Delivering interventions for newborn and child survival at scale: a review of research evidence

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Terminology

**Health system:** everything related to the infrastructure and capability of the system to deliver, e.g. bricks and mortar, geographical coverage, human resources including nos. of health care workers and their competencies, the management structures, supervision, finances available etc.

**Intervention delivery approach:** distinct from the system, 'approach' refers to the mechanism used/led by the delivery system e.g. mass immunization days, community health workers outreach programmes, provider initiated testing and counselling (PITC) within clinics, training and supervision staff, financial incentives to staff, quality assurance or improvement approaches, Baby Friendly Hospital Initiative (BFHI) etc. Might also include approaches for increasing demand by the user as these would still be initiated and orchestrated by 'the health system'. (Also referred to as 'implementation strategy')

**Intervention content:** the intervention to be delivered, e.g. vitamin A, antibiotics, infant feeding counselling and support, ORS, zinc, ARVs to mother or infants etc.
KEY MESSAGES

For policy makers

1. Interventions are available that can prevent serious illness and save the lives of millions of infants and children living in low and middle income countries. Achieving universal coverage of these interventions depends on three factors: i) a functional health system, ii) the delivery approach used by that system, and iii) community or individual considerations such as access, demand for and acceptability of the intervention, and ability to comply;

2. While much is reported on implementing an intervention or package of interventions at scale, little is known about the process of scaling up, namely moving from delivery in one district to national coverage;

3. Any intervention aimed at reducing financial or physical barriers needs to consider questions of affordability, equity and sustainability at scale;

4. Strategies taking health interventions directly to communities and individual homes can increase the uptake and improve the quality of local services. Their impact on maternal, newborn and infant mortality has been promising though inconsistent. The variation in effect suggests that the details of each strategy will be context specific, and modification will be required to identify the most appropriate combination of approaches;

5. Implementing focussed, or single interventions such as TB programmes or immunisations can be very successful. Integrated, comprehensive interventions such as those included in IMCI are more complex to introduce and scale up. Additional considerations and planning are required;

6. Knowledge and training need to be linked with establishing conditions that encourage health workers to change their practices - leadership, motivation, opportunity and accountability;

7. Developing and implementing prototypes that can be rapidly adapted may be a useful concept to include in formal scale-up plans;

For researchers

1. Comparative studies are needed that use, or integrate more than one delivery approach for a single, or combination of interventions that measure outcomes including mortality and cost. Evidence is needed to inform ways in which existing health systems can more effectively deliver existing national packages of care;

2. Research is lacking on methods to improve the functioning of district health systems i.e. the organizational context irrespective of the intervention being delivered;

3. Standardised approaches or conventions for quantifying, or systematically describing a health system and its functioning, or the community setting in which an intervention is tested or delivered would enable better interpretation of research findings and health planning;

4. Research into optimal training and supervision approaches is needed to facilitate implementation at scale and sustain behaviour change on site;

5. Research into the methods and the science of rapidly and reliably scaling up proven successful child survival interventions within countries and regions is needed in addition to the investigation of approaches for implementing at scale;

6. New and innovative collaborations are needed between researchers, systems and evaluation specialists and national health authorities that will be responsible for expanding and sustaining the findings of health systems research.
EXECUTIVE SUMMARY

Objectives
The review examined approaches for delivering child and newborn interventions to large populations and how research can inform the mechanism for achieving universal coverage of essential maternal, newborn and child health interventions. In the addition, the review aimed to identify specific gaps in health systems research design and interpretation.

Background
Achieving universal coverage of the newborn and child survival interventions that could significantly reduce global mortality rates, depends on three factors: i) a functional health system, ii) the delivery approach used by that system, and iii) community or individual considerations such as access, demand for and acceptability of the intervention, and ability to comply. Health systems need to be technically competent, adequately distributed and sufficient in human resources; they also need to be responsive to, and capable of overcoming predictable obstacles, e.g. populations not attending facilities. Health systems are thereby distinct from the interventions but their relationship mean that the delivery approach for any intervention is shaped by the nature of, and needs of the other, and may therefore be different in different settings. We note that while the implementation of interventions at scale is dependent on a successful process of scaling up, namely moving from delivery in one district to national coverage, little is known about this topic.

Research conventionally investigates the efficacy of interventions in controlled settings, or their effectiveness when delivered within routine services. In general, interventions perform less effectively when implemented in "real life" compared to controlled research settings. How factors within an health system determine the effectiveness of interventions is however, uncommonly examined and reported. While identifying and describing these factors helps to explain differences in research findings, they become all the more important when designing delivery approaches to implement interventions at scale.

Methods
We reviewed reports from the peer-reviewed literature published after January 1995 that were identified using the following inclusion criteria: i) an intervention taking place at scale, ii) in a low- or middle-income country (LMIC), and iii) with discussion of strategies to implement newborn or child survival interventions. We employed a MESH term search in PubMed to identify and analyze studies according to the mechanism of implementation. In addition, we included a small number of reports, known by the authors but not captured in the search, and also some from the grey literature.

Following review of the abstracts, 1,318 reports were excluded because they did not meet the inclusion criteria. The full manuscripts of the remaining 167 articles were reviewed and 106 were subsequently excluded leaving 58 articles that matched our criteria. Three review articles identified in the search, and five pre-search reviews referenced eighteen additional articles. Finally we included eight references provided by colleagues. These 87 articles described 79 discrete studies.

We identified four broad categories of implementation strategies: demand creation, health systems management and organization, human resource development and training and broad delivery mechanisms. Within these categories, we established 16 sub-categories.
Findings and Discussion

There was significant overlap with many of the reports being represented in more than sub-category of implementation strategy. In part, this illustrated the conceptual blurring between 'intervention content' and the 'delivery approach' but also reflected the bias or preferences of the investigators. Some strategies aimed to create demand, empower communities, and decrease barriers to care, while others focused their efforts on care that could be delivered within the community or at facilities. Few studies reported efforts to integrate more than one delivery approaches and rarely was one combination weighed against the other. The potential for either an additive or negative effect when one delivery approach was implemented in conjunction with another was never reported. Most significantly, none of the studies reported on ways in which existing health systems in LMIC could more effectively deliver existing national packages of care.

Only a minority of studies showed a decrease in child mortality while in most mortality was not in fact measured. In some, large scale multi-country interventions that reported no effect on mortality, it was not always conclusively shown that the processes that were designed to lower child mortality were effectively implemented, or that some critical strategies for child survival (e.g. neonatal care) were included in the “package” of interventions. The most sobering reports were those that did show benefit in the targeted processes but no demonstrable effect on mortality. The importance of context and dosing was highlighted by the variations in effectiveness of largely the same interventions when delivered in different countries.

In evaluating the effectiveness of strategies to create, or increase demand for health services, we found that interventions that actively engaged communities, such as creation of community empowerment groups, and those that specifically adapted intervention to local context were more successful than more passive interventions such as mass media campaigns. Removing cost barriers resulted in increased service utilization but surprisingly did not necessarily result in improved health outcomes. This may have been due to poor quality of the underlying services even when attendance rates improved. The difficulties of increasing uptake or improving the quality of local services has prompted strategies to take health interventions directly to communities and individual homes. Their impact on maternal, newborn and infant mortality has been promising though inconsistent. The variation in effect suggests that the details of each strategy will be context specific, and modification will be required to identify the most appropriate combination of approaches. Developing and implementing prototypes that can be rapidly adapted may be a useful concept to include in formal scale-up plans.

Knowledge, and therefore training is unquestionably important but needs to be linked with establishing the conditions that encourage health workers to change their practices - leadership, motivation, opportunity and accountability. Health workers need to believe that it is better to change than to remain with their old practice and managers need to create the environment for this to happen. Linking training to improved management systems such as integrated care protocols and audit systems have the potential to significantly impact on care and mortality.

Surprisingly there were relatively few intervention approaches that focussed principally on improving the functioning of the health system - the organizational context - irrespective of the intervention that was being delivered. Quality improvement approaches, data audits and approaches to improve stewardship of health facility resources can improve health outcomes and assist scaling up of interventions. Supervision of health workers encourages continuity of practices with training and promotes personal accountability. Yet these methods do not provide solutions to all systemic problems encountered at health facilities and often, intervention at another level is needed.

Future health systems research is challenged with designing studies that engage and address the underlying limitations of the health systems as well as the specific needs of the intervention. In addition to developing some specific methodologies and research tools, achieving this will require new and innovative collaborations between researchers, systems and evaluation specialists and the ministries of health that will be responsible for expanding and sustaining the findings. The review
illustrates that no one approach is likely to achieve universal coverage of all essential maternal, newborn and child interventions. Delivery approaches will need to more explicitly understand and adapt to the macro-environment that surrounds the health system including social development, economic realities, gender equity and education. Furthermore, the research community needs to urgently address the crucial question of how to rapidly and reliably scale up proven child survival strategies within the resource and infrastructural limitations of health systems in low and middle income countries. National ministries of health should partner with researchers to more strategically use the research process as a means of implementing and improving health care delivery at scale.

Research gaps

- Comparative studies of different delivery approaches of the same intervention to determine the relationships between health systems characteristics, contextual factors, interventions and final outcomes. Studies should be designed to report on health impact, cost-effectiveness as well as process outcomes;
- Standardised approaches or conventions for quantifying, or systematically describing a health system and its functioning, or the community setting in which an intervention is tested or delivered;
- Design and evaluation frameworks for assessing public health programmes functioning at scale, noting the influence of context;
- Innovative approaches for changing community and health worker practices. This should include learning from the private sector and other disciplines such as political campaigners and marketing agencies to learn their successful strategies and philosophy for generating behaviour change;
- Research into optimal training and supervision approaches that facilitate implementation at scale and sustain behaviour change on site;
- Determining factors that influence successful implementation - what are the core elements/requirements for a delivery system to implement at scale vs. what is important at local level for adaptation;
- Research into the methods and the science of rapidly and reliably scaling up proven successful child survival interventions within countries and regions.

Conclusions

The review was conducted to synthesize the knowledge on accelerating progress towards universal health coverage and explore how health systems research can be strengthened. There was the implied objective of answering "what works and what does not?" However the authors concluded that the results cannot be reduced to this level of simplicity. Instead the review illustrates that implementation strategies must carefully understand the context, both within the health system and outside, in which interventions are to be introduced and sustained at scale. The review demonstrates that the context, namely the organization of health services and sensitivities of local communities, will require adaptation of both interventions and delivery approaches; that good health systems research can be systematically employed to bring learning and discover local solutions.
Health systems and delivery approaches to achieve universal coverage

Interventions are available that can prevent serious illness among infants and children and save the lives of those who become critically ill. It is estimated that 63% of under-5 year deaths could be averted if 23 preventive and treatment interventions were implemented with universal coverage of these interventions, defined as 99% coverage at population level except for exclusive breastfeeding, which was defined as 90% coverage.

Achieving universal coverage of these child survival interventions, or other interventions such as antiretroviral treatment, depends on three factors: i) a functional health system, ii) the delivery approach used by that system, and iii) community or individual considerations such as access, demand for and acceptability of the intervention, and ability to comply. Health systems need to be technically competent, adequately distributed and sufficient in human resources; they also need to be responsive to, and capable of overcoming predictable obstacles, e.g. populations not attending facilities. Health systems are thereby distinct from the interventions but their relationship mean that the delivery approach for any intervention is shaped by the nature of, and needs of the other, and may therefore be different in different settings. For example, where health facilities are well distributed and attended, dispensing of oral rehydration solution or counselling and testing for HIV can be effectively accomplished through fixed services; in settings where there are few facilities or where women do not frequently attend services, ORS can be distributed through local vendors and community-based HIV testing may be needed.

Health systems and delivery approaches are important but not sole determinants of universal coverage. Factors such as global financing and market strength, national political commitment and strife, international health worker movement and agreements and the socioeconomic situation of the population significantly influence the environment in which health systems function. Achieving universal coverage requires funding and support to strengthen health systems coupled with efforts to optimize the political and economic context in which they function.

Figure 1 illustrates interventions according to i) the continuum of care, ii) the 'site' of intervention and iii) other contextual or organizational factors that influence achieving universal coverage.
EFFECTIVENESS OF INTERVENTIONS IN DIFFERENT SETTINGS AND HEALTH SYSTEMS

Research conventionally investigates the efficacy of interventions in controlled settings, or their effectiveness when delivered within routine services. In general, interventions perform less effectively when implemented routinely compared to controlled research settings. For example, antiretroviral drugs to HIV-infected pregnant women can reduce rates of mother-to-child transmission of HIV to 2-3% in clinical trials; yet in programmes offering the same drugs, transmission rates of 7-9% are reported. Less commonly, interventions perform better in routine practice. In India, a large community-based intervention that provided zinc in addition to oral rehydration salts reduced not only the prevalence of diarrhoea but also pneumonia, and all-cause, diarrhoea, and pneumonia hospitalizations. Access to diarrhoea case management improved within the villages, the use of unwarranted oral and injectable drugs during diarrhea reduced as did the out-of-pocket costs to the family. Other reports illustrate how the performance of interventions are sensitive to the setting and approach used to deliver them. In Malawi, when corn soy blend was given by food aid volunteers who screened children for wasting in an operational programme, recovery rates were 56% but when given by nurses who were seen by the community as diagnosing the child with a condition that needed supplements, the same CSB achieved recovery rates of 72%. Less well reported is how factors within an health system determine the effectiveness of interventions. In South Africa, increased mortality among children with severe malnutrition was attributed to several operational factors including the practice of rotating junior doctors between wards and hospitals resulting in inexperienced care and practice. In Nepal and India, interventions to empower and transfer basic skills to pregnant women and mothers improved antenatal and early newborn care, whereas in Bangladesh a similar approach did not yield the same benefits. While identifying and describing these factors helps to explain inconsistencies between outcomes in different settings, they become all the more important when designing delivery approaches to implement interventions at scale.

THE PURPOSE OF THIS REVIEW

This paper reviews approaches that have been reported to deliver child and newborn interventions to large populations and how research can inform the mechanism for moving towards universal coverage. A case study is included to illustrate how researchers worked in partnership with a national authority to offer a highly effective child survival intervention, and some of the lessons learned.

METHODS

The review used the following inclusion criteria for reports published after January 1995: i) an intervention taking place at scale, ii) in a low- or middle-income country, and iii) with discussion of strategies to implement child survival interventions. We note that implementing at large scale (across nations and regions) is dependent on a successful process of scaling up, namely moving from delivery in one district to national coverage. This review does not however, report on methods or the science of scaling up child survival interventions. We employed a MESH term search in PubMed to identify and analyze studies according to the mechanism of implementation. In addition, we included a small number of reports, known by the authors but not captured in the search, and also some from the grey literature. Figure 2 illustrates the process followed.

The categories used to group the implementation strategies and the MESH search terms were developed through an iterative process of conceptualisation, testing, and revising. First, we identified four broad categories of implementation strategies that were expected to appear in the
literature: demand creation, health systems management and organization, human resource development and training, and broad delivery mechanisms. Within these categories, we established 16 sub-categories (table 1). Twenty one studies that were referenced in 5 major reviews\textsuperscript{10-14} on child survival interventions “at scale” were used to test and refine the MESH terms. “At scale” was defined as the programme being implemented across a functional health unit (i.e., a nation, province, district, sub-district, or regional healthcare referral area) or covering a population greater than 10,000 people. Low- and middle-income countries (LMIC) were defined by the International Monetary Fund’s list of Emerging and Developing Economies.\textsuperscript{15}

The final MESH terms reflected three search areas. The first area captured strategies for implementation or delivery of care and included “health plan implementation,” “child health services,” and two non-MESH terms, namely “scale-up” and “community-based interventions.” The second search area included terms related to child survival, such as “child mortality” and “infant mortality.” For the third search area, we assigned one or more MESH terms to each of the 16 sub categories of implementation strategies. For instance, the sub-category called “Consumer Education and Counselling” was represented by two MESH terms: “Patient Education as Topic” and “Directive Counselling.” The final set of MESH terms is listed in table 2. The search was limited to papers published between January 1995 and 2nd September 2010.

We restricted the search to identify reports that were associated with at least one term from any of the three search areas, and with at least one term categorized as a “major MESH topic” from either the first or second search area. The search yielded 1,485 reports.

Following review of the abstracts, 1,318 reports were excluded because they did not meet the inclusion criteria. The full manuscripts of the remaining 167 articles were reviewed and 106 were subsequently excluded leaving 58 articles that matched our criteria. Reasons for exclusion are provided in figure 2. Three review articles from the search, and the initial five pre-search reviews referenced eighteen additional articles. Finally we included eight references provided by colleagues. These 87 articles described 79 discrete studies.

RESULTS

The main messages and lessons of the reports classified under each category are presented below:

**Demand Creation and Access Improvement**

*Education and counselling of women and families*

Education and counselling of women and families was tested as a mechanism for improving caregiving and care-seeking behaviours and was a successful strategy in nine cases,\textsuperscript{6, 8, 16-22} and, in some cases, was able to link village-based women’s empowerment groups to improved neonatal survival.\textsuperscript{6, 8} A cluster-randomized controlled trial (RCT) in Jharkhand and Orissa, India found that neonatal mortality in women’s groups clusters fell from 55.6 to 36.3 per 1000 in three years, compared to a rise from 53.4 to 64.3 per 1000 in the control clusters.\textsuperscript{8} Another trial in Gadchiroli, India tested group meetings, as well as health education by TBAs and CHVs during home visits. Reductions were observed in the incidence of infections (55%), care-related morbidities (45%) and low birth weight (16%).\textsuperscript{7} However, Azad et al tested women’s groups in Bangladesh and found no significant effect on neonatal mortality,\textsuperscript{9} suggesting that context and dosing of the intervention were critical factors for success. Three other studies\textsuperscript{23-25} reported use of group education, although their designs prevented attribution of effect to that strategy. Several studies used individual rather than group approaches at health facilities or during home visits. In Peru, children in control areas of a nutrition education intervention were more likely to be stunted at 18 months than in intervention areas (odds ratio = 3.04),\textsuperscript{20} despite lower-than-expected adherence to intervention protocols (28-70% adherence).\textsuperscript{26} The effect of individual education and counselling in other studies is difficult to determine as they were often used as part of a larger strategy,\textsuperscript{27-42} or the design lacked a comparison group.\textsuperscript{43}
Community engagement

Community engagement has been used as a process for seeking community agreement to test new child survival interventions, and to tailor interventions to local circumstances. The effect of these additional efforts to consult with communities had mixed results; five programmes had positive impacts on health outcomes, one had no impact, and three did not report outcomes results. In rural Kenya and Tanzania, following consultation with the spiritual leaders of the Maasai people, traditional birth attendants were taught to use water or milk to wash the umbilicus rather than packing it with cow dung; neonatal tetanus rates were reduced (0.75/1000 births) compared to control areas (82/1000 births). In Uganda, multiple community meetings were designed to enhance community monitoring of primary health care service delivery and increase social accountability. Without addressing any technical aspect of services, the quality and utilization of care improved and under-five mortality was 33% lower than the control district, although with a wide confidence interval (90% CI: 8%-64%). In contrast, a trial by Phillips et al in Ghana which tested integrating community and maternal health services within the traditional social structure and cultural resources had no effect on child survival.

Facility-based Incentives

Providing incentives or removing barriers to care is a common strategy for improving utilization of child survival interventions. A nationwide conditional cash transfer scheme was launched across India in 2005 to encourage women to deliver at health facilities. Although implementation was patchy in the targeted region, the intervention was associated with an overall small reduction (2 – 4/1000) in perinatal and neonatal deaths. Complementing this programme, a public-private partnership in five districts increased hospital deliveries from 38% to 59% in less than a year by subsidizing care for the poor in the private health facilities. The results of incentive schemes in Bolivia (for prenatal, postnatal attendance and skilled delivery) and in Tanzania (vouchers provided for part-payment of bed nets for prevention of malaria to women attending antenatal or vaccination clinics) on child survival were not reported. A large cluster randomized trial is underway in India to evaluate an intervention that couples subsidized obstetric care for the poor at non-public health centres with a community health promotion campaign.

In a relatively small trial in Ghana, enrolment into a low cost, pre-payment health insurance scheme (fees paid from research funds) marginally increased health system utilization but did not achieve a measurable difference in health outcomes. A review of the effects of large-scale removal of user fees in a number of countries in Africa suggests that truly free (subsidized) health care does result in increased utilization of health services, including services such as skilled birth attendance (SBA) that should improve child survival; however, the linkage between removal of user fees and improved child survival has yet to be proven. In countries where coverage is already high, the effects of subsidized health care on utilization of services may be less obvious. For example, in Ecuador, a national law entitling free maternal and postpartum care was associated with minimal increase in access to skilled delivery (from 75.3% to 82.4%) with no meaningful change in neonatal mortality (2.0 to 1.9/1000). Bari et al combined home visits by CHWs with free in-facility care for those referred by the CHW. Compliance with referral increased from 55.7% to 80.1% in three months. Morris and others reported on the effects of a voucher scheme in Honduras that was suspended if mothers and infants did not attend antenatal or preventive care. Compared to a scheme to strengthen peripheral health services the conditional payment scheme was significantly more effective in promoting clinic attendance and nutrition surveillance.
Community-based funding schemes

Community-funded financial schemes have been used to set up, and manage loan pools that provide funds for treatment – mostly directed at improving access to obstetric care. In Nigeria, researchers established loan funds in remote areas and achieved repayment in the great majority of cases, but the effect of these activities on maternal or child health outcomes was not reported. Emergency loan funds that used a similar model have been used in conjunction with other interventions to improve access to transport for mothers and newborns in poor communities. In each of these studies, however, community-based funding schemes represented only a small part of a larger intervention, and none were able to isolate the effects of the financial incentives on outcomes or utilization of health services.

One study in Ghana incorporated a community-funded scheme to pay for an array of community health needs including the costs of a “community health officer” - a nurse who was deployed and housed in the village at the community’s expense. The nurse worked with chiefs and elders to establish a deferred payment scheme that paid for a range of locally based health services that facilitated gains in health outcomes. Over three years, child mortality rates fell faster in intervention villages compared to non-intervention villages.

Home visits

Mechanisms for delivering child survival interventions in the home (preventive and curative) at scale have also been widely reported. While many large scale programmes have successfully incorporated prospective or follow-up home visits as part of a package of community based health interventions only a few have studied and reported actual improvements of child mortality following these interventions. In Indonesia, early infant mortality was reduced by 18% among those whose mothers received multiple micronutrients during pregnancy and by 30% among the subgroup delivering with a SBA. Success was attributed to the use of locally resident intermediaries who used home visits to promote SBAs and implement a range of child survival intervention based on education and monitoring. The advantage of delivering vaccines through home visits vs hospital visits was shown in a large Chinese RCT study. The home visit strategy showed double the vaccine rates compared to the hospital visit group and the rates were even higher when additional system efficiencies were employed (e.g. pre-loaded syringes).

Health Systems Management and Organization

Legal frameworks, Policy and Planning

Effective public policy is used by health systems planners to spread child health interventions on a broad scale. The introduction of Bolivia’s national primary health care programme, begun in the early 1990s was credited with a decline in that country’s infant mortality rate from 49.7 to 28.9 per 1000 live births between 1990 and 2002. In Costa Rica, national health reform, initiated in 1995, was associated with an 8% reduction in child mortality. Specific aspects of childhood health are often targeted by Ministerial public health programming. In Chile, rates of exclusive breast feeding for six months were improved from 16% to 43.1%, largely as a result of activities that stemmed from a reorganization of the National Commission on Breastfeeding. In Malawi, Enarson et al reported a 54.8% reduction in childhood death from pneumonia through government implementation of standard case management in the Child Lung Health Programme. In Zambia, a multimodal strategy, including adoption of new infant and child feeding guidelines improved exclusive BF rates from 57.2% to 74% in the prototype district.
Leadership-initiated changes

Only one study specifically discussed an organization’s leadership’s role in implementing child survival interventions. Dawodu et al\(^8\) evaluated changes implemented after a neonatal audit of two teaching hospitals in the UAE. The heads of the hospitals’ neonatal units initiated changes in resourcing, supply management, and organizational structure. Between the two measurement periods (1992-1994, immediately following the audit, and 1995-1998, following reforms) neonatal mortality declined 17\%. However, the authors did not report on how the leadership’s approach affected the results of improvements; nor did they discuss how their process was perceived by the front-line staff that implemented the changes. Thus, leadership’s role in initiating interventions to improve child survival is an area for which greater documentation or formal research is warranted.

Care protocols, audits and local restructuring

The impact of the implementation of the IMCI care protocols in various contexts has been reported.\(^2\),\(^7\) In Bangladesh, Arifeen et al\(^2\) conducted a cluster RCT to evaluate the impact of IMCI and found that despite significant improvements in all intermediate indicators (health worker skills, family & community practice and health systems performance), under-five childhood mortality rates were similar in IMCI versus non-IMCI clusters. Other efforts to improve child survival include the use of multi-disciplinary care teams in Costa Rica\(^7\) (8\% reduction in U5MR), multimodal strategies (community outreach, home visits, training programmes) to provide integrated maternal and child care in Brazil\(^6\) (38.3\% reduction in infant mortality) and the use of retrospective mortality audits to guide protocol redesign in KwaZulu Natal, South Africa\(^8\). This intervention was associated with a 40\% decrease in perinatal mortality rates. Others evaluated the impact of new WHO C-section guidelines on improving quality of labour ward care and improved access to c-section as a therapeutic option in Burkina Faso.\(^3\) Over the four year study period, all quality indicators (partograph use, admission examination, and post-partum follow-up) improved and c-section rates rose steeply from 1.9\% to 25.4\%, without a change in maternal case fatality rates, or a change in the rates of absolute maternal indication for these procedures. A community-based therapeutic feeding programme in Ethiopia differentiated care protocols based on the acuteness of the child’s malnutrition. In one district, 16 weeks after the start of the programme, two thirds of the severely malnourished children were rehabilitated.\(^3\)

Mortality audits were used in four of the studies we examined to drive improvements in child health protocols or care system redesign. Wilkinson et al reported the effects of an audit of 21,000 birth records in a health district in KwaZulu Natal, South Africa. The audit was used to guide protocol redesign and in-service training. This method drove avoidable death rates down from 19\% to zero in the four year study period.\(^3\) Similar audits were used to improve C-section care and management in Burkina Faso,\(^3\) neonatal mortality in the UAE,\(^8\) and under-5 mortality in the Northwest Province in South Africa.\(^8\)

Quality improvement

Few investigators have studied the use of healthcare quality assurance and improvement methods to reliably improve the delivery of child health services at scale. Legros et al,\(^7\) writing on behalf of the USAID’s Quality Assurance Project, deployed the Basic Support of Institutionalizing Child Survival Project (BASICS) which included the IMCI strategy in two health departments in Niger using “quality management principles”. In this observational study, 77 quality improvement teams worked to improve utilization of curative services, vaccination coverage and family practice utilization rates. Initially there were substantial improvements - most strikingly in vaccine coverage (e.g. measles coverage rising from 24\% to 83\% during the study period) - however in the final year of analysis there was substantial regression to the pre-intervention levels of coverage (measles coverage dropped to 55\%). While not reported yet in the scientific literature, we are aware of at least one other large-
scale programme utilizing QI methods to decrease child mortality (www.fivesalive.org). The “Fives Alive” programme in Ghana is seeking to reduce under-five childhood mortality to meet the Millennium Development Goal target by using a QI design to improve the quality of antenatal, intrapartum and post-natal care across the country.

**Facility supply stewardship**

A number of studies looked at the impact of improving the maintenance and distribution of equipment and supplies within health facilities. In all cases, the strategy was included in a larger package of tactics. Two national-level programmes provided hospitals with equipment and supplies for prevention of mortality. In Bulgaria, all city hospital delivery rooms were provided with resuscitation equipment and training in its use. The proportion of neonatal deaths caused primarily by asphyxia fell by about 10% over a two year period. In Malawi, the Child Lung Health Programme introduced standardized and routine reports for hospitals to order annual supplies, and the country kept a reserve stock of medications to avoid supply shortages. However, the authors report that lack of equipment was a challenge; the programme funded vehicles and computers to improve communication, and provided oxygen concentrators (with training on their use and maintenance) at each site.

**Community supply stewardship**

In a number of studies, supply stewardship was carried out by community-based health workers or volunteers. In most cases, the provision of supplies was tied to the health providers’ participation in a training programme. The ACSD programme in Ghana provided kits containing chloroquine, oral rehydration salts, and handwashing and educational materials to “community-based agents,” to be distributed in 600 villages. However, a review indicated that not all agents received kits, and three years after the start of distribution, about 60% of agents did not have kits. Kits were more successful in a smaller, cluster-randomized controlled trial in rural Pakistan, which provided TBAs with sterilized supplies, an umbilical-cord clamp, and a surgical blade. Puerperal sepsis was significantly less likely in the intervention areas than the control areas (odds ratio 0.17), as was perinatal mortality (odds ratio 0.70). TBAs used 8,172 kits, during which time there were 9,710 singleton births.

**Population-based care/screening**

Population-based care such as mass vaccinations or screening programmes (such as severe acute malnutrition) were successful in several cases at achieving broad coverage for an intervention; in some instances the programmes demonstrated improved health outcomes as well. In China, iodination of irrigation water was linked to reduced infant, maternal and neonatal mortality 8 years after intervention. A cluster randomized trial in Hunan Province, China compared three delivery mechanisms for Hepatitis B vaccination of newborns: in-hospital administration, out-of-cold-chain delivery by CHWs, and pre-filled injections administered by CHWs. Both community-based clusters demonstrated a greater increase in vaccination coverage (from 2.6% coverage to 51.8% and 0.6% to 66.7%, respectively) than the in-hospital coverage (2.4% to 25.2%). A review article by Victora et al pointed to four large-scale syphilis screening evaluations that demonstrated success expanding coverage, though they did not report on child mortality outcomes. In Mozambique, Gloyd and others showed that routinely incorporating a syphilis blood test into antenatal services delivered by nurses, combined with the introduction of rapid testing and a change in policy (free Penicillin) increased syphilis screening in settings with, and without laboratories from 5% in 1992 to 60-90% consistently since 1999.
Human Resource Development and Training

Facility personnel training

Training of personnel at facilities in the reliable application of maternal and child health interventions has been used widely as a primary mechanism for implementing child survival strategies at scale. While this strategy has been widely reported it is difficult to determine the impact of personnel training on child survival outcomes, mainly because the training component is so universal and usually combined with other strategies. Studies that looked specifically at the effect of large scale direct training or a “train the trainer” interventions were able to demonstrate both short-term and more long-lasting improvements in neonatal resuscitation and breastfeeding practices and cause-specific neonatal outcomes. Intensive training on management of pneumonia across 22 hospitals in a District in Malawi was credited (together with attention to supply chain issues) with a 50% fall in the case fatality rate for pneumonia over 5 years. On the other hand, a cluster randomized intervention to test training around use of the WHO Reproductive Health Library did not result in significant improvement of clinical practice, cautioning that more passive training approaches may not yield benefits. Even large scale multi-level training interventions (physicians, midwives, TBAs, mothers and families), while successful in increasing skilled delivery utilization, have not yielded improvements in perinatal death rates.

In a review of interventions to improve health worker performance (not specific to child survival interventions), didactic training of large groups had almost no effect on outcomes; better results were obtained if the groups were small, focussed in terms of materials and sessions used multiple teaching approaches.

Non-facility personnel training

A large number of the studies reported on the utility of training of personnel working outside of the facility setting. Trainees included traditional birth attendants (TBAs), Community Health Workers (CHWs), Community Health Volunteers (CHVs), nurses, midwives, NGO staff, government officials, and sometimes non-clinical workers. While nearly all of the training focused to some extent on clinical practices (basic antenatal and postnatal care, breastfeeding and nutrition, warning signs for complications, etc.), a significant minority (15 studies) included training on communication skills, including counselling and negotiation. These skills appeared in programmes meant to promote maternal knowledge and birth preparedness, breastfeeding and nutrition, PMTCT, and malaria treatment. They also were taught where non-clinical workers facilitated programme implementation. McPherson and others, working with CHWs and TBAs in rural Nepal, evaluated the effects of counselling that encouraged good decision-making and knowledge on obstetric emergencies. Using an index measure, women who were counselled showed an improvement of decision-making and increase in knowledge from 33% to 54%. The multi-country evaluation of IMCI showed that workers trained in communication (as well as clinical topics) were more willing to educate caregivers in drug administration. Less successfully, Darmstadt et al reported a large cluster randomized trial in multiple rural unions in India that focused on CHWs trained in pregnancy surveillance, counselling and essential care including home visits and expedited transport of sick infants. The study reported no significant decrease in neonatal mortality. Most studies however, did not evaluate the success of individual trained workers. Shankar et al found that better facilitators improved the impact of a micronutrient intervention on infant mortality (risk ratio 0.67), while poorly-performing facilitators did not add benefit (risk ratio 1.04). The role of communication training remains important going forward: an ongoing study in 232 villages in India uses communication training to mitigate harmful locally-held superstitions about birth and newborn care.

The remaining 18 programmes trained personnel in clinical topics only, with mixed results. Jokhio et al performed a cluster RCT in 3 sub-districts of rural Pakistan,
in which TBAs were trained on basic maternal and neonatal care. Perinatal mortality was less likely (OR - 0.7) in intervention districts. However, Azad et al., using a cluster-RCT in rural Bangladesh to train TBAs in mouth-to-mouth and bag-valve-mask resuscitation found that the training did not significantly impact neonatal mortality rates. Tests of the effectiveness of established curricula for non-facility workers likewise showed mixed results. Carlo et al. used the WHO Essential Newborn Care curriculum and the American Academy of Pediatrics’ Neonatal Resuscitation Program to train community attendants in 95 rural communities in five countries. While neonatal mortality did not decrease, there was a major impact on stillbirth rates (31% reduction). The AAP resuscitation curriculum did not add benefit beyond the WHO Essential training. Anand et al. evaluated the use of IMCI training modules for CHWs operating out of rural health centres in India. While there was some initial improvement in health workers’ knowledge, the improvement quickly plateaued and there was no impact on infant mortality.

**Broad Delivery Mechanisms**

*Campaigns and mass media*

Large scale child health programmes often use a campaign structure to deliver a key health message. The campaigns covered a broad range of topics, such as breastfeeding promotion, vaccination, insecticide-treated nets (ITN), and PMTCT, and were generally coupled with a larger intervention programme. Yet, evidence for the effectiveness of mass media interventions, either alone or in conjunction with other interventions is weak.

Bosnjak et al. studied implementation of the WHO/UNICEF Baby Friendly Hospital Initiative in one county in Croatia during and after a UNICEF-organized breastfeeding promotion campaign in the 1990s. The campaign used printed materials (posters, pamphlets, etc.) and videotapes distributed in maternity wards and doctors’ offices, staff training as well as breastfeeding support groups in the community, to educate health professionals and the general public in recommending breastfeeding practices. The percentage of mothers breastfeeding increased modestly during the 10 year campaign (68% to 87% at age 1 month; 11.5% to 29% at age 6 months) but changes in mortality were not reported over that time.

The ACSD programmes in Benin, Ghana, and Mali used campaign structures to deliver vaccinations and distribute ITNs during a multiyear comprehensive intervention of multiple child intervention “packages”. Vaccination campaigns covered measles, polio, and vitamin A supplementation. In Ghana and Mali, the interventions delivered through campaigns showed significantly greater increases in coverage in intervention areas than in comparison areas, though that was not the case in Benin. Overall, the rate of decline of child mortality in ACSD intervention districts was not greater that that seen in non-intervention districts.

The LINKAGES programme in Zambia, an integrated PMTCT programme including support for infant feeding, conducted a national media campaign called “Act Now!” that reached about half of the population using radio, TV, and print materials to promote HIV prevention, counselling and testing, and optimal appropriate feeding. Mothers exposed to the TV/radio spots were more likely to have skin-to-skin contact with their infants within an hour of birth than those not exposed to the broadcasts. They were also more likely to see colostrum as a special food (84.6% vs. 65.6%), exclusively breastfeed (92.3% vs. 88.1%), test for HIV (30% vs. 18.7%), and use a condom the last time they had sex (21.9% vs. 6.3%). An evaluation of the congenital syphilis Elimination Campaigns in Rio de Janeiro, Brazil in 1999 and 2000 found that children born to mothers exposed to the campaigns had a significantly reduced risk of perinatal morbidity and mortality. An ongoing study of a “community health promotion” campaign to reduce neonatal mortality in Mahabubnagar, India, is using theatre, films, and song and dance to convey health messages to communities. The campaign also includes women’s discussion groups and CHW training. Results have not yet been published.
**Integrated Interventions**

A number of interventions can impact child survival on a large scale, but no one intervention, of its own, has been shown to have a major impact on overall neonatal, infant and child survival. Many efforts have been directed at refining the “package” of interventions that will need to be applied to decrease child mortality and morbidity in country programmes. The IMCI programme was the first effort to provide a common package of interventions primarily directed at simplifying protocols and their associated training modules for a defined set of common illnesses. The results of the effects of IMCI on child survival are mixed. In Tanzania, introduction of IMCI was associated with lower mortality and lower costs, and in Bangladesh IMCI was associated with improved outcomes of the elements of health that were targeted by the programme, but no mortality effect has been demonstrated across the different contexts. A more targeted version of IMCI - the Accelerated Child Survival and Development (ACSD) was intended to implement more recent evidence based interventions, and was tested in several African countries in the past decade. Again, the package of interventions did not accelerate child mortality reduction in intervention vs. non-intervention districts. The evaluators speculated that the lack of apparent effect could be the absence of neonatal mortality reduction strategies in the ACSD programme.

Some middle income countries have successfully introduced integrated child survival programmes that are credited with lowering child mortality. In Brazil multimodal strategies (community outreach, home visits, training programmes) to provide integrated maternal and child care was associated with a 38.3% reduction in infant mortality.
CASE STUDY - SCALING UP OF ZINC FOR YOUNG CHILDREN (SUZY) PROJECT, BANGLADESH, 2003-2010

Zinc treatment of childhood diarrhoea: context and nature of the intervention

Globally, the successful scaling up of zinc treatment for childhood diarrhoea could potentially save 400,000 under-five deaths per year.¹ With this in mind, the International Centre for Diarrheal Diseases Research, Bangladesh (ICDDR,B) developed a project performance framework (PPF) in partnership with key stakeholders that included public and private sector, NGO and multinational organizations under the “Scaling Up Zinc for Young Children (SUZY) Project. The aim of the project has been to implement zinc treatment promotion and delivery strategies that will reach all children with diarrhoea, regardless of gender, income or where they live.

Mechanisms for scaling up zinc treatment of childhood diarrhoea

Between 2003-06, activities in support of scale-up included formative and operational research, product registration and technology transfer, awareness building and orientation of health professionals, and preparation of mass media messages. In December, 2006 a national mass media campaign that linked zinc treatment to the continued use of ORS, promoted a dispersible zinc tablet, “Baby Zinc”, for the treatment of childhood diarrhoea. The major PPF components are summarized in Table 3.

Challenges in design, methods, and analyses

The key indicators to be monitored during the scale-up included the following:

- Awareness among health providers and caregivers of zinc as a treatment for childhood diarrhoea
- The proportion of children with an acute diarrhoea episode (ACD) of at least 48 hrs duration that received
  - Zinc
  - ORS
  - Antibiotics
  - anti diarrhoeals
- For each of the above trends in use over time
- Monitoring for disparities in zinc coverage on the basis of household wealth assets, sex and location
- Monitoring of adherence to the once daily for 10 days of zinc supplementation
- Utilization of health services

Given the impact might differ among populations, monitoring and respective sample size estimations were carried out in randomly selected megacity slums and non-slums, urban municipalities, and rural sub-districts. To assist with recall, laminated photo cards that included commonly prescribed medications were shown. The surveys employed a variant of standard EPI cluster survey methods and were adjusted for design effect. Each selected sub-district (urban and rural) was repeatedly surveyed every three to four months over the first two years of the scale-up campaign and thereafter annually. Key findings included rapid attainment of awareness of zinc treatment, by the end of the second year about 20% of children in Bangladesh were receiving zinc and there was no change in relatively high use of ORS. Important disparities in zinc coverage favouring urban non-slum populations and higher wealth index households were observed, but gradually reduced over time. As the use of zinc was generally included with traditional practices, this was typically an additional expenditure. Licensed practitioners and public sector providers were more likely to prescribe zinc (30 to 50%), while less than 20% of unregulated village doctors or drug vendors did so. Less than 50% of children received at least 8 days of zinc.
**Relationship between research project and zinc scale-up in Bangladesh**

The research carried out was intended to guide the planning of zinc promotion among providers and caregivers, identify health seeking and household diarrhoea management practices, willingness to pay for zinc treatment, confirm zinc safety and likelihood of side effects, and test through RCTs alternative zinc treatment strategies.

**Key messages / lessons learned**

- Mass media campaigns need to adjust their messages as the population moves from awareness of zinc treatment to actually including zinc in their home management.
- The introduction of zinc treatment had no detrimental effect on the use of ORS.
- Greater effort and more effective strategies to reach the unregulated, private sector of providers is needed.
- Public-private partnerships that include pharmaceutical laboratories, social marketing firms and private sector distributors that take full advantage of zinc as an OTC product are essential and can occur.
- Impact monitoring and evaluation should be designed to detect changes over time and document disparities in coverage.
- Implementation research that directly supports and has relevance to a scale-up campaign needs to be built into project planning and frameworks.
Discussion

We organized the delivery approaches and implementation strategies into four main categories. There was significant overlap with many of the reports being represented in more than one subcategory. In part, this illustrated the conceptual blurring between 'intervention content' and the 'delivery approach' but also reflected the bias or preferences of the investigators. Some strategies aimed to create demand, empower communities, and decrease barriers to care, while others focused their efforts on care that could be delivered within the community or at facilities. Few studies reported efforts to integrate more than one delivery approaches and rarely was one combination weighed against the other. The potential for either an additive or negative effect when one delivery approach was implemented in conjunction with another was never reported. Most significantly, none of the studies reported on ways in which existing health systems in LMIC could more effectively deliver existing national packages of care.

Only a minority of studies showed a decrease in child mortality while in most, mortality was not in fact measured. In some, large-scale multi-country interventions that reported no effect on mortality, it was not always conclusively shown that the processes that were designed to lower child mortality were effectively implemented, or that some critical strategies for child survival (e.g. neonatal care) were included in the "package" of interventions. The most sobering reports were those that did show benefit in the targeted processes but no demonstrable effect on mortality. The importance of context and dosing was highlighted by the variations in effectiveness of largely the same interventions when delivered in different countries.

In evaluating the effectiveness of strategies to create, or increase demand for health services, we found that interventions that actively engaged communities, such as creation of community empowerment groups, and those that specifically adapted intervention to local context were more successful than more passive interventions such as mass media campaigns. Mass media initiatives continue to thrive as a mechanism for mobilising and educating communities despite their cost and limited evidence that they achieve sustained behaviour change. A similar theme for the importance of participatory and adult learning emerged on review of training approaches which have limited effect when passive didactic methods are used. While empowerment approaches have been more successful in decreasing neonatal compared to child mortality, the mechanism by which this effect is achieved, the sustainability and the scalability of these approaches have not been demonstrated.

In most LMIC, the majority of child deaths occur at home or in the community due to cultural and physical barriers such as distance or the cost of transport or health care. Removing cost barriers resulted in increased service utilization but surprisingly did not necessarily result in improved health outcomes. This may have been due to poor quality of the underlying services even when attendance rates improved. In poor communities, families may still weigh the time and effort to take a sick child to local health services against the perceived value of the child and the likelihood of the services providing significant benefit. Any intervention aimed at reducing financial or physical barriers needs to consider questions of affordability, equity and sustainability at scale. Evidence suggests that conditional cash grants can in part address these issues though implementing these also requires competent management systems.

The difficulties of increasing uptake or improving the quality of local services has prompted strategies to take health interventions directly to communities and individual homes. Their impact on maternal, newborn and infant mortality has been promising though inconsistent. The variation in effect suggests that the details of each strategy will be context specific, and modification will be required to identify the most appropriate combination of approaches. Developing and implementing prototypes that can be rapidly adapted may be a useful concept to include in formal scale-up plans. However, presently lacking are systematic approaches for describing or categorizing health systems' characteristics and community or cultural factors in order to better understand and compare the effectiveness of interventions in different settings.
When any new intervention is introduced the immediate reaction of health managers tends to be to plan for training. Knowledge, and therefore training is unquestionably important but needs to be linked with establishing the conditions that encourage health workers to change their practices - leadership, motivation, opportunity and accountability.\textsuperscript{104, 105} Health workers need to believe that it is better to change than to remain with their old practice and managers need to create the environment for this to happen. However, managers frequently comment on the difficulty to accommodate large amounts of time for training and more flexible, innovative and decentralised training approaches are needed. Managers also need to permit and facilitate adaptation of local health systems to deliver the ‘new care’ and provide incentives, not necessarily financial, to sustain change. Linking training to improved management systems such as integrated care protocols and audit systems have the potential to significantly impact on care and mortality.

Surprisingly there were relatively few intervention approaches that focussed principally on improving the functioning of the health system - the organizational context - irrespective of the intervention that was being delivered. Published reports on interventions frequently comment that health systems strengthening is important if the benefit of an intervention is to be realised. Health systems are often viewed as a ‘black box’ that are not the object of research nor the terrain of researchers to investigate. Quality improvement approaches, data audits and approaches to improve stewardship of health facility resources can improve health outcomes and assist scaling up of interventions. Supervision of health workers encourages continuity of practices with training and promotes personal accountability. Yet these methods do not provide solutions to all systemic problems encountered at health facilities and often, intervention at another level is needed. Leadership and legal frameworks have been studied but it is hard to determine their final downstream effects. Impressive declines in child mortality rates have been attributed to specific leadership initiatives. However, similar to removing costs or physical barriers to access, such leadership and legal frameworks can only effect change when functioning, accessible and high quality “supply” systems stand ready to deliver services.

Linkages with the private sector have not been significantly explored as mechanisms to assist providing of health interventions at scale. Yet in many communities, the private sector whether through local pharmacies or corner shops, represents a major delivery system for pharmaceutical products and health advice. Intervention researchers and programme implementers have infrequently explored the opportunities that public private initiatives might offer in a deliberate and systematic way. However, in contrast to the commercial systems and the drivers of market forces, public health must maintain the goal of equity and health care for all.

**Research gaps**

- Comparative studies of different delivery approaches of the same intervention to determine the relationships between health systems characteristics, contextual factors, interventions and final outcomes. Studies should be designed to report on health impact, cost-effectiveness as well as process outcomes;
- Standardised approaches or conventions for quantifying, or systematically describing a health system and its functioning, or the community setting in which an intervention is tested or delivered;
- Design and evaluation frameworks for assessing public health programmes functioning at scale noting the influence of context\textsuperscript{106};
- Innovative approaches for changing community and health worker practices. This should include learning from the private sector and other disciplines such as political campaigners and marketing agencies to learn their successful strategies and philosophy for generating behaviour change;
• Research into optimal training and supervision approaches that facilitate implementation at scale and sustain behaviour change on site;
• Determining factors that influence successful implementation - what are the core elements/requirements for a delivery system to implement at scale vs. what is important at local level for adaptation;
• Research into the methods and the science of rapidly and reliably scaling up proven successful child survival interventions within countries and regions

CHALLENGES FOR IMPLEMENTATION AT SCALE

The review identified multiple approaches that were adopted to address the challenges of implementing essential maternal, newborn and child health services at scale. Though integration was partially addressed, no studies operated across all parts of the system. In general the design of the delivery approaches were driven by the nature of the interventions rather than adapting interventions to fit the nature of systems. Future health systems research is challenged with designing studies that engage and address the underlying limitations of the health systems as well as the specific needs of the intervention. In addition to developing some specific methodologies and research tools, achieving this will require new and innovative collaborations between researchers, systems and evaluation specialists and the ministries of health that will be responsible for expanding and sustaining the findings.

The review illustrates that no one approach is likely to achieve universal coverage of all essential maternal, newborn and child interventions. Health systems' strategies will need to utilize or devise interventions according to the functionality of the system, the nature of the intervention, the social context and geographic conditions. Implementing focussed, or single interventions such as TB programmes or immunisations can be very successful. Integrated, comprehensive interventions such as those included in IMCI are more complex to introduce and scale up. Delivery approaches will need to more explicitly understand and adapt to the macro-environment that surrounds the health system including social development, economic realities, gender equity and education. Furthermore, the research community needs to urgently address the crucial question of how to rapidly and reliably scale up (cf. implementing at scale) proven child survival strategies within the resource and infrastructural limitations of health systems in low and middle income countries.

This will take significant funding and raises the question to what extent research can bear the cost of implementation. Yet the goal of implementation research and health systems is the same, namely to improve the health and survival of the populations they serve. National ministries of health could more strategically use the research process as a means of implementing and improving health care delivery at scale.

CONCLUSIONS

The review was conducted to synthesize the knowledge on accelerating progress towards universal health coverage and explore how health systems research can be strengthened. There was the implied objective of answering "what works and what does not?" However the results cannot be reduced to this level of simplicity. Instead the review illustrates that implementation strategies must carefully understand the context, both within the health system and outside, in which interventions are to be introduced and sustained at scale. That context requires adaptation and that research and implementation approaches can be systematically employed to bring learning and local solutions.
Table 1. Main categories and sub-categories of implementation strategies for scaling up interventions to achieve universal coverage of newborn and child survival interventions

<table>
<thead>
<tr>
<th>Category</th>
<th>Sub-categories</th>
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<tbody>
<tr>
<td>Demand Creation and Access Improvement</td>
<td>• Education and counselling of women and families</td>
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<td>• Community Engagement</td>
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<td>• Facility-Based incentives</td>
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<td>• Community-based funding schemes</td>
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<td>• Home visits</td>
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<tr>
<td>Health Systems Management and Organization</td>
<td>• Legal frameworks, Policy and Planning</td>
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<td></td>
<td>• Leadership-initiated changes</td>
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<td></td>
<td>• Care protocols, audits, and local restructuring</td>
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<td></td>
<td>• Quality Improvement</td>
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<td></td>
<td>• Facility supply stewardship</td>
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<td>• Community supply stewardship</td>
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<td></td>
<td>• Population-based care/screening</td>
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<td>Human Resource Development and Training</td>
<td>• Facility personnel training</td>
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<td></td>
<td>• Non-facility personnel training</td>
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<tr>
<td>Broad Delivery Mechanisms</td>
<td>• Campaigns and mass media</td>
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<td></td>
<td>• Integrated Interventions</td>
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</table>
Table 2. Search Strategy

The search strategy divided terms into three search areas, which are listed below. All terms are MESH terms, except for two Title/Abstract terms (“scale-up” in the first and third areas, and “community-based interventions” in the first area). Some terms were searched with subheadings, which are depicted with a slash (/).

The search was set up to find articles with at least one term in each area, and with at least one term listed as a “major” topic in either Area 1 or Area 2. The Title/Abstract terms were treated as major terms. An equation depicting the search follows:

\[(\text{Area 1 [Majr]} \text{ AND Area 2 [Mesh]} \text{ AND Area 3 [Mesh]}) \text{ OR (Area 1 [Mesh]} \text{ AND Area 2 [Majr]} \text{ AND Area 3 [Mesh]})\]

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<tr>
<th>Search Area 1</th>
<th>Search Area 2</th>
<th>Search Area 3</th>
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<td>“Medical Assistance/economics”</td>
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<td>“Mass Media”</td>
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<td>“Child Nutrition Disorders”</td>
<td>“Patient Education as Topic”</td>
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<td>“Intensive Care, Neonatal”</td>
<td>“Directive Counseling”</td>
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<td>“Child Mortality”</td>
<td>“Cultural Characteristics”</td>
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<tr>
<td>&quot;Health Plan Implementation&quot;</td>
<td>“Infant Mortality”</td>
<td>“Community-Institutional Relations”</td>
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<td>“Fetal Mortality”</td>
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<td>“Breast Feeding”</td>
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<td>&quot;Financing, Organized&quot;</td>
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<td>&quot;Quality Assurance, Health Care&quot;</td>
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<td>&quot;Community-Institutional Relations”</td>
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<td>&quot;Midwifery/education&quot;</td>
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<td>&quot;Program Evaluation&quot;</td>
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<td>&quot;Public-Private Sector Partnerships&quot;</td>
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<td>&quot;Delivery of Health Care, Integrated/organization and administration&quot;</td>
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<td>“Practice Guidelines as Topic”</td>
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Table 3. SUZY Project Performance Framework

<table>
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<th>Performance Activities</th>
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<tbody>
<tr>
<td>1. Research in support of zinc scale-up</td>
<td></td>
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</tbody>
</table>
| a. Pre-launch | • Safety and side effects studies<sup>9,10</sup>  
• Provider and caretaker diarrhoea management practices survey<sup>12</sup>  
• Formative studies of provider behaviours and interaction with drug salesmen  
• Zinc formulation acceptability and caretaker adherence<sup>13</sup>  
• Product branding exercise  
• Frequently asked questions compendium  
• Diarrheal illness expenditures and willingness-to-pay for zinc treatment  
• Pre-test of zinc provision through NGO community health workers |
| b. Post-launch | • Monitoring for intended and unintended consequences  
• Drug vender barriers to prescribing zinc  
• NGO-village doctor (unregulated private sector) promotion of zinc treatment |
| 2. Zinc formulation | |
| a. Choice of zinc formulation | • Syrup vs. dispersible tablet formulations: confirmation of acceptability and willingness to pay |
| b. Regulatory steps | • Registration of formulation with Bangladesh Drug Administration  
• Product pricing approval  
• Product branding, logo and packaging approval  
• Application for OTC waiver  
• Approval for mass media (TV and radio) promotion |
| c. Technology transfer | • Open bidding and eventual selection of a local pharmaceutical laboratory  
• Patent and technology transfer agreements  
• Conduct of technology transfer and follow up quality control monitoring |
| d. Production | • Preparation of a business plan  
• Import of raw products  
• Production, tablet compression and packaging  
• Quality control reviews |
| e. Distribution | • Private sector drug vendors  
• Public sector health facilities  
• Private sector retail outlets |
| 3. Product promotion | |
| a. Providers | • Training of drug representatives (salesmen)  
• Education/promotion materials  
• Conduct and monitoring of provider promotion activities |
| b. Caregivers (mass media) | • Identify key messages  
• Identify target audience(s)  
• Contract agreements with TV and radio outlets  
• Preparation and implementation of marketing tools  
✓ TV and radio commercials  
✓ Billboards and posters  
✓ Special events  
✓ Courtyard meetings |
<table>
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<tr>
<th>4. Health care delivery systems</th>
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</thead>
<tbody>
<tr>
<td>a. Key players and partnerships</td>
</tr>
<tr>
<td>• Bangladesh Pediatrics Association</td>
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<tr>
<td>• WHO/UNICEF</td>
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<tr>
<td>• Project advisory committee</td>
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<tr>
<td>b. Health policy</td>
</tr>
<tr>
<td>• MOHFW Project oversight committee</td>
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<tr>
<td>• MOHFW Project implementation committee</td>
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<tr>
<td>• MOHFW Diarrheal Diseases Control Programme</td>
</tr>
<tr>
<td>c. Manpower</td>
</tr>
<tr>
<td>• Training in private and public sectors</td>
</tr>
<tr>
<td>d. Financing</td>
</tr>
<tr>
<td>• Medical schools and other training institutions</td>
</tr>
<tr>
<td>• Essential drugs list</td>
</tr>
<tr>
<td>• Public sector subsidies</td>
</tr>
<tr>
<td>5. Knowledge transfer/Dissemination</td>
</tr>
<tr>
<td>a. Website</td>
</tr>
<tr>
<td>• Create a project website with links to other sites addressing zinc or diarrhea management more generally</td>
</tr>
<tr>
<td>b. Newsletter</td>
</tr>
<tr>
<td>• Published in Bangla and English semi-annually</td>
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<tr>
<td>• Distributed to 20,000 health workers in Bangladesh</td>
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<tr>
<td>c. International conference</td>
</tr>
<tr>
<td>• Held annually</td>
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<tr>
<td>• International presentations and participation</td>
</tr>
<tr>
<td>d. Publications</td>
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<tr>
<td>• Local and international publication of key findings and progress reports</td>
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</table>
A framework for considering interventions within the continuum of care, the site or approach used within the delivery system and other contextual or organizational factors for achieving universal coverage

*Organizational factors can be defined as ‘the environment or setting in which the proposed change is to be implemented’. A strong context is key to create an environment receptive to implement evidence* \(^{107}\)
Authors identified initial categories of 'implementation strategies' and MESH search terms

Authors identified 5 seminal reviews on child survival intervention and implementation. 21 relevant studies used to test / validate categories, MESH terms, and definitions.

Categories of implementation strategies refined. MESH search strategy finalized. Definition of “large scale” established.

1485 articles identified through search. Abstracts reviewed.

167 potentially relevant articles. Full papers reviewed

61 articles + 9 from uncovered reviews + 9 from initial reviews + 8 from colleagues = 87 reports of 79 “large scale” studies

Implementation strategies for each study categorized

Studies in each category summarized as narrative

1318 articles excluded following review of abstracts:
- Not in a low or middle-income country, as defined by the IMF
- Not “at scale” (covering a functional health unit, or a population >10,000)
- Did not discuss implementation strategy

106 articles excluded:
- 45 - Not implementing a child survival intervention
- 28 - Not “at scale” (covering a functional health unit, or a population >10,000)
- 10 - Not in low or middle income country
- 3 - Not available in libraries
- 20 - Review articles with no discussion of includable studies
REFERENCES


