. Modelling this efficiency scenario showed a 45% reduction in cost of the programme, hence strengthening affordability. It may however incur other, but limited, costs such as the provision of bicycles to cover a wider area.

In contrast, extension workers in Malawi were already full-time multi-purpose cadres and analysis of CHW time showed they were overburdened and could not have reached target coverage and target number of visits set by the protocol. They visited 35% of the target mothers, with an average of 2.8 visits per mother. If coverage increased to 95% with the target number of five home visits per mother, each CHW would have spent around 31% of a full time equivalent on the programme, a challenging proposition given the other health and social programmes they have to cover. This raises the question of whether the protocol was too ambitious, or whether more CHWs must be employed, or whether volunteers should support CHWs as observed in the Mai Mwana study (Lewycka *et al.* 2013). Ethiopia shows an interesting response to this type of challenge, where CHWs were also existing full-time multi-purpose cadres, paid by the government, but each was supported by an average of 13 volunteers. Each CHW covered a population of 2438 (compared with 1409 in Malawi) and also provided sepsis management for newborns at the local health post. The volunteers identified pregnant women and performed home visits, simultaneously informing CHWs about deliveries to enable the CHWs to also attempt to visit within the critical first 48 h after birth. Each mother was expected to receive six home visits from the volunteer and three from the CHW. According to the programme monitoring, the coverage was 95%, compared with 35% in Malawi, with an average of 5.2 visits (1.2 by HEW and 4 by volunteer). While it is likely that the strengthened support and supervision provided in the Ethiopian research study participated in this high coverage, the model of two layers of community-based cadres appears to bring some solution to the issue of overburdened workers covering several programmes. However, further studies are required, likely specific to countries, to ascertain the acceptability of volunteer work and the maximum amount of time a volunteer can be expected to work. Our assumption of six hours a week may be too high in some countries. Very limited time spent by volunteer would imply a need for a greater number of volunteers to achieve the programme's objectives. Given the high fixed costs per CHW, this has implications for the financial desirability of volunteer-based programmes.

In all countries, with the exception of South Africa (with high mobile phone charges), CHWs fixed costs, independent from the level of activity, represented 97% and over of the financial costs of the programme. Therefore, increasing the coverage or number of visits by CHW translated into very marginal increases in financial costs if such activity increases did not imply an unreasonable time commitment. Further research is needed to analyse the impact of increased CHW workload on the intervention. These results highlight the importance of time analysis to support optimum use of financial and human resources in line with the objectives of the programmes, in particular regarding: the deployment of CHWs and

its impact on coverage and costs, the mix of cadres, the implications of multi-purpose vs single purpose CHWs.

Supervision and training are important factors and, constitute the main difference between study setting and the possibility of scale-up in a routine set-up. In all countries presented, with the exception of Malawi, supervision was stronger in the study setting, taking the form of higher allowances for supervision or supervision meetings (Bolivia, Ethiopia, Uganda), additional supervisors with dedicated transport (Ethiopia), additional time for supervision and mobile phone follow up (South Africa) and additional supervision meetings for the programme (Bolivia, Ethiopia, Uganda, Tanzania, South Africa). Apart from Bolivia, in five other countries coverage rates were 77% or higher. In contrast, the coverage rate was 35% in Malawi. Whilst partly explained by high workload, this lower coverage may reflect the limitations of the existing routine supervision. In routine systems, nurses from the local health facility typically provide supervision services. Besides the difficulty of adding supervision to an already heavy workload, the absence of budgets for supervisors transport running costs constitutes a serious impediment. Some programmes are supplied with motorbikes but with no funding or budget lines for the on-going maintenance and running costs. We could not find papers where supervision transport running costs were quantified. The estimation made for the Ethiopia programme, shows that a small additional expenditure could have significant impact not only on a specific programme but on the many programmes of the community-based platform.

While these programmes and research studies have focused on the additional cost of integrating CBMNC, other factors, often specific to each setting, also influence the organization of community-based platforms. For example, improving equity of access of indigenous communities in the Bolivian highlands was the main objective of the intervention in Bolivia. In Uganda, the intervention was found to be pro-poor with more women in the poorest quintile receiving a home visit by a CHW, compared with families in the least poor quintile (Waiswa *et al.* 2015). Higher costs may be acceptable within health programmes when high disease burden and/or marginalised populations need to be reached.

The use of a common tool, the COIN Care Tool, has improved the comparability of the results. The flexibility of the tool facilitated its adaptation to various contexts. However, one goal in the design of the tool, to make it usable by people with limited training in economics and Excel, failed to be achieved as significant support from economists was still required. Whether or not to include one-off design and formative research costs in the estimation of costs per mother or cost per capita total population was heavily debated among the network of economists. Such costs can be very significant and are not always distinguished from set-up costs which have to be replicated in each new district. Separating these costs would assist in the comparability of results and in the analysis of financial sustainability.

Limitations & directions for future research

Each country-specific paper in this supplement presents the limitations of the specific study; however, a few limitations were common to several of the studies. The studies do not present a full economic evaluation as they do not include costs to households, they only reflect financial and opportunity costs to providers. However, as explained in the methodology section both financial and opportunity costs to households were likely to be very low. While the cost of increased facility deliveries due to the programme was costed in Tanzania, the cost to providers and clients of other additional visits (e.g. sick newborn visits) were not assessed due to limited data from and links to health facilities. Another limitation is that projects' routine monitoring systems were used to provide activity and coverage data to align the period of costs and period of activity, but in several countries differences were observed in the estimates of coverage based on the project monitoring system and the results of the endline survey. In most settings, the community-based programme was combined with health system strengthening activities designed to improve the quality of facility-based services. However, the low quality of data extracted from the routine health information system in most settings prohibited the analysis of changes in facility utilisation and associated costs in most countries.

Time data for CHWs and supervisors was often collected via self-administered surveys or time-use diaries. The number of home visits during the period of monitoring appeared in some countries to be higher than would have been expected according to the project routine information system. To manage this distortion, we used the time recorded per home visit and applied the activity level supplied by the project. Biases of self-monitoring are well known, as are the problems associated with the Hawthorne effect in time-and-motion studies (Draper 2002). However, similarity across countries, apart from Ghana where the content of visits was wider, in the estimates of median time per home visit (both time in the client's home and travel time) indicates that time was recorded fairly reliably.

Regarding the COIN Care Tool, the first challenge emerged during its adaptation to each country situation, due to the flexibility of the tool which allows users to define their own lists of possible values which are then displayed as dropped down menus. Users tended to create too many values, in particular for categories of activity and categories of staff, when such detail was not necessary and initially made analysis more cumbersome. Another challenge arose for some countries in the classification of costs between design and set-up. Exclusion of research costs also proved a challenge, as researchers sometimes also provided management and support to the programme, which needed to be included in the cost analysis. An additional challenge was the classification of monitoring and evaluation costs. In some instances, these were considered research costs, but in other case were considered surveillance. Also, in order to keep the analysis within the Excel tool, some knowledge of pivot tables is required but with some external support this challenge was ultimately overcome.

While these comparable data from seven countries are an advance on previous single studies, our work brings to light new research questions and further work needed, particularly on CHW incentives, namely their possible impact on coverage, and supervisory systems. Some of the systems issues highlighted in the article have also been encountered in the implementation of the integrated Community Case Management, as highlighted a several country reports on iCCM (Collins *et al*. 2014; Daviaud *et al*, 2017c). Further research should link neonatal and under five iCCM interventions which have become combined in many countries. Finally new discussions are emerging on cost-effectiveness thresholds, 2016 (Ochalek *et al*. 2015) as mentioned in the Ethiopia paper, further research should link comparative evaluations of community-based care and facility-based services to these discussions.

Conclusion

This article and the wider supplement of eight papers aim to inform policy decisions regarding the desirability and feasibility of

CBMNC, as well as to promote more accurate planning for higher impact, sustainability and scale-up for maternal and newborn care. We also emphasise that community-based care protocols need to be carefully designed to account for the workload implied, the workforce availability and the types and mix of cadres required, including supervisors. Integration between community-based care programmes is likely to be desirable and less costly, but only when the time implications have been thoroughly analysed, guaranteeing that a programme does not displace another equally important programme. Volunteer-based programmes do not provide this possibility of integration due to their limited time available, confining them to being single purpose rather than multi-purpose cadres. Findings in this supplement highlight that CBMNC programmes can be highly cost-effective and also pro-poor as they often reach the hardest to reach women and babies. Yet, these programmes must be seen as part of the wider health system and sustainability requires careful, context-specific, data-based planning for which cadre, content of care, commodities, link to facility care and incentivization for CHWs and supervisors. Strengthening the impact of community-based care also entails ensuring that facilities are able to meet the demand of intervention-stimulated increases in health facility utilization. Improvements in the quality of care at facilities must be made in tandem with community-based intervention for maximum impact (Mason *et al.* 2014).

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