SUSTAINABLE HEALTH SYSTEMS AND POLICY SUPPORTS
PRODUCING BEHAVIOR AND SOCIAL CHANGES NEEDED TO
ACCELERATE REDUCTIONS IN THE MORTALITY AND OPTIMIZE
HEALTHY DEVELOPMENT OF CHILDREN UNDER FIVE YEARS OF AGE IN LOW AND MIDDLE INCOME COUNTRIES

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Introduction and methods

Jonathan Klein

In June, 2013, USAID and UNICEF convened an Evidence Summit to examine and summarize the evidence for Enhancing Child Survival and Development in Lower- and Middle-Income Countries through Population-Level Behavior Change. The Summit builds on the Child Survival Call to Action, and recognizes that governments, donors, and others need evidence to inform efficacious, effective, and sustainable policies, strategies, and programs to achieve the Millennium Development Goals. In preparation and to develop background, a technical working meeting was held in February, 2013 to organize evidence reviews and inform recommendations. Several groups were convened to conduct systematic evidence reviews for the summit, to summarize evidence for policies, strategies and programs, and identify evidence gaps to shape a future research agenda.

An Evidence Review Team was convened for each content area. Each team consisted of volunteer scientists and public health practitioners from a broad range of relevant disciplines from both governmental agencies and civil society organizations from different countries. The purpose of this paper is to describe why Health Systems and Policy Supports (Evidence Review Team 3 – ERT3) are important to child survival and child development, how the evidence was selected and evaluated, and to inform summit participants’ discussion and formulation of recommendations for practice, policy, and research needs.

The methodology for identifying the evidence is described in more detail on the web page for the Summit (http://plbec evidencesummit hsaccess org/docs/public-documents/evidence- summit- process-15mar13. pdf?sfvrsn=2). The process involved Search and Screening steps, and a Call for Evidence. First, the SCOPUS, Science Direct, Pubmed, JSTOR, Africa-Wide, CINAHL, CAB, Business Elite, Global Health and Cochrane databases were searched using a set of terms appropriate for each database, that identified documents using a combination of a Social/Behavior change term + Maternal/Child term + Health terms which included Child
‘Thrival’ + “Intervention” + Low/Middle Income Countries. The resulting set of 3,802 documents were then screened three times manually for relevance and nature of the outcome measure (health outcomes, behavior change outcomes, knowledge/attitude outcomes, etc.), resulting in 737 documents that were assigned to one or more ERTs. A formal Call for Evidence was issued asking ERT members to identify documents that might have been missed in the search (e.g. so-called grey literature, reports from high-income countries, etc.). The Call for Evidence generated an additional 332 unique submissions, for a final total of 1,069 papers.

ERT3 members conducted an initial relevance review on papers related to Health Systems and Policies. Two hundred and twenty nine of the initially identified references were judged to be relevant, and were further reviewed for the quality and strength of their evidence in supporting recommendations for practice and policy. When available, we also considered recommendations and consensus reports from UN agencies, World Bank, and professional associations. We also considered whether and how extrapolation of existing evidence might be justified in considering specific recommendations when reviewing strategies and areas with limited evidence, as relatively few articles examine system-level interventions. However, specific extrapolation rules were not adopted by the work group. Quality reviews and summary of evidence were distributed among ERT3 members by topic, with an effort to match it to their expertise as much as possible. Documents were exchanged as team members found additional manuscripts relevant to other team members. This paper comprises the evidence reviewed by ERT3.

Areas of review included:

- Issues Associated with Healthy Child Development and Survival:
  - Healthy Timing and Spacing of Pregnancy/Antenatal care
  - Preventing Mother to Child Transmission of HIV/AIDS
  - Neonatal Survival and Health
  - Healthy Early Child Development/Good Parenting Skills and Family Environment

- Health Practices and Diseases Associated with Child Survival
  - Nutrition/Micronutrients including Vitamin A/Breastfeeding
  - Prevention and treatment of diarrhea/pneumonia/acute respiratory infections (hand washing, etc.)
  - Malaria prevention and treatment
  - Childhood Immunization

Policy or systems interventions able to produce behavior change reviewed included media (mass media, social media, etc.), community mobilization, educational programs (for caregivers, communities or providers), social marketing, opinion leadership, economic incentives (for both caregiver and provider), health systems strengthening/policy/legislation, and other interventions.
We used a systems—services—outcomes model, and the following analytic framework for our evidence review. Four key questions were identified, which correspond to the numbers on the figure, below:

1 – Are there policies that affect the system? Or systems that affect the policies?
2 - Are there policy and systems that affect the capacity of the care system, family, individual and community?
3 – How does the capacity of the care system, family, individual and community affect the outcomes of interest?
4 - Are there policy and system interventions that have been shown to change outcomes?

Health systems and health policy supports are effective in producing behavior and social changes. Healthy behaviors are maximized when environments and policies support healthful choices, and individuals are motivated and educated to make those choices. The review of evidence on Health Systems and Policy supports that are effective in producing behavior and social changes to accelerate reductions in the mortality and optimize the development of children under five years of age yielded a series of interventions with the strongest evidence favoring integration within and among systems, training and establishing and monitoring guidelines to implement evidence based practices, and identifying the needs and practices of communities and health workers to strengthen supply and demand models, consistent monitoring and evaluation.

Besides support for integrated ecological approaches, strong evidence was found for specific interventions such as prevention and control of nosocomial infections, Baby Friendly Hospital Initiatives and “First 1,000 days” programs, nutritional assessment and food fortification, increasing the variety and quality of nutrient dense foods, regular home visitations, adoption of
formal and community-based pre-schools, and the use of planning resources such as the computerized Lives Saved Tool. Promising practices with supporting evidence in some regions and whose dissemination to other regions needs further study include economic incentives and conditional cash transfers, and the use of new media.

Further research is needed in areas such as assessing and preventing adverse effects of micronutrient supplementation, the intersection between under-nutrition and over-nutrition, specific interventions to promote healthy timing and spacing of pregnancies, evaluation of behavioral outcomes in addition to the more common knowledge and awareness effects, long term effects of behavioral change programs, and institutionalization or long term sustainability of effective programs.
Healthy timing and spacing of pregnancy and antenatal care

Gloria Coe

Introduction

Healthy timing and spacing of pregnancy (HTSP) helps women and families make informed decisions about the delay of first pregnancy and the spacing or limiting of subsequent pregnancies for having healthy newborns, infants, children and mothers. A study using data from 17 developing countries showed that birth intervals of less than 30 months are associated with higher risk of mortality for children under-5, and of child malnutrition.\(^1\) Interpregnancy intervals of less than 6 months have also been found associated with preterm, low birth weight, and small-for-gestational-age infants in Latin America.\(^2\) Family planning has also been associated with lower risk of mother-child transmission of human immunodeficiency virus. Despite the scientific evidence related to birth spacing and the health and survival of newborns, infants and young children, the evidence for contraceptive use between pregnancies is weak.\(^3\) An unpublished study reported by Tsui, et, al, using data from 19 developing countries suggests that 12 months of contraception-only coverage in the preceding birth interval can reduce the mortality risk for the next newborn by 31.2%, while 12 months of contraceptive use overlapping with breastfeeding reduces the risk by 68.4%.\(^4\)

In this framework, there are four key behaviors that increase the likelihood of achieving the healthiest outcomes: Prevent pregnancy occurring: (1) before 18 years of age; (2) less than 24 months after a live birth, (3) less than six months after an induced abortion or miscarriage, (4) after 34 years of age. Six journal articles and three unpublished papers were identified through a USAID-commissioned call for evidence, keyword search, and screening process. Reviewers assigned criteria for relevance and quality scores to each paper and prepared narrative reviews. The publications selected were on interventions in children under the age of 5 in the eight priority health areas. However, due to the absence of published literature on HTSP interventions from low and middle income countries that report child outcomes, the inclusion criteria were expanded to include adolescents and family planning, and maternal outcomes. The six articles reviewed were published in peer-reviewed journals in 1995–2012. The three papers are two literature reviews of mHealth and Maternal, Newborn and Child Health, the Final Report of the U.S. Government Evidence Summit Community and Formal Health System Support for Enhanced Community Health Worker Performance, and a study by the FHI360 C-Change Project Health Communication Assessment of Ministries of Health and National AIDS Authorities in 6 Countries.
The six articles reviewed included standard-days method of contraception, community-based maternity care, adolescent post-abortion care, and maternal, neonatal and postnatal care. Two of the articles focused on improving the supply of health care services while four articles implement an integrated ecological approach focusing on both the supply and demand-side. The strength of the evidence varies: two pre/post designs, two descriptive studies, a client-centered efficacy evaluation, and a cluster-randomized controlled efficacy trial that distributed 39 villages to a control and two intervention sites where both intervention sites received a preventive package for essential newborn care and the second also received a hypothermia indicator (study registered as International Standard Randomized Control Trial).

The interventions in the six articles focused on three strategies: strengthening health services, promoting healthy behaviors, and policy interventions. In general, the interventions focused on community mobilization, educational programs for caregivers, communities and providers; working with opinion leaders, and strengthening health systems.

**Strengthen health services**

The evidence suggests that well-functioning and humane health facilities will attract use even if clients have to pay. Linking community, public health and hospital systems through standing relationships improves referral and use of facilities, as well as integrating HIV and family planning services. Community-based reproductive health workers increase the reach and capacity of government health workers by providing primary health services, increasing community knowledge and offering immediate access to reproductive health services and HIV/AIDS prevention and care. Effective and efficient obstetric services in the community both supply and demand side interventions are necessary to build successful community obstetric care, although the process is complex.

**Promotion of healthy behaviors**

The reviewed evidence points to two behavioral intervention models that may led to substantial behavior change and reduced neonatal mortality: 1. Focusing on social networks, community leaders, influencers effecting multiple levels of community stakeholders, collective behaviors, and social norms to influence and sustain individual behaviors; and 2. Including men in educational interventions related to healthy timing and spacing of pregnancies, rather than focusing on women alone. Using mobile communication devices appears to be a promising practice, but there are few cost-effectiveness studies, and current data is coming primarily from pilots, lacks baseline documentation, has no control/comparison groups, and/or lacks rigorous study methodology.

**Policy interventions**

The evidence suggests that training (knowledge and skills) and supervising providers to influence how they provide health care and counsel clients about timing and spacing of
pregnancies effectively increases of providers. Equipping providers with pre-packaged messages may facilitate such interaction. Postpartum family planning counseling during post-natal visits provides optimum opportunities for this type of counseling. There is strong evidence is support of involving community health workers in rural or suburban areas in the promotion of family planning, along with other primary care community needs (e.g., breastfeeding, immunization, sanitation, home-based neo-natal care, vitamin A, infant feeding, hand-washing, ARV to pregnant HIV+ women, clean delivery, water treatment and safe storage, etc.).

Conclusions and Recommendation

The reviewed evidence for the promotion of healthy timing spacing of pregnancies supports the importance of integrating and/or linking services to improve referral and use; focusing on social networks, community leaders, multiple levels of community stakeholders, collective behaviors, and social norms; including men in educational interventions; and training (knowledge and skills) and supervising providers - including community health workers – to influence how they provide health care and counsel clients.

Preventing mother-to-child transmission (PMTCT) of the human immunodeficiency virus (HIV)

Donna Barry and Lisa Meadowcroft

Introduction

Preventing mother-to-child transmission (PMTCT) of the human immunodeficiency virus (HIV) is an important way to halt a leading cause of childhood mortality. In 2011, 330,000 infants were infected with HIV through MTCT and only 57% of the estimated 1.5 million women infected with HIV who were pregnant that year received effective antiretroviral therapy (ART) to prevent transmission to their fetuses and infants. Given that treatment can prevent over 95% of transmission during pregnancy, deliver and childbirth in low and middle-income countries, evidence-based interventions at the policy and health system level must be shared and implemented more widely.

Through the initial relevance review of articles which were identified through a comprehensive literature explained elsewhere in this paper, 26 articles were recommended for the quality of evidence review. Of those 26 articles, only 9 included evidence of either health outcomes and/or...
behavior change related to PMTCT. More recent pieces (published since the literature review) of white and grey literature were reviewed by the authors, however only one of those are included in this review.

**Key findings from literature and evidence reviews**

An important study in Kenya identified systems’ issues as barriers to PMTCT care and that these issues were more obstructive than stigma in preventing access and uptake of PMTCT services. Systems’ issues included not providing opt-out testing, unavailability of services due to lack of care provided in the community, cost, stock-outs of tests, and poor follow-up for facility based deliveries of those women found to be HIV-infected. With adequate health system financing and good policy implementation, all of these barriers can be eliminated and increase the number of women accessing services to prevent MTCT.

A nationwide PMTCT strategy with buy-in at all administrative and service-delivery levels of the health system and consistent provision of laboratory tests was critical to Jamaica’s success in reducing their transmission rates to less than 2%. National managers developed policies and strategies which included strong leadership, training, strengthened health services for PMTCT, women and children, research and multiple collaborations with local, national and international partners.

Thailand’s national PMTCT program – the first ever implemented in a resource-poor country, beginning in 1998 -- was successful in large part because of early, strong and consistent monitoring of the program, and strong data management. Additionally, during routine antenatal visits, women received HIV tests, and special funds were available to pay for the test should any woman not be able to afford it, thus eliminating the cost hurdle.

Having reliable and accurate public health data helps inform and drive health practices and policies related to PMTCT prevention, care and treatment, as demonstrated by a study in KwaZulu-Natal, South Africa, a district with extremely high prevalence rates. Another study in KwaZulu-Natal showed that rates of MTCT could be reduced and that sampling at infant immunizations offers a robust method of estimating the impact of interventions.

In order to enroll as many women as possible into effective PMTCT programs, it is important to ensure that HIV testing is available and accessible through antenatal care as well as in general health care services. In 2007, the Ethiopian national PMTCT guidelines included opt-out or provider initiated testing and counseling (PITC) during antenatal care however it has not been widely implemented. Recent research found that PITC during antenatal care greatly increased rates of testing. While this study does not include PMTCT outcomes for those women, infants and their partners who accepted PITC, it shows the importance of documenting successful outcomes of national policies.
Stigma related to HIV is a recognized barrier to people being tested for HIV. Another significant bottleneck to adequate service is lack of knowledge among key health staff. To help address these problems, in 2003 China created a comprehensive HIV prevention, care and treatment program geographically focused on rural, resource-poor and ethnic minority areas. The program set norms and standards at both national and local levels. Program activities were developed based on local needs and using multi-sectoral collaboration, among various ministries, including health, security and FDA.

Along with ensuring that women have the widest access possible to testing for HIV, enrolling and retaining women with HIV into treatment programs is also obviously critical. Many low-income countries face difficulties getting women on treatment based on older treatment protocols due to lack of CD4 count machines, vertical programs which locate antenatal and HIV care in different clinics (often at quite a distance from one another), long wait times for both types of care and transportation costs. A new treatment protocol, Option B+, developed in 2011 and adopted by the World Health Organization (WHO) in 2012, helps tackle these barriers to enrollment by beginning lifelong triple ARV therapy for all women infected with HIV who are breastfeeding or pregnant. In Malawi, implementing Option B+ led to a 748% increase in women who were pregnant or breastfeeding enrolling in treatment programs and 77% remained on treatment one year later, similar to the rate for adults who were previously enrolled. Key health system and policy changes included decentralizing ART provision to health centers where antenatal care is provided; training for health center staff on HIV treatment; adding Efavirenz to nearly all treatment regimens; sustaining quarterly visits by MOH staff to clinics to monitor the program and data collection to monitor and evaluate the program.

Recommendations:

Practice

- Expand opt-out or provider initiated testing and counseling; eliminate the VCT recommendations and requirements of USG funded projects and expand the testing reporting to include PITC
- Option B or Option B+ with requisite increases in personnel as well as testing and treatment supplies should become standard of practice in all countries with high burdens of HIV
- Improve data collection and dissemination at all levels of a health system in order to properly evaluate program outcomes

Policy

- Adopt Option B+ in all countries with moderate to high rates of HIV and integrate care for women at healthcare centers

Research Needs/Gaps
There’s a need to evaluate national programs based on behavior change outcomes, and not just knowledge based outcomes.

Neonatal Survival and Health

Luis Fernando Vélez

Introduction

Although the neonatal mortality rate (NMR) in low and middle income countries has declined since 2000, in 2010 over three million newborns died in the first month of life. Significant improvements have been made in Asia and Latin America, but in some other regions like sub-Saharan Africa, progress has been slow. It is urgent to document cost-effective interventions to reduce NMR that can be easily disseminated, but wide-scale coverage is a critical barrier, and many promising interventions have been poorly documented. The current systematic review included over 40 articles specifically related to neonatal survival and health published in peer-reviewed journals, 26 of which met the quality review criteria. The evidence supports three types of policy and health system interventions, mostly focused on systems delivery and personnel training, to promote healthy behaviors:

Integration within and among services

*Primary care systems integrated and organized to provide services at different levels of complexity*, with free or low cost access, a strong community component, education, technical support for ground workers (volunteer or paid) and triaging systems to detect and transfer higher-risk cases to a health center of higher complexity, have shown to be effective in increasing antenatal care, immunization rates, postnatal birth control, and malnutrition. An example of these systems is presented by Abel, et al, in their study of reducing The Rural Unit for Health and Social Affairs, in Vellore, India. The program achieved immunization coverage between 80% and 90%, antenatal coverage of 85%, and 55% postnatal contraception. Amaouzou, et al, also showed the impact of ecological approaches for neonatal survival in a study assessing the impact of government policies supporting universal access, provision of free health care for pregnant women and children, and decentralized nutrition programs in Niger. The authors estimate that about 59,000 lives were saved in children younger than 5 years in 2009, attributable to the introduction of insecticide-treated bed nets (25%); improvements in nutritional status (19%); vitamin A supplementation (9%); treatment of diarrhea with oral rehydration salts and zinc, and care seeking for fever, malaria, or childhood pneumonia (22%), and vaccinations (11%). Similarly, Baqui, et al, showed a 34% lower neonatal mortality after postnatal home visits, with
75% of the reduction seen in homes visited within the first three days of birth, as part of a large-scale community-based integrated nutrition and health program in northern India. Strong results have been also documented in programs training informal and formal health care workers, making services more accessible (birthing homes in villages, adequate triaging - referral, transportation and communication – and appropriate case management), and community education in rural West Java, and in India.

**Training and monitoring health care delivery workers**

*Training personnel to apply evidence-based protocols to improve health care delivery* has been shown to produce a strong impact on neonatal survival and health. A study reported by Al-Rafay, et al, used a quasi-experimental design to assess an intervention to improve Neonatal Intensive Care Unit (NICU) nursing care, significantly improving nurses’ knowledge and practices. The most significant components of this program were comprehensive guidelines for NICU nursing care and checklists to verify the implementation of such guidelines. Berglund, et al, also reported significant improvement in maternal and infant outcome when staff of was trained on the evidence-based guidelines of the WHO package Effective Perinatal Care (EPC) to decrease induction and augmentation during labor, and reduce hypothermia in the infants. This study reports that with optimum adherence to protocols, the use of a graphical record of maternal and fetal data during labor (partogram) increases (up to 60%), induction and augmentation of labor decreases (to less than 1% and less than 5%, respectively), and the proportion of hypothermic infants decreased to almost nothing (1%) from up to 85%. Allen, et al, reported that an evidence-based teaching program consisting of four short lectures and interactive skills stations in rural Nepal produced a 100% increase in measuring length and head circumference, charting percentiles, and documentation of structured history and examination, 71% increase in administration of vitamin K at birth, and 94% increase in assessment of hypoglycemia. In an intervention-control interactive educational intervention with physicians in Bangladesh, Akter, et al, also found statistically significant improvement in appropriate use of antimicrobials in pediatric services.

There is also strong evidence supporting the implementation of WHO Essential Newborn Care (ENC) course among traditional birth attendants, nurses, and doctors in Guatemala, India, and Sri Lanka. ENC has also been used with other health care personnel training interventions including a nurse training program in Cairo, a training program in 14 hospitals in India to improve management of birth asphyxia, a 10-month intensive training for doctors and nurses in Macedonia, intensive education for traditional birth attendants to reduce neonatal tetanus in Thailand, and training community based health workers and traditional birth attendants to safely manage uncomplicated cases of neonatal pneumonia in India.

**Preventing and controlling nosocomial infections**

*Training personnel and establishing and monitoring the use of evidence-based practices to control nosocomial infections* are particularly relevant in the reduction of neonatal mortality.
Calil, et al, documented the efficacy of measures to control colonization and nosocomial infection by multi-resistant bacteria in a neonatal training the whole health care team to reduce cross-colonization, and rationalize the use of antibiotics (including suppression of usage of third-generation cephalosporins). The study found that parenteral nutrition and antibiotic use were critical risk factors for colonization by multi-resistant E cloacae. Health care team training reduced nosocomial infections due to multi-resistant bacteria to about 10% of the pre-intervention levels. A similar intervention educating pediatricians on antibiotic prescribing, applying an antimicrobial spectrum chart, and controlling the prescription of specific antibiotics with the use of a guideline at the Beijing Children's Hospital found a significant increase in rational use of broad-spectrum antibiotic and reduction in bacterial resistance. Darmstadt, et al, evaluated a low cost comprehensive infection control program emphasizing staff and caregiver education about measures to decrease risk of contamination, particularly hand-washing, proper disposal of infectious waste, strict asepsis during procedures, and prudent use of antibiotics, finding a decline of 61% in culture-proven sepsis and 50% in deaths. Other evidence supporting training for the control of nosocomial infections include a parent education program in Argentina, a surveillance and targeted interventions program in Algeria, staff education and implementation of evidence-based infection control measures in Lithuania, education, reinforcing hand hygiene, antibiotic restriction, and infection control measures to control an outbreak of Ab-BSI in Turkey, and stepwise introduction of evidence-based intervention and intensive and continuous education of neonatal intensive care workers to reduce catheter-associated bloodstream infections in Brazil.
Conclusions and recommendations

1. Primary care systems organized to provide services at different levels of complexity, with free or low cost access, a strong community component, education, technical support for ground workers (volunteer or paid) and triaging systems to detect and transfer higher-risk cases to a health center of higher complexity, have shown to be effective in increasing antenatal care, immunization rates, postnatal birth control, and malnutrition.

2. Training personnel to apply evidence-based protocols to improve health care delivery has been shown to produce a strong impact on neonatal survival and health. The evidence supporting the implementation of the WHO Essential Newborn Care (ENC) program is particularly solid.

3. Training personnel and establishing and monitoring the use of evidence-based practices to control nosocomial infections is particularly relevant in the reduction of neonatal mortality.

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Early Childhood Development and Thriving

Wendy J. Nilsen

Introduction

Although reducing preventable child deaths in health care settings and policy efforts in low and middle income countries is critical, an additional focus is needed on enhancing healthy child development beyond survival is essential. Child development is traditionally seen as including the related developmental components of social-emotional, sensory-motor and cognitive skills. Surviving and thriving is especially important in the developing world because challenges to healthy child development are closely linked with the common problems of poverty and malnutrition. Although precise estimates for rates of healthy child development in developing countries is lacking, and the only available data for development is in the cognitive realm, Grantham-McGregor and colleagues have conservatively estimated that over 200 million under the age of five are failing to reach their cognitive potential. Further, a survey of disabilities in 18 low- and middle-income countries showed that 23% of children between the ages of 2-9 either have a disability or were at risk for one. Although these findings paint a bleak picture for the millions of children developing in these environments, research with humans and animals has highlighted the plasticity of the brain and improvements in functioning with early intervention. Thus, addressing children’s ability to not only survive, but thrive is an important focus and one in which identification and intervention is critical.
Fortunately, having children both survive and thrive is now seen by many countries as both an economic and moral imperative. Economically, the rationale is clear: without children having adequate cognitive, sensory, motor and social and emotional skills and abilities, children are less likely to succeed in the educational system. A lack of educational success, predicts lower wages and a continuation of a familial cycle of poverty. Morally, the imperative arises because “a stimulating and enriching physical and psychosocial environment is the right of every child”.

Additionally, early child development is essential in meeting the second UN Millennium Development goal of ensuring all children complete primary schooling.

Thus, attention to healthy child development has been recognized in low- and middle income countries. In the developed world, attention to the use of the health system and policies has become well established for addressing issues of optimal child development. Current best practices encourage health care providers to promote early development, as well as utilize systems for early identification and management of development delays and disabilities. In addition, policy efforts, such as the United States’ Early Intervention system, are designed to provide community supports and services for the identification and treatment of delays and disabilities and allow children to reach their full developmental potential. These programs have been initiated because of the understanding that for most of the world, the health care system is the only place that has the potential to reach all young children and the longer remediation is delayed, the more costly it becomes.

Despite this potential, the research literature on the use of health care systems and policy efforts in low and middle income countries to support child development is in its infancy. Research in this area falls into one of three areas: assessment, treatment and policy. Findings in each of these areas are described below.

### Assessment and Identification of Delays

Currently, there are no globally accepted indicators of child development, which has stymied efforts to monitor progress and accountability in assessments of child development. Even without globally recognized measures, there is evidence that healthcare providers are aware of early childhood developmental assessment, although training is necessary to translate awareness into accurate identification. These findings have led to efforts to train health care providers in identifying healthy and abnormal child development and effects have been found for knowledge of child development and confidence in assessment. Challenges to the sustaining assessments were a lack of provider time and no referral system for children who were found to have delays.

### Treatment

Behavioral interventions to enhance child development have to address a number of dynamic and inter-related health, nutrition and developmental factors that extend well past traditional health care settings. The majority of child development interventions from health systems target...
intellectual and physical stimulation, often paired with nutritional assistance. Most of this research has taken place in Jamaica or Bangladesh and has generally delivered in the home by community health workers with limited educational attainment (some secondary education) who were given additional training before beginning the intervention and supervision by a professional with education in child development. The intensity of the intervention ranged between weekly sessions from between one and three years. Interventions targeted stimulation and interaction through play activities and enriching verbal interactions (talking and singing) between the caregiver (usually the mother) and child. Target children were either malnourished, stunted low birth weight or poor. Effects for the interventions on child development, especially in the cognitive realm were significant across studies and populations, with the only exception being children from families whose home visits were monthly (no effect observed). Children began the interventions between the ages of 6-24 months with no impact found for age at enrollment.

Additional research in China, South Africa and India has focused on providing support for child development during health care visits. Similar to home visiting programs, caregivers were taught to stimulate their children through counseling and demonstrations. Interventions were delivered by trained health care professionals. The effects on cognitive development in all three trials were significant, although one trial was limited by a lack of blinding in the assessment.

Policy

One of the more recent aspects of policy strategies to enhance childhood development is the adoption of preschools, both formal and community-based. Preschools generally include formal and informal support for all three major components of healthy child development, as well as including nutritional supplementation. Although the research is clear that early childhood education is not just a downward extension of primary education and that high quality stimulation and interactions through play between the child and caregiver is essential for enhancing early childhood development. Few trials of these preschools have been done, although a large scale example from Bolivia highlights the potential for this work. Berman and colleagues found that early enrollment in the program (before 24 months) was related to increases in motor development, language skills and psychosocial interaction after 13-18 months of participation. Benefits decreased as children enrolled in older ages (increase in psychosocial skills only for children enrolling after 36 months).

Reports indicate that often preschool providers with the appropriate skills are lacking. For example, in India, efforts to develop a national early childhood development curriculum have not been paired with appropriate funding and evaluation and, thus, have yielded limited success.

Policy supporting financial incentives, in the form of conditional cash transfers, has also been offered by multiple countries as a policy mechanism for enhancing child development. More specifically, conditional cash transfers have been employed with low income families around the world to encourage children’s utilization of preventive care visits, vaccinations and attendance in
educational programs. Although these programs have many documented outcomes, including reductions in household poverty, increased child attendance in school and utilization of well child visits to health care, the evidence for an effect on child development has been limited. Work in Mexico suggests that the effects have been strongest for children who were poorest when entering the program.
Prevention of Pneumonia, ARI and Diarrhea

Gael O’Sullivan and Stefan Peterson

Introduction

While significant progress is being made to reduce mortality in children under five worldwide, it is unlikely that we will meet the goal of MDG 4, which is to reduce deaths in children under 5 by two-thirds between 1990 and 2015. Pneumonia and diarrhea are the largest causes of morbidity and mortality from infectious diseases in children under 5 years of age, with an estimated 1.3 million and 700,000 child deaths respectively in 2011.

Pneumonia and diarrhea have many risk factors, with under nutrition playing a major role in both illnesses, along with lack of exclusive breastfeeding, underweight, stunting, and wasting. From a health system and policy strengthening perspective, there are a number of proven interventions that can improve the capacity of caregivers, health providers and the community to take preventive and curative steps that foster sustained behavior change and ultimately improved health outcomes. Hundreds of thousands of lives can be saved through systematic delivery of pneumococcal vaccine, better case management of pneumonia infections, improved quality of water sources, zinc supplementation, Hib vaccine, hand washing with soap, improved sanitation, increased use of oral rehydration solution, rotavirus vaccine, hygienic disposal of children’s stools, and improved use of zinc as a diarrhea treatment. The challenge becomes one of translating a proven intervention into aspects of “health systems and policy support”, which may require adopting a conceptual framework. Few articles go to that level of analysis.

Forty-one articles that met the ERT relevance and quality review criteria for inclusion in the analysis were reviewed. They were selected from a total of 50 articles on ARI/pneumonia/diarrhea. We have synthesized the evidence of the outcomes by themes and subtopics. The evidence is limited and its strength is moderate, mainly due to the lack of rigorous evaluations for behavior change communications interventions implemented.

Evidence Synthesis

Interventions for the prevention and treatment of diarrhea:

A recently published systematic review of the evidence in *The Lancet* showed the effectiveness of various potential preventive and therapeutic interventions against childhood diarrhea and pneumonia, along with relevant delivery strategies. Using the Lives Saved Tool model to assess
the effect on mortality when these interventions are applied to a scale of at least 80%, and assuming that immunization rates reach at least 90%, the authors estimate that 95% of diarrhea deaths and 67% of pneumonia deaths in children younger than 5 years could be eliminated by 2025 at a cost of US $6.715 billion. Importantly, new delivery platforms and expanded community platforms can help reach this result in an equitable fashion.

The recommended interventions for the prevention of diarrhea based on a recent review of evidence include: breastfeeding promotion; rotavirus vaccine, as this vaccine was 74% effective against very severe rotavirus infection and 61% against severe infection; and cholera vaccine, as this vaccine was 52% effective against cholera infection.

Based on the evidence, numerous interventions have been effective for the treatment of diarrhea. Oral rehydration salts (ORS) and home fluids are recommended, as their use demonstrated reduced diarrhea mortality by 69%. Zinc administration is endorsed for diarrhea management because it significantly reduced all-cause mortality by 46% and hospital admission by 23%. It also resulted in a 28% reduction in pneumonia-specific mortality, and a 50% reduction in hospital admission for pneumonia. In acute diarrhea, lactose-free diets significantly reduced the duration of diarrhea compared with lactose-containing diets, and the treatment failure was also significantly reduced. Weight gain did not have any significant effect. Including antibiotics for the treatment of shigella is important, and showed a reduced clinical failure by 82% and bacteriological failure by 96%. Antibiotics are also important for the treatment of cholera, demonstrating a 63% reduction in clinical failure, and a 75% reduction in bacteriological failure, making it a valuable intervention. Lastly, including antibiotics for treatment of cryptosporidiosis demonstrated a 52% reduction in rates of clinical failure, a 38% reduction in parasitological failure, and a 76% non-significant reduction in all-cause mortality.

**Interventions for the prevention and treatment of pneumonia:**

Recommended interventions for prevention of pneumonia based on the evidence review include breastfeeding promotion and vaccinations. The Hib vaccine has shown a 6% significant reduction in severe pneumonia, an 18% non-significant reduction in radiologically confirmed pneumonia, and a 7% reduction in pneumonia mortality. The pneumococcal conjugate vaccine has shown a 29% significant reduction in radiologically confirmed pneumonia, an 11% reduction in severe pneumonia, and an 18% non-significant reduction in pneumonia mortality. On the treatment side, one of the recommended interventions is antibiotics for neonatal pneumonia. This includes both oral and injectable antibiotics at home, or in first-level facilities, and in-patient hospital care. Antibiotics resulted in a 25% reduction in all-cause neonatal mortality, and a 42% reduction in neonatal pneumonia mortality. The detection of hypoxaemia by pulse oximetry together with oxygen therapy, with an assured oxygen supply from oxygen concentration, resulted in a 35% significant reduction in severe pneumonia mortality.

Bhutta et al. estimated potential cost-effectiveness of targeting the same set of interventions to address neonatal mortality and mortality in children younger than 5 years within wealth quintiles for Pakistan, Bangladesh, and Ethiopia. The effect of various evidence-based interventions is
greatest in the poorest quintiles. The authors also examined the effect of reaching the poorest individuals through community-based platforms, and focused on three strategies: breastfeeding promotion, scale up of zinc or ORS interventions, and case management of pneumonia by deploying community health workers in these strata. The model showed that if 90% coverage were achieved for these three interventions, 64% of diarrhea deaths and 74% of pneumonia deaths could be averted in the poorest quintiles in the three countries assessed.

Reduction of indoor smoke, an important additional policy issue, has the potential to reduce lower respiratory tract infections in children younger than six years of age. Although no clear estimations exist about smoke from wood or coal burning, exposure to environmental tobacco smoke (ETS) increases the risk of acute lower respiratory disease in young children by 1.5 to 2-fold.\textsuperscript{86,87,88} Evidence from developed countries suggest that strict smoke-free policies in the community increase adult quit rates, and reduce children’s exposure to ETS as measured by cotinine levels in saliva, though not among children whose parents smoke inside their homes.\textsuperscript{89,90,91}

**Implications for health system and policy strengthening**

*Scaling up national level systems*

Counties and Ministries of Health must ensure that systems are in place at all levels to support scale up, in line with the burden of disease for each country. Scaling up existing vaccine programs will be beneficial. Issues related to strengthening supply chain commodities, human resources, transportation/logistics, cost, must all be addressed, making this a complex recommendation to execute for most countries. One key area within this recommendation is to increase availability of key antibiotics and zinc. Scale-up includes authorizing community health workers to provide these services, and especially allowing them to provide antibiotics to children presenting with clinical pneumonia. It also includes ensuring that policies are in place for encouraging zinc use for routine case management of diarrhea.

*Improving coordination*

Coordination between services of different levels of complexity, prevention and treatment services, and private and public sectors is a strongly supported best practice. Coordinating the improvement monitoring systems and harmonized systematic program indicators is also necessary. Public-private partnerships improve performance, enhance reach, and reduce unnecessary duplications. Providing accreditation to private sector providers trained in antibiotic dispensation, and providing incentives to motivate are two areas that will provide the biggest gains in the private sector. Lastly, sustained advocacy efforts to increase awareness of the magnitude of health problems caused by pneumonia and diarrhea and expand support for water, sanitation and hygiene initiatives are central to bringing up sustainable systems and policy changes.

There is some evidence that improved implementation of Integrated Management of Childhood Illness (IMCI), focusing on health worker training, health systems improvements, and family and community activities, can result in increased care-seeking for illnesses, more children under six
months being exclusively breastfed, and reduced prevalence of stunting.\textsuperscript{92} Similarly, there is data demonstrating the effectiveness of training health care workers on Acute Respiratory Infections (ARI) case management, using interactive techniques and ensuring continuous medical equipment and drug supply, coupled with community educational and snowballing approaches.\textsuperscript{93}

### Training and educating providers

The reviewed evidence supports interventions that include educating communities and families, training health workers, and ensuring comprehensive health systems support for first-level health workers, especially supervision and drugs/supplies at community and facility level.\textsuperscript{94,95} Some limited evidence suggests positive effects of Collaborative Quality Improvement to improve compliance with standards.\textsuperscript{96} There is also some evidence that behavior change efforts that use multiple strategies – such as hand washing promotion strategies that provide instruction, modeling, social support, and soap – have greater impact than more limited behavior change approaches\textsuperscript{97}

Providers must be trained in prevention and treatment protocols to improve their knowledge and skills and eliminate improper behaviors such as prescription of antibiotics for watery diarrhea. Employing interactive training methodologies\textsuperscript{98,99}, job aids\textsuperscript{100}, and post-training dialogue and support have demonstrated promise as effective behavior change strategies. Educational programs for NICU staff on hand hygiene can contribute to reductions of nosocomial pneumonia, and systematic use of surveillance data with staff feedback loops can improve compliance rates.\textsuperscript{101} Improving case management and supportive supervision are shown to help. Creative strategies including hand washing songs, artistic posters and promotion of key phrases through music and art have not shown to be effective means of increasing adherence to handwashing protocols among healthcare workers in a newborn intensive care setting.\textsuperscript{102} A major review by Alexander Rowe is forthcoming on determinants of health worker behavior and improvement in low-income countries.

### Recommendations

The evidence reviewed provides enough evidence to recommend 1. Health worker interventions, such as trainings, be accompanied by integration of health systems support for the intended interventions (e.g. supervision, drugs/supplies etc); 2. Policies supporting of access to life-saving interventions at first-level care, which requires comprehensive policy review to align with treatment protocols; and 3. Systematic quality management effects at district, facility and community levels using more holistic models of health systems support\textsuperscript{103}. Most evidence is for particular interventions, with scant description of the health systems and policy supports required, let alone their “sustainability”. Additional research is needed to identify knowledge gaps through Health Policy and Systems research as indicated in recent systematic research prioritization publications\textsuperscript{104}. This may require translating evidence based interventions into constituent health systems supports and required policies, using a health systems model such as the WHO Building Blocks\textsuperscript{105}, or another conceptual or theory-of-change model. Similarly further

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evidence is necessary to characterize Health Systems supports and policies required for population behavior change.
Nutrition, Micronutrients and Breastfeeding

Vesna Kutlesic, Susan Vorkorper, and Daniel Raiten

Introduction

As efforts are designed and implemented to address the role of nutrition in health systems strengthening, it is important to recognize that malnutrition includes both under-nutrition- stunting, wasting, and micronutrient deficiencies- and over-nutrition including obesity and related diseases. Under-nutrition, often resulting from food insecurity (i.e., limited access and availability to food and adequate nutrition), has been shown to be a critical factor in the health and economic development of resource-poor countries. Interventions to mitigate against the adverse effects of malnutrition have implications for both short- and long-term health promotion and disease prevention, and facilitate economic development through improved work and productivity.

Interventions which target the most at-risk: children under 5 and pregnant and lactating women:

A rich evidence base exists to target the first “1,000 days”, which encompasses pregnancy and the first two years of life as highlighted recently in Lancet series on nutrition and global burden of disease analysis. The first “1,000 days” has been the focal point of such efforts as the Millennium Development Goals (MDGs), Scaling Up Nutrition (SUN), and Feed the Future. A compelling case for the creation, implementation, and scale-up of existing and new health systems strategies targeting these vulnerable groups, which result in behavior change and positive health outcomes, is provided by data supporting the notion that children under five and pregnant and lactating women are most at risk for nutrition-related problems. Addressing under-nutrition among these particular populations could help prevent up to 11% of all DALYs worldwide.

With regard to the nutrition of infants and young children, a primary focus of the global research, program, and policy agenda has been on strategies to improve the initiation and duration of exclusive breastfeeding and use of complementary feeding practices. While issues affecting a mother’s infant feeding choice remain complex, a review of programs to improve exclusive breastfeeding for the first six months of life indicate that success is dependent on community support, trained personnel, an evaluation feedback system, and defined program strategies. Structured programs, such as the Baby Friendly Hospital Initiative, along with contact before and immediately after giving birth, increase the rates of early initiation of breastfeeding and exclusive breastfeeding for six months, as recommended by WHO. Proper complementary feeding practices are dependent on dietary diversity that ensures children six to 24 months old consume nutrient-dense foods and age-appropriate complementary foods.
appropriate quantities of calories and proteins. These approaches are more effective and sustainable than targeting individual nutrients. Successful programs operate within an existing infrastructure and focus on a few key, feasible messages.

To improve dietary practices, proper complementary feeding practices are dependent on dietary diversity that ensures children six to 24 months old consume nutrient-dense foods and age-appropriate quantities of calories and proteins. These approaches are more effective and sustainable than targeting individual nutrients. Mainstream approaches, such as expanding building infrastructure, are less effective than comprehensive, multi-systems approaches that address the physical, economic, and political environment and consider the idiosyncratic concerns of the population. The latter engages participants through a variety of evidence-based techniques, such as prompt recall, social support, and materials and media messages. A key component to sustained health systems strengthening is an ample monitoring and evaluation system with valid and robust nutrition indicators; this helps identify areas for improvement and assesses the nutritional status of the population at large.

**Interventions which address the effective interaction and integrations among systems:**

The ability to address the dual burden of over- and under-nutrition demands a systems approach that is inclusive of all agencies/stakeholders up and down the chain including an effective and integrated interaction among health, agricultural, and economic systems. A comprehensive health systems approach builds technical and healthcare delivery capacity and improves access to disease prevention strategies and evidence-based standards of care and treatment. Strong health systems also incorporate robust monitoring and evaluation activities that track population-level nutrition needs, detect services that are ineffective, and identify implementation concerns. The technical guidance for such efforts is provided by key authoritative agencies. WHO, as the lead global agency for evidence-based health guidance, has developed and disseminated nutrition guidelines to address various aspects of maternal and child nutrition. These include: infant and young child feeding, school-based programs, single and multiple micronutrient interventions, and the prevention and treatment of nutrition-related, non-communicable diseases (NCDs) and infectious (e.g., HIV, TB) diseases. WHO also provides guidance on best indicators for population surveillance, as well as for program monitoring and evaluation.

**Interventions which scale-up evidence-based approaches:**

Sound principles in nutritional assessment and evidence-based interventions such as food fortification, single/multiple micronutrient supplementation, and improved dietary diversity are examples of the public health toolkit for addressing malnutrition. These approaches can prevent and reduce nutrient deficiencies and track potential safety concerns. They are also cost-effective and where appropriate, easily incorporated into existing health systems. Iodine fortified salt exemplifies the potential value of effective and successfully implemented health systems, nutrition interventions. Salt iodization has been instrumental in ameliorating the impact of iodine deficiency on cognitive development through its use in nearly every country in the world. Although the successes of well-implemented micronutrient interventions have been...
documented, it must be acknowledged that there is a risk for potential adverse effects. The recent results from studies evaluating iron and malaria and vitamin A and HIV provide sobering reminders that the “one-size-fits-all” approach of universal supplementation can have potentially negative outcomes under certain circumstances. The complexity of the public health context must be considered and addressed with sound principles of surveillance and nutritional assessments.

One way to meet nutritional needs is to increase the variety and quality of nutrient-dense foods. Research reviewing small-scale dietary diversity activities, such as home gardening and livestock, have shown improvements in the production of these foods and as a result, higher concentrations of hemoglobin and serum retinol. Further research is needed to assess their impact on a systems level. Incorporating fortification, supplementation, and dietary diversity activities into health systems can reduce malnutrition as long as they are safe, account for the needs of the population (e.g., areas with high rates of malaria or NCDs), are evidence-based, and have strategies for monitoring and evaluation process that includes relevant health outcomes.

Economic incentives, like conditional cash transfer (CCT) programs, have been increasingly popular as a way to alleviate poverty and incentivize parents to invest in their child’s long-term health and well-being. These programs when integrated into existing health services have been shown to improve linear growth, reduce anemia, and increase dietary diversity and consumption of nutrient-dense foods especially among low-income infants and children. However, design differences among various programs make it difficult to compare programs. Because of these variations, there is no consensus about eligibility criteria, urban or rural targeting, and implementation guidelines. To date, most CCT programs have been implemented in middle-income countries in Latin America; more rigorous research is needed to assess what impact these programs could have in low-income countries with less effective health care systems.

Approaches to improve nutrition have the added challenge of considering both under-nutrition and over-nutrition. As obesity-related problems become more predominant around the world, all those involved in healthcare delivery, from primary caregivers to country leaders, must consider the potential of reducing under-nutrition in some populations while inadvertently exacerbating issues linked to over-nutrition in others. To further strengthen health systems and improve nutrition globally, more research is needed to examine the intersection between these two issues. Due consideration must be placed on the potential interactions among food insecurity, malnutrition, NCDs, and infectious diseases, all of which may co-exist within a given individual or population. Moreover, implementation research will be essential to more fully appreciate both the opportunities and barriers to scaling up effective, cost-efficient interventions and to gauge their long-term impact. Data garnered from such efforts will inform and strengthen health systems and reduce the burden of malnutrition thereby improving the health of women, infants, and children.

Conclusions and recommendations

This review found evidence for the following health systems and policy supports that improve nutrition in children under five years of age through behavioral and social changes:

1. Comprehensive health systems approach should implement programs and policies with structured evidence syntheses.

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community support, trained personnel, an evaluation feedback system, and defined strategies; 2. The first “1,000 days” strategies, including structured programs and contact before and immediately after giving birth improve the initiation and duration of exclusive breastfeeding and use of complementary feeding practices; 3. Proper complementary feeding practices based on dietary diversity promote consumption of nutrient-dense foods and age-appropriate quantities of calories and proteins; 4. Scaling up evidence-based interventions, as long as they are safe, must account for the needs of the population, be evidence-based, and have surveillance and nutritional assessments strategies in order to avoid potentially negative outcomes; 5. Conditional Cash Transfer programs have been effective in reducing malnutrition among low-income infants and children in Latin America, but further research is needed to assess their potential impact in low-income countries with less effective health care systems; 6. Small-scale dietary diversity activities, such as home gardening and livestock, are a promising strategy; 7. More research is needed to examine the intersection between under-nutrition and over-nutrition.

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**Immunizations**

Franklin Apfel

*“With the exception of safe water, no other modality, not even antibiotics, has had such a major effect on mortality reduction…”* 152

**Introduction**

The health impact and cost-benefit evidence for investment in vaccination programs to reduce mortality and morbidity in children under five is very strong.153 154 Globally, current vaccination programs prevent an estimated 2.5 million deaths each year as well as a wide variety of illnesses and disabilities among children.155 156 Yet despite this extraordinary progress, almost one in five children remains unprotected against vaccine preventable diseases. WHO has estimated that an additional two million deaths a year could be prevented, by 2015, among children under five years old, if all the vaccines now available against childhood diseases were widely adopted, and if countries could raise vaccine coverage to a global average of 90%.157 To achieve this goal, health and supply systems need strengthening, awareness needs to be raised, and people’s concerns and “hesitancy” need addressing158 159. This section focuses on reviewing evidence on health system and policy-related behavior change initiatives aimed at enhancing immunization uptake (directly and as part of more complex interventions)

**Global policies and initiatives that shape national immunization system investments, design and behaviors**
Global policies aimed at achieving universal immunization for all children were first agreed in 1977 as an essential element of the WHO strategy, Health For All by 2000. The Expanded Program on Immunization (EPI) was established as the mechanism to achieve universal access to all relevant vaccines for all people at risk. The EPI and its related polices have catalyzed, supported and shaped all national vaccination systems. Most recently Global goals and milestones have been established through the Global Immunization Vision and Strategy 2006–2015 and the Global Vaccine Action Plan 2011-2020 and other international agreements. All of these policies and plans include expert-generated peer-reviewed recommendations for communication and advocacy activities related to behavior change. All plans call for more research to strengthen the evidence base underpinning the recommendations. In low- and middle-income countries implementation and evaluation of these policies has been supported by many bilateral donors, UN agencies, GAVI, NGOs and others. All these initiatives have resulted in the strengthening and shaping of national programs, priorities, systems and commitments.

Global initiatives and “tools” developed to help countries overcome barriers to expanded immunization include the Reaching Every District (RED) strategy and the Integrated Management to Childhood Illness (IMCI) strategy. RED was an intervention designed specifically to improve key components of immunization services including planning, outreach, community mobilization, supervision, and monitoring in select districts. The IMCI is a broader initiative and has 3 components: improving case management practices (behaviors) of health workers (especially in outpatient health facilities), strengthening health systems, and promoting (behavioral change related to) community and family health practices.

Several significant controlled studies have looked at the impact of both RED and IMCI programs in different low- and middle-income countries. In a 2-year RED evaluation study in Assam India, while vaccination uptake data in intervention districts showed no difference from controls, process data indicated significant improvements in program quality in the intervention districts. IMCI initiatives (for providers and community groups) have also undergone extensive evaluations. In controlled studies related to the provider training components in Benin and different States in India, the IMCI training was found to consistently enhance knowledge and performance of providers. There are concerns about sustainability of these strategies since they require continuing supportive supervision, adequate essential supplies and regular monitoring.

National initiatives – Primary Health Care Surveillance

There is evidence that strengthening primary health services can lead to increased vaccination uptake. Since the mid-1900s, for example, Brazil has initiated a Family Health Program (a family doctor, a nurse, an assistant nurse, and six community health agents) to bring primary health care into communities, showing a drop in infant mortality from 48 per 1000 to 17 per 1000 and DTP vaccine coverage in children less than 1 year old greater than 95% in selected municipalities.

Surveillance systems are essential for monitoring (disease prevalence, outbreaks, adverse effects,
etc.) of immunization programs in both normal\textsuperscript{174} and refugee camp settings. In the later, data can be used to direct community based public health interventions to control common infectious diseases and reduce high mortality rates among refugees while placing a minimal burden on health workers.\textsuperscript{175}

**Integrating services**

WHO and UNICEF promote integration of maternal and child health (MCH) and immunization services as a strategy to strengthen immunization and other programs. Global experience with integrating immunization services with many other services has been reviewed.\textsuperscript{176} The benefits identified include quick scale-up of coverage for the linked interventions and increased user satisfaction. Concerns raised include overburdening health workers and difficulty planning in the face of increased logistical requirements.

**Shaping provider capacity to promote and deliver vaccination services (supply) and consumer demand**

The UNICEF India Review concluded that adherence to childhood immunization schedules depends on demand generation, and supply of services. Each component alone cannot make significant impact to increase complete immunization coverage therefore, no single strategy can be found which is effective in isolation.\textsuperscript{179} Comprehensive interventions that address both “suppliers” and “demanders” work best. Here is a sampling of evidence-based interventions.

**Changing Provider behaviors (the supply side)**

**Training Primary Healthcare Workers**

A pre- and post study in Turkey,\textsuperscript{180} found that continuing education of primary healthcare workers related to vaccination issues can lead to increased vaccination coverage. The training included information about vaccines, national vaccination schedule, cold chain and management, planning and regulation of immunization, tracking the trends and increase in vaccination coverage, and immunization recording. Key findings showed that how long the training program lasts, where it is held and how well the trainers perform affect the post-workshop test scores of the trainees.

In a controlled study in Thailand,\textsuperscript{181} training traditional birth attendants in sterile techniques for umbilical cord cutting and correct method of dressing the umbilical stump was as effective as two doses of tetanus vaccination in reducing incidence of neonatal tetanus. Training CHWs and peer educators, using IMCI curricula and other tools, has been shown to positively impact on knowledge, attitudes and practices in many different settings.\textsuperscript{182} Although there is a lot of investment in such training, the findings of the USAID evidence summit on CHW suggest the need for more research in this area.\textsuperscript{183}
In a randomized control trial in Sudan\textsuperscript{184}, a simple system (re)design (moving vaccination service very close to GP consultation room) or having the doctor write a prescription recommending vaccination increased vaccination uptake by 55% amongst unvaccinated children seeking curative care.

**Understanding “customer” perceptions**

A variety of studies have focused on helping HCWs to better understand and support parents of children who have incomplete or no vaccinations. An essential element for informing this understanding is the gaining of insight into people’s perceptions. A variety of studies\textsuperscript{185, 186} support identifying and addressing system/provider and consumer barriers such as health staff attitudes and practices, reliability of services, false contraindications, parents’ beliefs and knowledge, fear of side effects, and conflicting priorities. Every immunization program should strive to provide quality services that are accessible, convenient, reliable, friendly, affordable and acceptable, and should solicit feedback from families and community leaders. Every program should monitor missed and under-vaccinated children and assess and address the causes. Local study, local enquiry and follow-up remain essential.

**Building consumer demand**

**Knowledge, attitudes and practices (KAP)**

Social mobilization and public education initiatives\textsuperscript{187} as part of a comprehensive education and information package including: training doctors and EPI staff can lead to a significant increase in public and provider KAP and support smooth integration of a new vaccine (JE) into EPI.

**Home based medical record**

The use of a home-based medical record has been shown to be positively correlated with increased tetanus toxoid immunization in pregnant women in an eight country WHO collaborative study\textsuperscript{188}.

**Social Mobilization Campaigns**

Vaccination campaigns have been shown to be highly effective. In Uganda\textsuperscript{189}, they led to a 93% decline in measles morbidity, interrupted indigenous measles virus transmission and benefited routine immunization. A unique feature of this campaign was the inclusion of supplemental products including vitamin A (given to all children aged 6–59 months), and albendazole for deworming (a “crowd-puller”) (given to all children 5–14 years). In selected districts, additional interventions included: supplemental tetanus immunization for girls and women of child-bearing age and/or praziquantel for schistomiasis. Involvement of political, religious and traditional leaders in mobilization activities for the campaigns, and the resulting rapid reduction in measles...
cases, helped to build public confidence in immunization services and in health services in general. Similar findings are reported for a nationwide rubella-measles immunization campaign in Haiti prior to introducing MR into the national program\textsuperscript{190}.

A special campaign in the Bihar State in India, called \textit{Muskaan Ek Abhiyan} (The Smile Campaign)\textsuperscript{191} led to a 16 to 26\% greater vaccination uptake than in the control areas. The main strategies of the \textit{Muskaan} campaign were increasing access to immunization sessions, enhanced inter-sectoral coordination between the Departments of Health, and Women and Child Development, training of trainers, alternate vaccinators were proposed to counter the shortages, women groups at community level involved in awareness generation, strengthening of monitoring and supervision mechanisms, and provision of performance based incentives to service providers.

\textbf{Media and mHealth}

Media campaigns in the Russian Federation\textsuperscript{192} contributed to a 20-80\% increase in diphtheria vaccination when used as part of a comprehensive intervention. Focus groups were conducted; audience specific messages developed and distributed into a variety of media products: television and radio public service advertisements (PSAs), print advertisements, posters, leaflets, and transit cards.

There is a lot of interest and investment in mHealth initiatives in low and middle income countries. Finding best ways to use mHealth to assist with vaccination uptake should be viewed as opportunities for future research. Some promising work on SMS vaccination appointment reminders is already available in many countries.\textsuperscript{193, 194}
Summary

This evidence review has looked at a wide variety of policy and action initiatives that Global, national and local public health agencies have taken to address behavioral obstacles to vaccination uptake. A great deal of attention and resources have been focused in this area and great gains have been realized. As we progress through this “Decade of Vaccine”, we hope this evidence review will help guide investments and action so that the goal of 2 million more lives saved can be realized.

MALARIA

Martin Alilio, Amparo Garcia, and Michelle Kaufman

Introduction

Twelve malaria articles that met the ERT relevance and quality review criteria for inclusion in the analysis were reviewed. They were selected from a total of 28 articles on malaria based on the inclusion of interventions implemented to promote desired behavior changes to increase prompt and correct use of antimalarials and preventative treatments, as well as to improve health professionals’ skills and performance. We have synthesized the evidence of the outcomes by four themes and subtopics shown below. The evidence is limited and its strength is moderate, mainly due to the lack of rigorous evaluations for behavior change communications interventions implemented. However, from the ones explored we have adequate insight into interventions that are effective in promoting behavior changes for malaria prevention and treatment in different countries across Africa. Table 1 provides a summary of the strength of the evidence for the interventions in the articles selected.

Interventions focusing on the improvement of provider behavior(s) to optimize patient-provider interactions and increase provider compliance and performance:

A systematic follow-up reminder to health workers after on-the-job professional training can help change and sustain malaria care provider’s behavior, operating at the action and maintenance stages of behavior change. A cluster-randomized controlled trial of an intervention to improve health worker malaria case-management was implemented in Kenya. Health workers were trained and were subsequently sent text messages with reminder information about artemether-lumefantrine (AL). These considerations resulted in sending two messages per day (9 am and 2 pm) for five working days (Monday to Friday) resulting in a total 10 different malaria messages weekly. The findings showed significant improvements in correct AL
management, which included correct dosing and counseling, both immediately after the intervention (November 2009) and six months later (May 2010) as compared to baseline data.\textsuperscript{196}

Health workers said being kept ‘up to date’ was an important factor influencing practice. A similar study in Tanzania carried out to evaluate short-term effects of a one-to-one educational intervention approach aimed at improving the private sector’s practices, compliance, and performance in using the national treatment guidelines for malaria and other common childhood illnesses showed a significant impact on prescribing and dispensing practices of drug stores for some common childhood illnesses. The training took place one month after the baseline data was collected and the end line data collection was undertaken eight months after training to assess the effects. About 90\% (n=18) of shops prescribed to clients the approved first-line antimalarial drug for uncomplicated malaria (sulfadoxine-pyrimethamine), as compared to only 55\% (n=11) of the control shops.\textsuperscript{197}

Similarly, a low-cost outreach educational program in Kenya to improve the private sector’s compliance with malaria guidelines by training and providing job aid to district’s wholesalers showed that 32\% of shops receiving job aids prescribed the approved first-line drug, sulfadoxine-pyremethamine, as compared to only 3\% of the control shops.\textsuperscript{198}

**Interventions seeking to raise awareness and knowledge of different methods to improve malaria prevention and treatment**

**Community interpersonal communication is effective in increasing the uptake of malaria prevention and treatment.** A study in Burkina Faso involved training a core group of mothers and supplying community health workers with antimalarial drugs specially packed in age-specific bags and containing a full dose of treatment.\textsuperscript{199} Two to twenty mothers formed the core group, depending on the size of the village. A baseline knowledge, attitudes, and practices (KAP) survey was conducted pre and post-intervention. The proportion of mothers seeking help from anyone in the village (primarily a community health worker) for their child's malaria episode increased from 21\% at baseline to 54\% at the end of the study. In addition, use of chloroquine and paracetamol for treatment rose from 25\% to 46\%. In another study, twelve health centers were selected in Burkina Faso, for a total study area of a population of about 75,000 people distributed in 57 villages. Four health centers were assigned to community promotion in addition to IPTp-SP and eight were randomly allocated to either IPTp-SP (intervention) or weekly chloroquine (control). The promotional campaign resulted in a major increase in IPTp-coverage, with two thirds of women at delivery having received more than two doses of SP. The proportion of women having received at least 2 doses was significantly higher in the arm with the promotion (70\%) compared to the arm without (49\%) (p = 0.014).\textsuperscript{200}

**Easy-to-read pictorial images in addition to health worker educational messages can be effective in increasing dosing compliance for malaria in the settings where illiteracy is high.** A comparative study in Nigeria examined a group of patients who received chloroquine syrup only, a second group that received the syrup with provider’s verbal instruction and a third group that received the chloroquine syrup with both provider’s verbal instruction and a pictorial insert.
explaining the doses. Results showed the latter had the highest level of compliance to the medication regimen. There was a significant correlation (p < 0.001) between full compliance, improvement and time for improvement of the condition. The pictorial insert was sufficient to explain dosing to patients with limited primary education who may not understand use of age or weight in drug dispensing.
Interventions that have sought to promote care-seeking and use of health services such as antenatal clinics to enable families to prevent or interrupt childhood illnesses and make better health decisions

*Improving referral advice in the community can be a powerful complement to other malaria case management strategies.* A Tanzanian study compared the clinical course of illness and time taken to reach a hospital from a concurrently conducted study that emphasized rapid referral to a group of pediatric patients admitted to the same hospital whose parents followed routine behavior. The intervention group had a pre-referral treatment of rectal artesunate and received messages from health professionals that stressed the importance of rapid referral. The most relevant findings were that parents of sick children from the intervention study transferred their children to the hospital following the advice they were given, but only somewhat faster than the control group. Overall there was about a day’s delay between the two groups in the average time to reach hospital (18 h vs. 51 h, P<0.0001). Among those patients who were admitted after 6 hours the delay averaged 53 h: 82 h in pediatric patients versus 29 h in patients from the intervention study (P<0.0001).

*Addressing barriers to compliance should be a central focus of communication interventions.* Strategies for an intervention tested in Malawi evolved from community-based formative research undertaken to learn about the local concepts of malaria and issues surrounding malaria prevention and treatment during pregnancy. The formative research found that many women complained about the taste of chloroquine, therefore the intervention compared distributing a sugar-coated chloroquine tablet, changing the health education message during antenatal sessions, and a combining the two strategies. The change in use of chloroquine, from the baseline percentages in weeks one and two, was 64% when the product was changed and 45% when the health education message was improved. The results provide evidence for the importance of formative research to understand the barriers and limitations that prohibit or discourage women to comply with chloroquine dosing. It also suggests that combining health messages and adapting the product had more effect on chloroquine use.

In Cameroon, a study examined the impact of a national communications campaign to ensure bednets delivered to the households through mass distribution campaign were used consistently showed that the exposure Ko Palu NightWatch campaign was associated with a 6.6 percentage point increase in last-night net use among respondents (65.7% vs 59.1%, p<0.05) and a 12.0 percentage point increase in last-night net use among respondents’ children under five years (79.6% vs 67.6%, p<0.025).

*Intervention that have addressed policy and community norms—focusing on political will, policy development, and resource allocation behavior*

*Changes in malaria drug policies must be accompanied by adequate drug supply plans.* Between 2004 and 2008 the ACCESS program in Tanzania implemented a social marketing...
campaign for improved treatment-seeking for malaria. Increases were seen in understanding of malaria, facility attendance as first treatment for patients older than eight and more timely use of antimalarials. However, the change of treatment policy during the study led to low availability of ALu in the private sector, the first line treatment of malaria, and this seems to have led to a drop in the proportion of patients taking a recommended malaria treatment (85% to 53%).

Recommendations

Of the twenty-eight malaria articles that met the ERT relevance and quality review criteria for inclusion in the analysis—there were limited (12 studies) that fit the criteria for evidence on the impact of different behavior change interventions. Nonetheless, these studies show strong evidence that supports the use of communication interventions to improve early treatment, net use, referrals and intermittent treatment during pregnancy. The most evidence gathered introduced a variety of methods that used interpersonal communication from health professionals, trained local health workers, or mothers who promote the use of antimalarials and prevention techniques. These individuals tend to be trusted sources by the community and are often trained or informally receive messages from a health professional to encourage the desired behaviors—i.e. compliance to dosing, IPTp, prompt treatment, etc. These interventions have been used across Africa and the evidence suggests that they are effective in different setting. Adapting them using formative research would most likely increase their efficacy, for example adding visual images as the one study did in Nigeria. Also observed in the evidence is the effect that formal trainings, including follow-ups using text messages, can have on health professionals performance and compliance to national guidelines. Trainings and educational interventions are being conducted and should include a follow-up component as well as a evaluations that assess the behavior changes that occur after these trainings.

Conclusion and Recommendations

Donna Barry

Recommendations for policy and practice

Each topic area (pneumonia/diarrhea, neonatal survival, nutrition, PMTCT, malaria, healthy pregnancies, and immunizations) contained specific and some contained general recommendations. We compiled here the recommendations from all topic areas and developed generalized ones related to health systems and policies.

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Recommendation 1: Primary care systems organized to provide services at different levels of complexity, with free or low cost access, a strong community component, education, technical support for CHWs (volunteer or paid) and triaging systems to detect and transfer higher-risk cases to a health center of higher complexity, have shown to be effective in increasing antenatal care, immunization rates, postnatal birth control, and malnutrition.

Recommendation 2: Systematic quality management has important effects at district, facility and community levels using more holistic models of health systems support.

Recommendation 3: Interpersonal communication from health professionals, trained local health workers, or mothers who promote the use of treatments (e.g., antimalarials) and prevention techniques. These individuals tend to be trusted sources by the community and are often trained or informally receive messages from a health professional to encourage the desired behaviors.

Recommendation 4: Integrate and/or link services to improve referral and use.

Recommendation 5: Formal trainings, including follow-ups using text messages, can have strong impacts on health professionals performance and compliance with national guidelines.

Recommendation 6: Training personnel to apply evidence-based protocols to improve health care delivery has been shown to produce a strong impact on neonatal survival and health.

Recommendation 7: Trainings and educational interventions are being conducted and should include a follow-up component as well as evaluations that assess the behavior changes that occur after these trainings.

Recommendation 8: Focusing on social networks, community leaders, multiple levels of community stakeholders, collective behaviors, and social norms.


Recommendation 10: Strong health systems with good data collection also incorporate robust monitoring and evaluation activities that track population-level needs, detect services that are ineffective, and identify implementation concerns.

Recommendations for Research

- Most evidence is for particular interventions, with scant description of the health systems and policy supports required, let alone their “sustainability”. This may require translating evidence based interventions into constituent health systems supports and required policies, using a
health systems model such as the WHO Building Blocks, or another conceptual or theory-of-change model.

- Health Systems supports and policies required for population behavior change are poorly characterized in research papers.
- There’s a need to evaluate national programs based on behavior change outcomes, and not just knowledge based outcomes.
- Further research is needed in other areas such as assessing and preventing adverse effects of micronutrient supplementation, the intersection between under-nutrition and over-nutrition, specific interventions to promote healthy timing and spacing of pregnancies.

Acknowledgements: Alfonso Contreras, Michael Manske, Helia Molina

10 Philbrick WC (2012) mHealth and MNCH: State of the Evidence. mHealth Alliance.


22 Ibid.


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Effects of Psychosocial Stimulation on Growth and Development of Severely Malnourished Children in a Nutrition Unit in Bangladesh.


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84 Executive Summary of *The Lancet* Childhood Pneumonia and Diarrhoea Series (2013)


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Cunliffe N et al., Efficacy of human rotavirus vaccine RIX4414 in Africa during the first year of life, 26th Meeting of ESPID, Brussels, Belgium, 9-13 June 2009.


The **GAVI Alliance** (formerly the “Global Alliance for Vaccines and Immunisation”) is a public-private global health partnership committed to saving children’s lives and protecting people’s health by increasing access to immunisation in poor countries. The Alliance brings together developing country and donor governments, the World Health Organisation, UNICEF, the World Bank, the vaccine industry in both industrialised and developing countries, research and technical agencies, civil society, the Bill and Melinda Gates Foundation and other private philanthropists. As a public-private partnership, GAVI represents the sum of its partners’ individual strengths, from WHO’s scientific expertise and UNICEF’s procurement system to the financial know-how of the World Bank and the market knowledge of the vaccine industry. [http://en.wikipedia.org/wiki/GAVI_Alliance](http://en.wikipedia.org/wiki/GAVI_Alliance), [http://www.gavi.alliance.org](http://www.gavi.alliance.org)

These barriers, all of which have a behavior change component, include: the underlying weakness (including a lack of service integration) of health systems in many developing countries; difficulties in procuring and delivering vaccines through an infrastructure and logistical support system that is often overloaded; a lack of understanding about the importance of vaccines – amongst some populations and providers; and, public concerns (“hesitancies”) about vaccine safety often shaped by false or unsubstantiated rumors.

The Expanded Programme on Immunization (EPI) was established in 1974 through a World Health Assembly resolution (resolution WHA27.57) to build on the success of the global smallpox eradication programme, and to ensure that all children in all countries benefited from life-saving vaccines. The first diseases targeted by the EPI were diphtheria, whooping cough, tetanus, measles, poliomyelitis and tuberculosis. Coverage of vaccines that have been in use since the inception of the Expanded Programme on Immunization (EPI) has expanded, and new vaccines have been introduced. Vaccines against hepatitis B and Haemophilus influenzae type b have become part of national immunization schedules in 179 and 173 countries, respectively.


**Global Immunization Vision and Strategy 2006-2015** or GIVS describes strategies and key activities for countries to consider in developing policies for immunization and planning their national immunization programmes.

Including the United Nations Millennium Declaration, the United Nations World Summit for Children, the United Nations General Assembly Special Session on Children, and, more recently, the United Nations Secretary-General’s Global Strategy for Women’s and Children’s Health. All have stimulated expansion of national immunization programmes.


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165 The GAVI alliance has created a number of financial mechanisms to further support global and national investments. The international Finance Facility for Immunisation; the Advanced Market Commitment; and the GAVI Matching Fund. - see http://www.gavialliance.org/about/gavis-business-model/securing-predictable-financing/

166 Financing from domestic budgets allocated to immunisation programmes has risen over the past decade, as has the flow of international resources dedicated to immunization. According to the immunization programme data for 2012 154 of the 193 WHO Member States report having a specific budget line item for immunization, and 147 have developed multi-year national plans to sustain the gains achieved.( ref)


Volume 86, Number 3, March 2008, 161-240

168 For evaluation data see http://www.who.int/imci-mce/

169 IMCI encourages the use of evidence-based guidelines for identifying and treating the leading causes of child deaths (e.g., pneumonia, diarrhea, and malaria) in first-level health facilities that lack sophisticated diagnostic equipment and treatments. WHO recommends implementing the guidelines through an 11-day in-service training course, a follow-up visit to health workers’ facilities in 4 to 6 weeks to reinforce new practices, and job aids (a flipchart and wall chart of clinical algorithms, a pictorial counseling guide, and a 1-page form for recording a patient’s assessments, illness classifications, and treatments).


174 BMJ Editorial .Brazil’s Family Health Programme BMJ 2010; 341 doi: http://dx.doi.org/10.1136/bmj.c4945


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Compliance to correct dose of chloroquine in uncomplicated malaria correlates with improvement in the condition of rural Nigerian children. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 95(3), 320-324.


