

HOW EFFECTIVE ARE COMMUNITY HEALTH WORKERS?

*An Overview of Current Evidence with Recommendations
for Strengthening Community Health Worker Programs to
Accelerate Progress in Achieving the Health-related
Millennium Development Goals*

September 2012

Henry Perry and Rose Zulliger

Departments of International Health and Health, Behavior and Society
Johns Hopkins Bloomberg School of Public Health



JOHNS HOPKINS
BLOOMBERG
SCHOOL of PUBLIC HEALTH

Protecting Health, Saving Lives—*Millions at a Time*

Acknowledgements

Funding of this work was provided by the Millennium Development Goal (MDG) Health Alliance (see <http://www.mdgha.org/>). We are grateful for the assistance of Sara Ju, master's student in the Department of International Health at the Johns Hopkins Bloomberg School of Public Health, for her assistance in collecting information used in this review and in editing this document. We are also grateful for the assistance of Ingrid Friberg, Assistant Scientist in the Department of International Health, with the LiST calculations.

Table of Contents

Introduction.....	1
Methodology	2
The Potential Contribution of Community Health Workers towards Achieving the Millennium Development Goals for Health.....	2
The Cost-Effectiveness of Community Health Worker Programs	9
Drivers of Community Health Worker Program Performance	10
Conclusions.....	11
Recommendations.....	12
References	13

Glossary

AIDS	Acquired immune-deficiency syndrome
BRAC	Building Resources across Communities (formerly Bangladesh Rural Advancement Committee)
CDI	Community-directed intervention
CHW	Community health worker
CMAM	Community-based management of severe acute malnutrition
DALY	Disability-adjusted life year
DOTS	Directly observed therapy, short course (for tuberculosis)
HIV	Human immunodeficiency virus
LiST	Lives Saved Tool
MDG	Millennium Development Goal
NGO	Non-governmental organization
ORS	Oral rehydration solution
RUTF	Ready-to-use therapeutic food
TB	Tuberculosis
TTBA	Trained traditional birth attendant
UNICEF	United Nations Children’s Fund
WHO	World Health Organization

Introduction

In 2000, the Millennium Development Goals (MDGs) were adopted by the United Nations for the purpose of focusing global efforts on challenging but achievable development targets, including the following goals for health and nutrition:¹

- Goal 1, “Eradicate Extreme Poverty and Hunger,” calls for halving the proportion of people who suffer from hunger between 1990 and 2015.
- Goal 4, “Reduce Child Mortality,” calls for reducing the under-five mortality rate by two-thirds, between 1990 and 2015.
- Goal 5, “Improve Maternal Health,” calls for reducing by the maternal mortality ratio by three fourths between 1990 and 2015.
- Goal 6, “Combat HIV/AIDS, Malaria and Other Diseases,” calls for halting and beginning to reverse the spread of HIV/AIDS by 2015; achieving by 2010 universal access to treatment for HIV/AIDS for all who need it; and halting by 2015 and beginning to reverse the incidence of malaria and other major diseases.

In spite of considerable progress in many countries in achieving the Millennium Development Goals (MDGs) for health and nutrition, progress is inadequate, stalled, or even worsening in a number of countries, particularly in Africa.^{2,3} Community Health Workers (CHWs) are now recognized by the World Health Organization and the Global Health Workforce Alliance as an integral component of the health workforce needed for the progression of health-related MDGs.⁴

CHWs are community members who provide health-related services in their communities. These workers are primarily based outside of fixed health facilities, but have some formal but limited training provided by the health system or health program which sponsors their work. Their training may be only a few days or as much as 6 months or more. They do not, however, receive any formal professional or paraprofessional certificate or tertiary education degree. They may receive a salary, receive some kind of incentive, or work entirely on a voluntary basis.

The purpose of this document is to review the effectiveness of CHWs and CHW programs in achieving the health-related MDGs, to examine the important determinants of CHW program effectiveness, and to make recommendations for how CHW programs can assist in accelerating progress towards achieving the health-related MDGs.

Methodology

We have reviewed the recent published evidence from the scientific literature regarding the effectiveness of community health workers (CHWs), including trained traditional birth attendants (TBAs) and community-based midwives, in providing effective interventions at the community level. We specifically document evidence on CHW services related to improving nutritional status, reducing maternal and child mortality, and controlling the transmission of HIV, tuberculosis (TB) and malaria. We have also documented evidence related to CHW program performance and CHW cost-effectiveness. When possible, we have cited the findings from recent relevant literature reviews. Our findings and recommendations arise from this literature review as well as from expert opinion and recent conferences about CHWs held in 2012.

The Potential Contribution of Community Health Workers towards Achieving the Millennium Development Goals for Health

Field research has now demonstrated that the programs using CHWs can make important contributions to improving health- and nutrition-related behaviors, increasing utilization of key preventive and curative health services, and diagnosing and treating serious illnesses at the community level, all with beneficial effects on population health. Here, we review the effectiveness of CHW programs in achieving health- and nutrition-related MDGs.

Effectiveness of CHWs in Improving Childhood Nutrition and Reducing Under-Five Mortality

a. Improving Childhood Nutrition

One out of every four children in developing countries is undernourished⁵ and approximately one-third of under-five mortality can be attributed to undernutrition.⁶ Moreover, the effects of undernutrition on long-term physical and mental development of children have been well-documented.⁷ The contribution that CHWs have made or can make to the effectiveness of nutrition programs depends not only on the CHW program but on the efficacy of the nutritional interventions used by the CHW program. We will review some of the notable recent research in this area, with particular reference to the contributions made by CHWs.

Exclusive breastfeeding during the first six months of life is recommended by the World Health Organization for optimal nutritional and health outcomes, most notably for the prevention of diarrhea.⁸ At present, only 25% of infants in low- and middle-income countries are exclusively breastfed during their first six months of life,⁶ and the extension of this approach to all newborns is vital to reducing under-five mortality. According to one estimate, 13% of under-five deaths could be prevented by the universal practice of exclusive breastfeeding

during the first six months of life – more than could be achieved by universal coverage of any other single intervention.⁹ The promotion of exclusive breastfeeding by CHWs through community-based interventions has been shown to be highly effective: a recent systematic review concluded that the odds ratio (a measure of intervention effectiveness) is 5.6 meaning that the odds of exclusively breastfeeding is 5.6 times greater for women counseled by CHWs than for women who were not.¹⁰ The effectiveness of CHWs in promoting appropriate feeding after six months of age, as measured by improvements in anthropometric measures, is minimal at best according to current evidence.⁷

Studies have demonstrated that CHWs can identify moderately or severely malnourished children in communities and help their mothers improve the nutritional status of their children through appreciative inquiry regarding how “positive deviants” (mothers in the same environment with well-nourished children) feed and care for their children.^{11, 12} The results indicate positive outcomes in terms of nutritional rehabilitation, but higher-quality studies in large-scale programs are needed.¹¹

Community-based management of severe acute malnutrition (CMAM) involves the provision of ready-to-use therapeutic foods (RUTF) in the community and providing inpatient care for children with complications. CMAM requires community mobilization and supplementary feeding programs. CHWs play an important role in organizing and administering this program. CMAM provides an alternative to the previous standard of inpatient care. The success rate for rehabilitation of children with CMAM is comparable to that for children who undergo hospitalized care, but the CMAM approach has made it possible to reach a much larger number of malnourished children – five times that reached through inpatient programs – for the same cost.¹³

Micronutrient deficiencies in children, most notably due to a lack of vitamin A and zinc, are responsible for an estimated 10% of the global burden of disease in children.⁷ The role of CHWs in distributing supplements to eliminate these micronutrient deficiencies is critical. The most recent meta-analysis of the effect of vitamin A supplementation on child mortality concluded that vitamin A supplementation reduces the risk of death by 23% in geographic areas where there is clinical evidence of vitamin A deficiency.¹⁴ Evidence is also becoming stronger that daily zinc supplementation for children leads to improved growth and reduced mortality from diarrhea and pneumonia: the effect size on growth is 0.13-0.19 and leads to a net gain of 0.37 cm, and there is a reduction in diarrheal mortality of 13% and pneumonia mortality of 15%.^{15, 16} Recommendations for its widespread promotion in developing countries with high levels of under-five mortality are foreseen, and CHWs are critical to the distribution of these supplements.

The regular home-based distribution of micronutrients to pregnant women, principally iron and folate, by CHWs has been associated with favorable results for birth weight and mortality in neonates and pre-term infants: intrauterine growth restriction is reduced by 14%.⁷

These micronutrients can be provided to patients at health facilities or at drug shops, but when CHWs provide them through routine periodic contact with families, the coverage rate is much higher.

b. Preventing and Treating Serious Childhood Illness

Pneumonia is the leading single cause of under-five mortality globally, accounting for 15% of the 7.6 million deaths that are occurring annually.¹⁷ The effectiveness of CHWs in diagnosing and treating childhood pneumonia is well-established: a meta-analysis of seven published studies from Bangladesh, India, Nepal, Pakistan, the Philippines, and Tanzania demonstrate a reduction in total mortality of 24% and a reduction in pneumonia-specific mortality of 36% in under-five children.¹⁸ WHO and UNICEF now recommend that appropriately trained and supervised CHWs provide community case management of pneumonia.¹⁹

Diarrhea is the second single leading cause of under-five mortality, accounting for 15% of deaths.¹⁷ Based on the experience and rigorous evaluations of numerous child survival programs carried out by Ministries of Health and NGOs in which CHWs counsel mothers about oral rehydration solution (ORS), their effectiveness in the prevention, diagnosis and treatment of diarrhea is well-established. There is also strong evidence for the addition of daily oral zinc with ORS, which is now recommended by WHO and UNICEF.²⁰

Malaria is the cause of 8% of under-five deaths globally and 16% of under-five deaths in Africa.¹⁷ CHWs are instrumental in interventions that reduce the transmission of malaria and treat malaria cases. They can distribute and promote the use of insecticide-treated bed nets, provide intermittent preventive therapy to pregnant women, infants and children, accurately diagnose malaria using rapid diagnostic tests, treat children with antibiotics, and instruct mothers on proper diagnosis and treatment techniques for malaria.^{21, 22, 23, 24, 25} For instance, studies have demonstrated that management of childhood malaria by CHWs reduces overall under-five mortality by 40% and malaria-specific under-five mortality by 60%.^{22, 26}

Neonatal deaths account for 41% of under-five mortality globally. Pre-term birth complications account for 12% of under-five mortality, birth asphyxia 9%, and infections 7%.¹⁷ A package of interventions provided by CHWs for home deliveries has been developed and shown to be effective in reducing neonatal mortality. A recent systematic review and meta-analysis of eight studies from Bangladesh, India, Nepal and Pakistan concluded that neonatal mortality is reduced by 24% with the implementation of this package of CHW services.²⁷ The interventions include home visits to educate expectant and post-partum mothers about good nutrition, danger signs of complications during pregnancy and childbirth, cleanliness during delivery and care of the newborn (including airway management, hypothermia prevention, immediate and exclusive breastfeeding, and umbilical cord care). Home visits also include facilitating home deliveries and monitoring newborns for signs of neonatal infection and for antibiotic treatment and referral, if necessary.

c. Promoting and Providing Immunizations

The widespread use of vaccines is responsible for prevention of 2.5 million deaths of children globally. Currently, vaccine-preventable diseases cause only 4% of under-five deaths (mostly from measles, pertussis and tetanus).^{17, 28} Maintenance and expansion of coverage of the standard immunizations for mothers and children against TB, polio, pertussis, diphtheria and measles are of critical importance for preventing a resurgence of deaths and disability due to these conditions. Furthermore, since new and effective vaccines against meningitis, pneumonia and diarrhea are being introduced in low-income settings, sustained high immunization coverage among mothers and children will be essential to further reduce under-five mortality. Even with currently available vaccines, including those for pneumococcal disease (a cause of childhood pneumonia), rotavirus (a cause of diarrhea), and hemophilus influenza (a cause of pneumonia and meningitis), an additional 1.5 million deaths of children could be prevented if all children received routine immunizations.²⁹ CHWs are effective at promoting immunization utilization, identifying children who have need immunizations, expanding immunization coverage, and providing immunizations.^{30, 31}

When CHWs provide various combinations of these interventions together, often along with other types of primary health care services, reductions in under-five mortality have been achieved. Impressive impacts on under-five mortality have been reported by using CHWs to reach every child with a basic package of services provide several days a year (Child Health Days),³² in the diagnosis and treatment of a variety of childhood illnesses,³³ in promoting appropriate behaviors by meeting with women's groups^{34, 35} and by being part of a team that provides integrated, comprehensive primary care.³⁶⁻⁴⁰

Using a technique called the Lives Saved Tool (LiST)⁴¹ and assuming that the mortality impact of interventions that CHWs can provide (based on the most recent scientific evidence) is maintained as interventions are scaled up, we have estimated that if CHW interventions are expanded to 100% coverage in the 73 highest-burden countries globally, 3.6 million under-five deaths could be averted – almost half (47%) of the under-five deaths occurring at present.

Effectiveness of CHWs in Reducing Maternal Mortality

At present, there are approximately 270,000 women dying of pregnancy-related causes each year.⁴² Prevention of unwanted pregnancies is one of the four pillars of prevention of maternal mortality. An estimated 215 million women who want to avoid pregnancy are not using an effective method of contraception, 40% of pregnancies that occur in developing countries are unintended, and 82% of women in developing countries with an unintended pregnancy had an unmet need for contraception.⁴³ Without the current use of modern methods of contraception, the number of maternal deaths would have been almost twice as great; conversely, if the unmet need for contraception were fully met, maternal deaths would further decline by 29%.⁴⁴

59% of births in the least developed countries and 60 million births worldwide occur at home.⁴⁵ Although CHWs (including TTBAAs) are not trained to manage obstetrical complications, the early recognition and referral of these complications are essential for safe home deliveries. The promotion of clean deliveries at home is also key. One randomized controlled trial from rural Pakistan has demonstrated a reduction in perinatal and maternal mortality through training and support of TTBAAs.⁴⁶ However, there are few other studies of sufficient quality to draw strong conclusions.

In addition to delivery care, CHWs can provide antenatal and postnatal care. They can reduce the risk of post-partum hemorrhage and subsequent maternal mortality with the provision of oral misoprostol for mothers to take immediately after the delivery to promote uterine contraction.^{47, 48}

CHWs also have a long and distinguished history of promoting family planning through home visits, distributing oral birth control pills and condoms, and referring women for longer-term methods provided at facilities.⁴⁹ More recently, they have been able to effectively provide women with injectable contraceptives which only need to be provided at three-month intervals at home or nearby.⁵⁰ Of course, the benefits of family planning extend far beyond reducing the risk of maternal mortality to virtually all of the other MDGs. Birth spacing reduces under-five mortality, improves child nutrition (by virtue of having fewer children to care for), facilitates women's empowerment and education (due to greater control they have over their lives), and reduces environment degradation by slowing population growth.^{51, 52} Furthermore, family planning reduces HIV transmission by reducing the number of pregnancies in HIV-infected women.

Effectiveness of CHWs in Reducing the Transmission of HIV

In 2010, there were 2.7 million new HIV infections, 34 million people living with HIV infections, and 1.8 million AIDS-related deaths. Less than half of those needing treatment, including HIV-positive pregnant women, were receiving treatment.⁵³

CHWs working outside of facilities have played a relatively limited role in HIV prevention and treatment since most programs have been facility-based.^a However, from the beginning, CHWs have played a role in promoting of AIDS-related educational messages, providing supportive care of AIDS patients, and assisting with clinic services. More recently, CHWs are carrying out voluntary counseling and testing and provision of directly observed treatment in the community outside of facilities has been reported. The limited evidence to date indicates that CHWs can effectively perform all of these roles and expand coverage of services when properly trained, supervised and supported.⁵⁴ However, we are not aware of any studies

^a Lower-level workers have played an important role in many facility-based programs by assisting with testing, counseling and supporting patient adherence to treatment. While these are commonly referred to as CHWs, they do not fit the definition we have established for this review.

comparing programs with and without CHWs and measuring whether their introduction into programs reduces HIV transmission.

Effectiveness of CHWs in Reducing the Transmission of Tuberculosis

Tuberculosis (TB) is second to HIV as the leading cause of death globally from a single infectious agent. In 2010, 8.8 million people developed clinical illness from TB and 1.4 million died. Reducing transmission requires early case detection since patients with active disease can infect as many as 10-15 other people over the course of a year. It also requires ensuring that patients complete their entire course of therapy so that a cure is achieved and so that patients do not develop drug-resistant TB.⁵⁵

CHWs have played a central role in TB programs globally, particularly in community-based Directly Observed Therapy, Short-Course (DOTS). CHWs have been employed to detect symptomatic patients and facilitate sputum collection in homes, to ensure treatment compliance, and to assist in the treatment of patients in health clinics. Compared to facility-based services, involvement of CHWs in community-based programs for early case detection, treatment compliance and facilitation of DOTS can substantially increase treatment completion rates, provide convenient access to care and reduce costs to patients and their families.⁵⁶⁻⁵⁸

Effectiveness of CHWs in Reducing the Transmission of Malaria

There were an estimated 216 million cases of malaria in 2010 and 655,000 deaths, mostly among African children.⁵⁹ As we mentioned earlier, CHWs can effectively provide a range of malaria control interventions that are directed not only at mothers and children but for all age groups. There is some modest evidence that malaria programs utilizing CHWs can reduce the transmission and prevalence of malaria.⁶⁰

Effectiveness of CHWs in Addressing Multiple MDGs

Certain CHW programs have simultaneously addressed multiple MDGs such as Community-based family planning services provided by CHWs, as mentioned earlier. Integrated health programs that rely on CHWs to provide a broad array of health services are engaged in maternal and child health activities as well as disease-control activities for HIV, TB and malaria, where appropriate. Among the integrated comprehensive programs mentioned earlier that had documented impact on under-five mortality, one of them (the Jamkhed Comprehensive Rural Health Care Project) has documented impressive gains in reducing maternal mortality as well as TB prevalence.^{61, 62} The African Program on Onchocerciasis Control has been engaged with CHWs in distributing medication (ivermectin) to 75 million Africans in remote and isolated locations through a community empowerment process involving CHWs called community-directed interventions (CDI). Recent reports indicate that the CDI process can be expanded to include interventions for child health (vitamin A supplementation), malaria (distribution of

insecticide-treated bed nets), and TB (provision of DOTS) without compromising the effectiveness of the ivermectin distribution program.⁶³⁻⁶⁵

National Examples of CHW Contributions to Progress in Achieving MDGs

Among the various countries with national CHW programs, there are three in particular that have made remarkable progress in achieving the MDGs for health and in which the contributions of CHWs have been well-documented. These are Brazil, Bangladesh, and Nepal. All three are on track to achieve the MDGs for mothers and children. In Brazil, CHWs have been expanded over the past three decades and work as members of health teams providing services for populations of about 1,000 families within a defined geographic area. Brazil now has 222,280 CHWs, each of whom regularly visits on average 150 families per month and the program reaches 110 million people.⁶⁶ Brazil has one of the most rapidly declining under-five mortality rates in the world (and in fact it achieved its MDG target for child mortality in 2010, five years ahead of schedule). Now, only 2% of children are underweight, immunization coverage is 99%, 91% of women obtain four or more prenatal visits, 93% of the demand for family planning has been met, 90% of eligible women receive treatment to prevent mother-to-child transmission of HIV, 88% of cases of TB are estimated to be detected, drinking water coverage and improved sanitation coverage are 98% and 96% respectively, and 95% of AIDS patients in need of medication are receiving it.^{2, 67} Other countries, including South Africa, are now establishing CHW programs based on the Brazil model.

Bangladesh has one of the most vibrant NGO sectors in the world, many of whom operate CHW programs. One NGO, BRAC, has the largest private sector CHW program in the world, with over 80,000 workers. They provide comprehensive community-based maternal and child health and family planning services, they collect sputum specimens at home from persons with symptoms suggestive of TB, they observe the daily treatment of TB patients, and they carry out other activities.^{68, 69} In addition, the government has a strong cadre of approximately 50,000 CHWs who provide family planning services, immunizations, and other basic health care.⁶⁸ Bangladesh also reached its target for child mortality five years ahead of schedule, although its levels of coverage of key services are still not as impressive as Brazil's, where there are more resources to support health programs.² Its case detection rate for TB has doubled since 1993.⁷⁰ CHWs are widely seen as one of the major components of Bangladesh's remarkable progress in maternal and child health, fertility reduction, and control of TB. HIV and malaria are not major contributors to disease burden there.

Nepal is one of the least likely countries to be a leader in improving the health conditions of its people, given its mountainous terrain, the remote location of much its population, and the history of political instability in the past two decades. Female Community Health Volunteers (FCHVs) are widely seen as one of the most important contributors to Nepal having one of the fastest rates of decline of under-five mortality rates in the world and to

achieving its MDGs for child and maternal health in 2010. FCHVs first gained widespread recognition for achieving high levels of coverage of vitamin A distribution. Now, with only 18 days of training, they provide family planning, diagnose and treat child illnesses (including childhood pneumonia), distribute misoprostol to pregnant women who plan to deliver at home, and provide home-based neonatal care.

The Cost-Effectiveness of Community Health Worker Programs

Given the importance of CHW programs for improving the health of populations, studies focused specifically on an analysis of the cost-effectiveness of CHW programs themselves have been surprisingly few.⁷¹ The methodological challenges for carrying out this type of research are daunting, partly because measuring the health impact of programs is in and of itself a challenge, not to mention gathering all the appropriate cost information. Consequently, most of the available evidence comes from cost-effectiveness studies of specific interventions that CHWs have implemented. The metrics used to assess cost-effectiveness are most commonly cost per death averted, cost per life-year gained, or cost per DALY (disability-adjusted life year) averted.

Most studies that have been reported have assessed the cost-effectiveness of specific interventions provided in the community by CHWs, particularly for reducing child mortality. However, there are studies assessing combined CHW-provided interventions as part of more comprehensive services. Studies are now appearing concerning the cost-effectiveness of CHWs for TB programs. With rare exception, the studies available to date all indicate that interventions implemented by CHWs are highly cost-effective by international standards. It is rarely possible to compare the cost-effectiveness of CHW programs with facility-based programs because there is rarely any evidence regarding the effectiveness of facility-based programs in improving health. In most studies, the cost per DALY averted is \$1 to \$110 for specific interventions and \$43 to \$93 for programs providing multiple interventions.^b For example, a number of community-based interventions provided by CHWs for maternal and neonatal health in developing countries have incremental cost effectiveness ratios in the range of less than \$50 per DALY averted.⁷² These are among the most cost-effective health interventions and programs that are known at present.⁷³

Given available estimates of cost effectiveness of family planning, maternal health, and neonatal care interventions which include community-based services provided by CHWs, the Guttmacher Institute has estimated that doubling current investments for reproductive, maternal and neonatal programs to \$24.6 billion annually would save the lives of 1.7 million newborns and 251,000 women annually – approximately \$12,000 for each life saved.⁴³ The

^b The expanded version of this report provides additional detail and references on cost-effectiveness calculations.

analysis does not specify the costs of CHWs in particular, but their presence is fundamental to being able to achieve these benefits.

But perhaps the most important insight into the cost-effectiveness of CHW programs is that the reality, at least for near future, is that the alternative to CHW programs is no care for the poor, particularly those living in geographically remote areas. Thus, Lehmann and Sanders, in their 2007 review of CHW programs for the World Health Organization, came to the following conclusion:

Given present pressures on health systems and their proven inability to respond adequately, the existing evidence overwhelmingly suggests that particularly in poor countries CHW programmes are not cheap or easy but they are nonetheless a good investment....[p. 27]⁷⁴

Drivers of Community Health Worker Program Performance

Research on the performance of individual CHWs and on the performance of large-scale CHW programs remains quite limited, and recommendations are often based more on expert opinion and experience than on solid research. Even when solid research has been conducted, it is often on small-scale programs or projects, many of which are carried out by NGOs. Unfortunately, examples exist where CHWs were selected inappropriately, where the community was not engaged in CHW selection, training and support, where CHWs had unclear roles and expectations and the community did not clearly understand the CHW's role. There are also examples where the behavior of CHWs was inappropriate, and where the community needs and ideas were disregarded or not taken into account in program development. Local political conflicts and social tensions can further affect CHW performance, and local elites can have an unfavorable influence. Feedback and rewards provided by communities have a strong influence on CHW performance. A general consensus arising from current reviews⁷⁴⁻⁷⁹ and discussions among persons with considerable experience with CHW programs⁸⁰⁻⁸³ is that the following principles should be adhered to in order for CHW programs to function as effectively as possible:

1. Countries need a comprehensive policy framework that is supportive of CHW programs, ensures adequate financial support, enables them to deliver interventions proven to be effective and recommended by or endorsed by the World Health Organization, and that ensures that CHWs who are diagnosing and treating patients or performing potentially dangerous or unsafe procedures (such as giving injections) are doing so with proper training and supervision.

2. Communities need to be partners in CHW programs, with the opportunity to participate in their design, in the selection of CHWs, and in providing oversight to CHW performance at the community level.
3. CHW programs need long-term stable financial support from governments at various levels, from the national to the local level.
4. CHW role descriptions need to be well-designed and clearly defined job descriptions should exist.
5. Numbers of CHWs should be adequate to achieve sufficient programmatic coverage in the population.
6. Appropriate pre-service education and continuing in-service education should be provided to CHWs.
7. CHWs need effective linkages with the formal health system for supervision, continuing education, receipt of supplies and medicines, and referral of patients.
8. CHWs need supportive supervision and constructive feedback.
9. CHWs need adequate financial and non-financial incentives.
10. CHWs need to be properly equipped and supplied by logistical support systems.
11. CHWs need opportunities for professional growth and career advancement.
12. CHW programs need to receive systematic monitoring and evaluation, including periodic transparent independent evaluation. Operations research on CHW programs should be encouraged through research funding for investigators. National demographic and health surveys should begin to collect information on CHW functioning.
13. CHWs should be seen as a long-term and essential component of the health work force in low-income settings. Even after the epidemiologic transition has been completed and maternal and child health and infectious diseases are no longer priorities, CHWs will be needed for the prevention, detection and treatment of chronic conditions and for assistance in the care of the elderly.
14. Mobile health technology (mHealth) holds enormous potential for the training, supervision, continuing education, technical support for CHWs. It also holds potential for assistance with the process of patient referral and for strengthening community-based health information systems. Other technological advances such as the further development of cheap rapid diagnostic tests can improve the capacity of CHWs to provide diagnosis and treatment at the community level.

Conclusions

CHWs are the world's most promising health workforce resource for enabling health systems in resource-constrained settings to reduce the burden of disease from serious, readily preventable or treatable conditions. They are the most promising health workforce resource because there is an abundant supply of potential recruits, their effectiveness has now been

demonstrated, they can be trained in a relatively short period of time, and they are highly cost-effective, relative to similar services provided by higher-level staff based at facilities.

Furthermore, they are living with the people who need services, in contrast to higher-level health professionals who often do not come from or want to live in the areas where services are needed. Yet, in most low-income countries, CHWs are still seen by higher-level health staff and by society at large as second-class providers of second-class care. The potential of CHWs to make it possible for health systems to reach their full potential is not recognized.

The exact roles and responsibilities of CHWs will vary from country to country and from program to program within countries, and there is not now nor likely in the foreseeable future an international CHW standard or a uniform “generic” CHW to emerge. However, establishing clear national guidelines and regulations describing what training and certifications needed by CHWs who provide diagnosis and treatment will clearly be needed.

Recommendations

Governments, civil society (including NGOs), communities, international health organizations, technical organizations, and donors need to support the groundswell of support that is emerging to transform health systems. Doing so will enable CHWs to play a foundational role in reaching every household with essential services and providing a referral link to enable people to more readily and effectively access higher-level services within the health system. It is in everyone’s interest for large-scale CHW programs to work effectively. Thus, all stakeholders need to begin to actively support CHWs in their roles and help to address the short-comings in CHW program functioning and CHW performance. Political pressure needs to be brought to bear to ensure that policies and regulations are favorable to enable CHW programs to reach their full potential, and to ensure that funding for CHW programs is sustained and adequate to enable programs to function effectively, including providing high-quality training, supervision and logistical support. Monitoring and evaluation of CHWs and CHW programs are essential in order to identify shortcomings and make continued improvements in CHW programs. Independent and transparent evaluations will also be needed on a regular basis. Finally, health systems need to begin to look for ways to shift their expenditures toward the most cost-effective interventions and programs, which most certainly will include CHW programs to address the health-related MDGs.

References

1. United Nations. Resolution 55/2 adopted by the General Assembly: United Nations Millennium Declaration; 2000.
2. UNICEF, WHO. Countdown to 2015. Maternal, Newborn and Child Survival. Accountability for Maternal, Newborn and Child Survival: An Update on Progress in Priority Countries. Geneva: World Health Organization; 2012.
3. United Nations. The Millennium Development Goals Report 2011. 2011.
4. WHO, GHWFA. Global Consultation on Community Health Workers. Geneva: World Health Organization and Global Health Workforce Alliance; 2010.
5. WFP. Hunger Stats. 2012 [cited 23 July 2012]; Available from: <http://www.wfp.org/hunger/stats?gclid=COzjtLzmr7ECFchB4AodfVwAfw>
6. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*. 2008; **371**(9608): 243-60.
7. Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al. What works? Interventions for maternal and child undernutrition and survival. *Lancet*. 2008; **371**(9610): 417-40.
8. WHO. Exclusive Breastfeeding. 2012 [cited 1 September 2012]; Available from: http://www.who.int/nutrition/topics/exclusive_breastfeeding/en/
9. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS. How many child deaths can we prevent this year? *Lancet*. 2003; **362**(9377): 65-71.
10. Hall J. Effective community-based interventions to improve exclusive breast feeding at four to six months in low- and low-middle-income countries: a systematic review of randomised controlled trials. *Midwifery*. 2011; **27**(4): 497-502.
11. Wollinka O, Keeley E, Burkhalter RB, Bashir N, editors. The Hearth Nutrition Model: Applications in Haiti, Vietnam, and Bangladesh. Wheaton, IL, Arlington, VA: World Relief, BASICS; 1997.
12. Sternin M. Rapid, Sustained Childhood Malnutrition Alleviation through a Positive Deviance Approach in Rural Vietnam: Preliminary Findings. In: Wollinka O, Keeley E, Burkhalter RB, Bashir N, editors. The Hearth Nutrition Model: Applications in Haiti, Vietnam, and Bangladesh. Wheaton, IL, and Arlington, VA: World Relief and BASICS; 1997. p. 49-60.
13. Ahmed T, Ahmed AMS, Mahfuz M, Abdullah K, Cravioto A, Sack D. Systematic review of management of childhood severe malnutrition (Web Appendix 5). *Lancet*. 2008; **372**: 417-40.
14. Gogia S, Sachdev HPS. Review of vitamin A supplementation in pregnancy and childhood (Web Appendix 10). *Lancet*. 2008; **372**: 417-40.
15. Imdad A, Bhutta ZA. Effect of preventive zinc supplementation on linear growth in children under 5 years of age in developing countries: a meta-analysis of studies for input to the lives saved tool. *BMC Public Health*. 2011; **11 Suppl 3**: S22.
16. Yakoob MY, Theodoratou E, Jabeen A, Imdad A, Eisele TP, Ferguson J, et al. Preventive zinc supplementation in developing countries: impact on mortality and morbidity due to diarrhea, pneumonia and malaria. *BMC Public Health*. 2011; **11 Suppl 3**: S23.

17. Black RE, Cousens S, Johnson HL, Lawn JE, Rudan I, Bassani DG, et al. Global, regional, and national causes of child mortality in 2008: a systematic analysis. *Lancet*. 2010; **375**(9730): 1969-87.
18. Sazawal S, Black RE. Effect of pneumonia case management on mortality in neonates, infants, and preschool children: a meta-analysis of community-based trials. *Lancet Infect Dis*. 2003; **3**(9): 547-56.
19. World Health Organization, UNICEF. *Management of Pneumonia in Community Settings*. Geneva and New York City: World Health Organization and UNICEF; 2004.
20. WHO and UNICEF. *WHO/UNICEF Joint Statement: Clinical Management of Acute Diarrhoea*. New York and Geneva: World Health Organization and UNICEF; 2004.
21. Hopkins H, Talisuna A, Whitty CJ, Staedke SG. Impact of home-based management of malaria on health outcomes in Africa: a systematic review of the evidence. *Malar J*. 2007; **6**: 134.
22. Kidane G, Morrow RH. Teaching mothers to provide home treatment of malaria in Tigray, Ethiopia: a randomised trial. *Lancet*. 2000; **356**(9229): 550-5.
23. Tine RC, Faye B, Ndour CT, Ndiaye JL, Ndiaye M, Bassene C, et al. Impact of combining intermittent preventive treatment with home management of malaria in children less than 10 years in a rural area of Senegal: a cluster randomized trial. *Malar J*. 2011; **10**: 358.
24. Kweku M, Webster J, Adjuik M, Abudey S, Greenwood B, Chandramohan D. Options for the delivery of intermittent preventive treatment for malaria to children: a community randomised trial. *PLoS ONE*. 2009; **4**(9): e7256.
25. Mubi M, Janson A, Warsame M, Martensson A, Kallander K, Petzold MG, et al. Malaria rapid testing by community health workers is effective and safe for targeting malaria treatment: randomised cross-over trial in Tanzania. *PLoS ONE*. 2011; **6**(7): e19753.
26. Sirima SB, Konate A, Tiono AB, Convelbo N, Cousens S, Pagnoni F. Early treatment of childhood fevers with pre-packaged antimalarial drugs in the home reduces severe malaria morbidity in Burkina Faso. *Trop Med Int Health*. 2003; **8**(2): 133-9.
27. Lassi ZS, Haider BA, Bhutta ZA. Community-based intervention packages for reducing maternal and neonatal morbidity and mortality and improving neonatal outcomes. *Cochrane Database Syst Rev*. 2010; **11**: CD007754.
28. WHO, UNICEF, World Bank. *State of the World's Vaccines and Immunization*. Geneva: World Health Organization; 2009.
29. WHO. *Immunization Surveillance, Assessment and Monitoring: Vaccine-Preventable Diseases*. 2012 [cited 23 July 2012]; Available from: http://www.who.int/immunization_monitoring/diseases/en/
30. Pegurri E, Fox-Rushby JA, Damian W. The effects and costs of expanding the coverage of immunisation services in developing countries: a systematic literature review. *Vaccine*. 2005; **23**(13): 1624-35.
31. Ryman TK, Dietz V, Cairns KL. Too little but not too late: results of a literature review to improve routine immunization programs in developing countries. *BMC Health Serv Res*. 2008; **8**: 134.
32. Vijayaraghavan M, Wallace A, Mirza IR, Kamadjeu R, Nandy R, Durry E, et al. Economic evaluation of a Child Health Days strategy to deliver multiple maternal and child health interventions in Somalia. *J Infect Dis*. 2012; **205** Suppl 1: S134-40.

33. Christopher JB, Le May A, Lewin S, Ross DA. Thirty years after Alma-Ata: a systematic review of the impact of community health workers delivering curative interventions against malaria, pneumonia and diarrhoea on child mortality and morbidity in sub-Saharan Africa. *Human resources for health*. 2011; **9**(1): 27.
34. Edward A, Ernst P, Taylor C, Becker S, Mazive E, Perry H. Examining the evidence of under-five mortality reduction in a community-based programme in Gaza, Mozambique. *Trans R Soc Trop Med Hyg*. 2007; **101**(8): 814-22.
35. Perry H, Sivan O, Bowman G, Casazza L, Edward A, Hansen K, et al. Averting childhood deaths in resource-constrained settings through engagement with the community: an example from Cambodia. In: Gofin J, Gofin R, editors. *Essentials of Community Health*. Sudbury, MA: Jones and Bartlett.; 2010. p. 169-74.
36. Fauveau V, editor. *Matlab: Women, Children and Health*. Dhaka, Bangladesh: International Centre for Diarrhoeal Disease Research, Bangladesh; 1994.
37. Perry H, Berggren W, Berggren G, Dowell D, Menager H, Bottex E, et al. Long-term reductions in mortality among children under age 5 in rural Haiti: effects of a comprehensive health system in an impoverished setting. *Am J Public Health*. 2007; **97**(2): 240-6.
38. Arole M, Arole R. A comprehensive rural health project in Jamkhed (India). In: Newell KW, editor. *Health by the People*. Geneva, Switzerland: World Health Organization; 1975. p. 70-90.
39. Mann V, Eble A, Frost C, Premkumar R, Boone P. Retrospective comparative evaluation of the lasting impact of a community-based primary health care programme on under-5 mortality in villages around Jamkhed, India. *Bull World Health Organ*. 2010; **88**(10): 727-36.
40. Bang AT, Reddy HM, Deshmukh MD, Baitule SB, Bang RA. Neonatal and infant mortality in the ten years (1993 to 2003) of the Gadchiroli field trial: effect of home-based neonatal care. *J Perinatol*. 2005; **25 Suppl 1**: S92-107.
41. JHU Institute for International Health Programs. LiST: The Lives Saved Tool. 2012 [cited 18 April 2012]; Available from: <http://www.jhsph.edu/dept/ih/IIP/list/>
42. WHO, UNICEF, UNFPA, Bank W. *Trends in Maternal Mortality: 1990 to 2010*. Geneva: World Health Organization; 2012.
43. Guttmacher Institute. *Facts on Investing in Family Planning and Maternal and Newborn Health*. New York: Guttmacher Institute; 2010.
44. Ahmed S, Li Q, Liu L, Tsui AO. Maternal deaths averted by contraceptive use: an analysis of 172 countries. *Lancet*. 2012; **380**(9837): 111-25.
45. UNICEF. *State of the World's Children 2012: Children in an Urban World*. New York: UNICEF; 2012.
46. Jokhio AH, Winter HR, Cheng KK. An intervention involving traditional birth attendants and perinatal and maternal mortality in Pakistan. *N Engl J Med*. 2005; **352**(20): 2091-9.
47. Rajbhandari S, Hodgins S, Sanghvi H, McPherson R, Pradhan YV, Baqui AH. Expanding uterotonic protection following childbirth through community-based distribution of misoprostol: operations research study in Nepal. *Int J Gynaecol Obstet*. 2010; **108**(3): 282-8.

48. Sanghvi H, Ansari N, Prata NJ, Gibson H, Ehsan AT, Smith JM. Prevention of postpartum hemorrhage at home birth in Afghanistan. *Int J Gynaecol Obstet.* 2010; **108**(3): 276-81.
49. Prata N, Vahidnia F, Potts M, Dries-Daffner I. Revisiting community-based distribution programs: are they still needed? *Contraception.* 2005; **72**(6): 402-7.
50. Malarcher S, Meirik O, Lebetkin E, Shah I, Spieler J, Stanback J. Provision of DMPA by community health workers: what the evidence shows. *Contraception.* 2011; **83**(6): 495-503.
51. Cates W, Jr. Family planning: the essential link to achieving all eight Millennium Development Goals. *Contraception.* 2010; **81**(6): 460-1.
52. Cates W, Jr., Abdool Karim Q, El-Sadr W, Haffner DW, Kalema-Zikusoka G, Rogo K, et al. Global development. Family planning and the Millennium Development Goals. *Science.* 2010; **329**(5999): 1603.
53. UNAIDS. UNAIDS Data Tables 2011. 2012 [cited 18 July 2012]; Available from: http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/JC2225_UNAIDS_datatables_en.pdf
54. Wringe A, Cataldo F, Stevenson N, Fakoya A. Delivering comprehensive home-based care programmes for HIV: a review of lessons learned and challenges ahead in the era of antiretroviral therapy. *Health Policy Plan.* 2010; **25**(5): 352-62.
55. WHO. Tuberculosis: Fact Sheet No. 104. 2012 [cited 18 July 2012]; Available from: <http://www.who.int/mediacentre/factsheets/fs094/en/>
56. Chowdhury AM, Chowdhury S, Islam MN, Islam A, Vaughan JP. Control of tuberculosis by community health workers in Bangladesh. *Lancet.* 1997; **350**(9072): 169-72.
57. Islam MA, Wakai S, Ishikawa N, Chowdhury AM, Vaughan JP. Cost-effectiveness of community health workers in tuberculosis control in Bangladesh. *Bull World Health Organ.* 2002; **80**(6): 445-50.
58. Wandwalo E, Robberstad B, Morkve O. Cost and cost-effectiveness of community based and health facility based directly observed treatment of tuberculosis in Dar es Salaam, Tanzania. *Cost effectiveness and resource allocation : C/E.* 2005; **3**: 6.
59. WHO. Malaria: Fact Sheet No. 94. 2012 [cited 18 July 2012]; Available from: <http://www.who.int/mediacentre/factsheets/fs094/en/>
60. Brenner JL, Kabakyenga J, Kyomuhangi T, Wotton KA, Pim C, Ntaro M, et al. Can volunteer community health workers decrease child morbidity and mortality in southwestern Uganda? An impact evaluation. *PLoS ONE.* 2011; **6**(12): e27997.
61. Arole M, Arole R. *Jamkhed - A Comprehensive Rural Health Project.* London, UK: Macmillan Press; 1994.
62. McCord C, Premkumar R, Arole S, Arole R. Efficient and effective emergency obstetric care in a rural Indian community where most deliveries are at home. *Int J Gynaecol Obstet.* 2001; **75**(3): 297-307; discussion 8-9.
63. Mutalemwa P, Kisinza WN, Kisoka WJ, Kilima S, Njau J, Tenu F, et al. Community directed approach beyond ivermectin in Tanzania: a promising mechanism for the delivery of complex health interventions. *Tanzania journal of health research.* 2009; **11**(3): 116-25.

64. Katarbarwa M, Habomugisha P, Eyamba A, Agunyo S, Mentou C. Monitoring ivermectin distributors involved in integrated health care services through community-directed interventions--a comparison of Cameroon and Uganda experiences over a period of three years (2004-2006). *Trop Med Int Health*. 2010; **15**(2): 216-23.
65. Okeibunor JC, Orji BC, Brieger W, Ishola G, Otolorin E, Rawlins B, et al. Preventing malaria in pregnancy through community-directed interventions: evidence from Akwa Ibom State, Nigeria. *Malar J*. 2011; **10**: 227.
66. UNICEF. State of the World's Children 2009. Maternal and Newborn Health. New York: UNICEF; 2009.
67. AVERT. HIV and AIDS in Brazil. 2012 [cited; Available from: <http://www.avert.org/aids-brazil.htm>]
68. Perry H. Health for All in Bangladesh: Lessons in Primary Health Care for the Twenty-First Century. Dhaka, Bangladesh: University Press Ltd; 2000.
69. Standing H, Chowdhury AM. Producing effective knowledge agents in a pluralistic environment: what future for community health workers? *Soc Sci Med*. 2008; **66**(10): 2096-107.
70. Zaman K, Hossain S, Yunus M, Arifeen SE, Mahmud A, Begum V, et al. Tuberculosis in Bangladesh: A 40-Year Review. Dhaka, Bangladesh: icddr,b; 2007.
71. Walker DG, Jan S. How do we determine whether community health workers are cost-effective? Some core methodological issues. *Journal of community health*. 2005; **30**(3): 221-9.
72. Adam T, Lim SS, Mehta S, Bhutta ZA, Fogstad H, Mathai M, et al. Cost effectiveness analysis of strategies for maternal and neonatal health in developing countries. *BMJ*. 2005; **331**(7525): 1107.
73. Jamison D. Investing in Health. In: Jamison D, Breman J, Measham A, Alleyne A, Claeson M, Evans D, editors. *Disease Control Priorities in Developing Countries*. New York, NY: World Bank and Oxford University Press; 2006. p. 3-34.
74. Lehmann U, Sanders D. Community health workers: What do we know about them? The state of the evidence on programmes, activities, costs and impact on health outcomes of using community health workers. Geneva: World Health Organization; 2007.
75. Haines A, Sanders D, Lehmann U, Rowe AK, Lawn JE, Jan S, et al. Achieving child survival goals: potential contribution of community health workers. *Lancet*. 2007; **369**(9579): 2121-31.
76. Bhutta ZA, Lassi ZS, Pariyo G, Huicho L. Global Experience of Community Health Workers for Delivery of Health Related Millennium Development Goals: A Systematic Review, Country Case Studies, and Recommendation for Integration into National Health Systems. Geneva: World Health Organization and the Global Health Workforce Alliance; 2010.
77. Shakir FK. Community Health Worker Programs: A Review of Recent Literature. Washington, DC: USAID Health Care Improvement Project; 2010.
78. Crigler L, K. H, Furth R, Bjerregaard D. Community Health Worker Assessment and Improvement Matrix (CHW AIM): A Toolkit for Improving CHW Programs and Services. Washington, DC: Health Care Improvement Project, University Research Corporation, and USAID; 2011.

79. Earth Institute. One Million Community Health Workers: Task Force Report. New York: Columbia University; 2011.
80. Community Health Workers: What Needs to Be Done to Help These Vital Workers to Be Most Effective and Sustainable? . In: Freeman P, Freeman M, editors. 13th Annual Community-based Primary Health Care Working Group Annual Workshop; 2011; Washington, DC: Working Group on Community-based Primary Health Care, International Health Section, American Public Health Association; 2011.
81. Berman P, Franco L. Formal Health System Support Activities and Community Health Worker Performance. Global Health Evidence Summit: Community and Formal Health System Support for Enhanced Community Health Worker Performance. Washington, DC; 2012.
82. Perry H, Townsend J. Community Support Activities and Community Health Worker Performance. Global Health Evidence Summit: Community and Formal Health System Support for Enhanced Community Health Worker Performance. Washington, DC; 2012.
83. Frehywot S, Wuliji T. Community and Formal Health System Support Activities and Their Impact on Community Health Worker Performance. Global Health Evidence Summit: Community and Formal Health System Support for Enhanced Community Health Worker Performance. Washington, DC; 2012.