

Community Health Workers in Low-, Middle-, and High-Income Countries: An Overview of Their History, Recent Evolution, and Current Effectiveness

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Annu. Rev. Public Health 2014. 35:399–421

First published online as a Review in Advance on January 2, 2014

The *Annual Review of Public Health* is online at publhealth.annualreviews.org

This article's doi:
10.1146/annurev-publhealth-032013-182354

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Keywords

human resources for health, primary health care, Millennium Development Goals, health systems, health systems strengthening

Abstract

Over the past half-century, community health workers (CHWs) have been a growing force for extending health care and improving the health of populations. Following their introduction in the 1970s, many large-scale CHW programs declined during the 1980s, but CHW programs throughout the world more recently have seen marked growth. Research and evaluations conducted predominantly during the past two decades offer compelling evidence that CHWs are critical for helping health systems achieve their potential, regardless of a country's level of development. In low-income countries, CHWs can make major improvements in health priority areas, including reducing childhood undernutrition, improving maternal and child health, expanding access to family-planning services, and contributing to the control of HIV, malaria, and tuberculosis infections. In many middle-income countries, most notably Brazil, CHWs are key members of the health team and essential for the provision of primary health care and health promotion. In the United States, evidence indicates that CHWs can contribute to reducing the disease burden by participating in the management of hypertension, in the reduction of cardiovascular risk factors, in diabetes control, in the management of HIV infection, and in cancer screening, particularly with hard-to-reach subpopulations. This review highlights the history of CHW programs around the world and their growing importance in achieving health for all.

INTRODUCTION

Community health workers (CHWs) are a powerful force for promoting healthy behaviors and extending the reach of health systems around the world. During the past decade, there has been an explosion of evidence concerning CHWs and their potential for improving population health where (a) health workforce resources are limited and access to basic services is low (mostly in low-income countries) and where (b) large disparities in health outcomes exist between selected subpopulations and the population at large in spite of the presence of well-developed health systems (mostly in developed countries). Given the massive shortage of health workers in Africa and Asia [recently estimated to be a shortage of 4.25 million workers (144)], the inequitable distribution of health workers within countries, and the need to accelerate progress in reducing the disease burden arising from readily preventable and treatable conditions throughout the world, now is an appropriate time to take stock of the current evidence regarding CHWs.

This article summarizes the history, recent evolution, and current evidence of effectiveness of CHWs around the world. We define who CHWs are, provide a brief history of CHWs, describe the recent evolution of CHW programs, and summarize the evidence on their effectiveness in addressing priority health conditions.

WHO ARE COMMUNITY HEALTH WORKERS?

CHWs are a diverse category of health workers who commonly work in communities outside of fixed health facilities and have some type of formal, but limited, training for the tasks they are expected to perform. They generally do not, however, receive any formal professional or paraprofessional certificate or tertiary education degree. The US Labor Department defines CHWs as workers who “assist individuals and communities to adopt healthy behaviors” while helping “to conduct outreach” and “advocate for individuals and community health needs” (133). These workers have many specific names that may be unique to the context in which they work. CHWs have a broad range of work environments, training, remuneration strategies, tasks, career opportunities, support mechanisms, and expectations from the programs and communities they support. In the United States, CHW roles and work arrangements vary broadly, from working in clinics to communities to homes, from preventing disease to promoting access to services, from engaging in highly specific disease-related activities to supporting primary health care in general (56, 72, 104). The manner of selection and training, payment and incentives, career advancement opportunities, and supervision also vary broadly (25, 44, 88). Recent estimates have suggested that as many as 85,000–200,000 CHWs function in various roles in the United States (25, 36, 132). In other countries around the world, a conservative estimate is that there are more than 5 million CHWs, including 2.3 million in India alone (**Figure 1**). In short, CHWs constitute a diverse group of health workers whose common characteristic is their work outside of health facilities directly with people in their homes, neighborhoods, communities, and other nonclinical spaces where health and disease are produced.

HISTORY OF COMMUNITY HEALTH WORKER PROGRAMS

Present-day CHW programs have their origins in Ding Xian, China, in the 1920s. The first CHWs were illiterate and received only three months of training. They learned to record births and deaths, vaccinate against smallpox and other diseases, give first aid and health education talks, help communities keep their wells clean, and provide basic medical care (101, 124). These CHWs were the precursors of the “barefoot doctor” program that grew rapidly in the 1950s. By 1972,

Country	Name of CHW Cadres	Number CHWs	Reference
India	Anganwadi Worker (AW)	1,203,300	S15
	Accredited Social Health Activist (ASHA)	863,506	S11
	Auxiliary Nurse Midwife (ANM)	207,868	S7
Indonesia	4 Kaders of CHWs: Gizi (nutrition); Kesehatan (health); KB (family planning); Mental	1,500,000	S13
	Community Health Agent	240,000	S1
United States	Community Health Workers	175,000	S6
Bangladesh	Family Welfare Assistant (FWA)	23,500	S4
	Shasthya Shebika (SS)	91,000	
	Health Assistant (HA)	4,500	
	Community-Based Skilled Birth Attendant (CSBA)	61,55	
Ethiopia	Community Health Care Provider (CHCP)	12,991	S5
	Health Development Army Teams (HDA)	>94,000	
Pakistan	Health Extension Worker (HEW)	>34,000	S2
	Lady Health Worker	93,000	S1
Nigeria	Community Health Worker (including Health Extension Worker and Village Health Worker)	86,600	S2
	Village Health Teams (VHT)	83,396	S9
Uganda	Village Health Volunteer	80,000	S1
Thailand	Home-Based Carer (HBC)	47,121	S3
	Lay Counselor (LC)	9,243	
	Adherence Counselor (AC)	2,010	
	Directly Observed Therapy Supporter for TB (DOTS)	2,740	
	Peer Educator (PE)	1,810	
Rwanda	Village Health Worker	60,000	S2
	Female Community Health Volunteer (FCHW)	49,000	S2
Nepal	Maternal Child Health Worker (MCHW)	2,500	
	Village Health Worker (VHW)	3,000	
Iran	Behvarz	31,000	S8
Nicaragua	Brigadista (BA)	12,700	S14
	Volunteer Midwives (VM)	7,200	
	Volunteer Collaborators (CV)	7,100	
	Health Promoters (HP)	2,800	
Zambia	Community Health Volunteer (CHV)	23,400	S10, S21
	Community Health Assistant (CHA)	600	
Afghanistan	Community Health Worker	22,000	S18, S19
Ghana	Community Based Agent	16,812	S17
Sri Lanka	Community Health Worker	15,000	S16
Malawi	Health Surveillance Assistant	10,500	S2
Papua New Guinea	Community Health Worker	4,449	S20
Niger	Agent de Santé Communautaire	2,560	S17
Haiti	Accompagnateur	2,378	S12
Mozambique	Agentes Polivalentes Elementares	2,726	S17
Mali	Agent de Santé Communautaire	2,052	S17

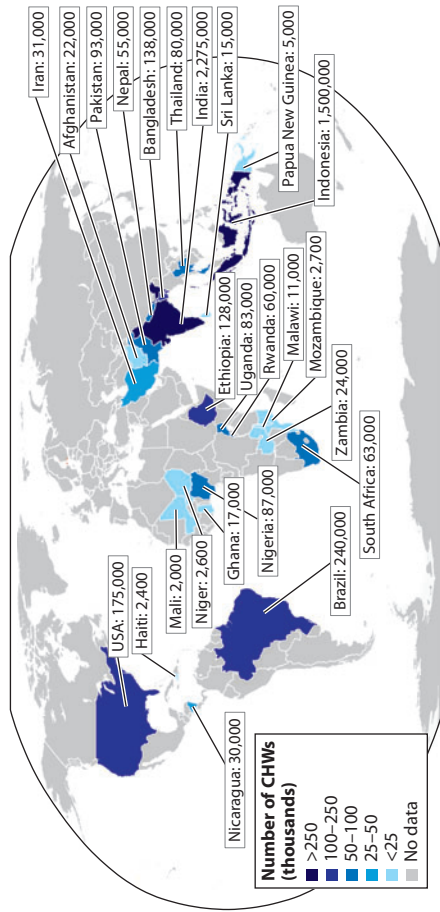


Figure 1

Current estimates of numbers and locations of community health workers (CHWs) from selected countries. This is not an all-inclusive list of the number of CHWs by country, but it does include all countries with the largest CHW programs. Reference numbers (preceded by S) correspond to citations in the **Supplemental References** online. Follow the **Supplemental Materials link** on the Annual Reviews website at <http://www.annualreviews.org>.

an estimated one million barefoot doctors were serving a rural population of 800 million people in the People's Republic of China. These barefoot doctors were peasants who were expected to work half time performing their health-related duties and half time doing agricultural work (113).

In the 1960s, the inability of the modern Western medical model of trained physicians to address the needs of rural and poor populations throughout the developing world was becoming readily apparent. The barefoot doctor concept gained attention around the world as one approach to addressing this need (64). During this period, CHW programs emerged in many countries, including Indonesia, India, Tanzania, Venezuela, Honduras, and Guatemala. The emergence in the mid-twentieth century of Latin American CHWs—often called *Promotores*—has been linked to the intersection of Catholic liberation theology with labor rights struggles (92).

The World Health Organization (WHO) began to explore the implications of these new approaches to providing medical care and promoting health that were based on principles of social justice, equity, community participation, disease prevention, multisectoral collaboration, decentralization of services to the periphery in close proximity to the people, use of appropriate technology, and provision of services by a team of workers, including community-based workers. These new ideas led to the publication of a book in 1975 by the WHO entitled *Health by the People* (84). This book was a series of case studies from different countries where CHWs had been incorporated as the foundation of innovative community health programs. It provided the intellectual foundation for the International Conference on Primary Health Care at Alma-Ata, Kazakhstan, in 1978, sponsored by the WHO and the United Nations Children's Fund (UNICEF). This conference was attended by official government representatives from virtually all WHO and UNICEF member countries, making it the first truly global health conference. The Conference resulted in the Declaration of Alma-Ata, which called for the achievement of Health for All by the year 2000 through primary health care. Article VII.7 of the Declaration clearly established a role for CHWs in the provision of primary health care:

Primary health care . . . relies, at local and referral levels, on health workers, including physicians, nurses, midwives, auxiliaries and community workers as applicable, as well as traditional practitioners as needed, suitably trained socially and technically to work as a health team and to respond to the expressed health needs of the community (148).

In the 1970s and 1980s, government CHW programs proliferated at the national scale worldwide. In the Western hemisphere, large-scale programs were developed in Brazil, Guatemala, Nicaragua, Honduras, Peru, and other countries. During this same time, smaller CHW programs operated by nongovernmental organizations (NGOs) began to proliferate in many low-income countries around the world, inspired in large part by the fresh vision arising from Alma-Ata that contrasted with the traditional professional, hierarchical approach to the provision of medical care that was dominant at that time.

In the 1980s, a number of large-scale programs in developing countries encountered serious challenges because of inadequate training, insufficient remuneration or incentives for CHWs, and lack of supervision and logistical support for supplies and medicines. Programs were also plagued by deficient continuing education, poor integration with the health system, and lack of acceptance by higher-level health care providers. Additionally, in many programs, political favoritism led to inappropriate selection of CHWs (101). A series of publications in the 1980s highlighted these concerns (13, 140, 141).

In addition to these serious problems within large-scale CHW programs, global political and economic forces threatened support for community-based health programs. The oil crises of the

1970s led to a global recession and a debt crisis for many developing countries in the 1980s. Governments were forced by international organizations, most notably the World Bank and the International Monetary Fund, to embrace free-market reforms and to reduce their public sector financing, including financing for health services. This was accompanied by the realizations that CHWs were not as inexpensive as governments had anticipated and that they required significant financial and supervisory inputs (13). Thus, financial resources needed to support new health initiatives, including large-scale CHW programs, were not available (109, 118). The cumulative effect of these shocks led to loss of financial and political support for comprehensive primary health care generally (109), and most large-scale CHW programs fell by the wayside (118). These global economic and political forces, together with the rising prominence of selective approaches that did not require CHWs, led to the demise of a number of comprehensive large-scale CHW programs in developing countries as well as to a loss of momentum of the nascent primary health care movement.

The political commitment for primary health care and for strong and effective CHW programs was often lacking in developing countries, as well. There was a perception among some governments that these programs represented “second class care” and that CHWs were a temporary fix for health system constraints rather than an essential element of a long-term solution. Priority was given to investments in secondary and tertiary levels of care, often benefiting primarily urban and elite populations (50). Furthermore, monitoring and evaluation systems for primary health care programs and for large-scale CHW programs were weak, and evidence of their effectiveness and cost-effectiveness was limited (50). Because of these influences, many governments in low-income countries reduced or discontinued their comprehensive CHW programs in the late 1980s and early 1990s as efforts at selective/vertical programs with strong international donor and technical support gained prominence (101, 139).

National Examples of Large-Scale Community Health Worker Programs Developed in the 1980s

Successful examples of CHW programs at scale did, however, begin to emerge during the mid-1980s. Here we describe three of these, in Brazil, Bangladesh, and Nepal, to give a sense of their scope and effectiveness.

Among the most notable of the programs emerging in the mid-1980s was the Brazilian national health care program (*Serviço Especial de Saúde Pública*, or Special Service for Public Health), which started in 1987. Since then, the program has achieved universal coverage of primary health care services by reaching all households through home visits and linking them to services at health centers, leading to marked improvements in population health status. The program utilizes health teams that include one of the largest CHW networks in the world, composed now of 240,000 CHWs known as *Visitadoras* (now called *Agentes Comunitários de Saúde*) who provide home visits and services to 110 million people (33, 78, 100).

Bangladesh started a large-scale community-based family-planning program with an initial cadre of Family Welfare Assistants in the mid-1970s, following a highly successful pilot program in the 1960s. The program expanded in the mid-1980s and was complemented by NGOs that utilized CHWs to provide family planning services. By 1997, 30,000 female CHWs were providing home-based family-planning services in Bangladesh (95). In the mid-1980s, BRAC, a Bangladeshi NGO, initiated a CHW program composed of women who were members of a microcredit savings group. Each group had women who obtained special training in an area of personal interest, including various types of income-generating activities or health. This program has expanded and

this national NGO cadre consists of almost 100,000 CHWs who reach more than 100 million people with comprehensive services (95, 118).

Another notable program that emerged in the late 1980s is Nepal's Female Community Health Volunteer (FCHV) Program. This program was an outgrowth of an earlier CHW program that had begun in Nepal following the 1978 Alma-Ata conference but failed in the early 1980s primarily because of the lack of continued government funding. The resurrected program engaged unpaid women (many of whom had been trained under the original CHW program) to ensure the distribution of vitamin A. Over the following decade, the National Vitamin A Program gradually scaled up to more than 40,000 workers. More recently, these FCHVs have expanded their responsibilities to include detection and treatment of common childhood diseases (including pneumonia), home-based neonatal care, distribution of oral contraceptives, and promotion of available health services for first aid, antenatal care, family planning, and immunization (46, 125).

These three countries—Brazil, Bangladesh, and Nepal—have produced some of the most rapid achievements in reducing childhood mortality under age 5 (known as under-5 mortality) worldwide since 1990 (102). The strong CHW programs in each of these countries have all played a strong contributory role toward this important achievement.

Large-Scale Community Health Worker Programs that Have Emerged Since the 1990s

CHWs came back into prominence globally as the WHO promoted task shifting to alleviate overstretched health care systems (107). More recently, various countries have begun to invest again in large-scale CHW programs. In 2004, Ethiopia began its program to train Health Extension Workers, who now number more than 34,000 (15). The workers have completed tenth grade and are from the local community (39). These workers primarily serve in newly constructed health posts and provide services that include provision of basic first aid, contraceptives, and immunizations, as well as diagnosis and treatment of malaria, diarrhea, and intestinal parasites.

There are many other notable examples of countries currently implementing CHW programs. The Lady Health Worker Program in Pakistan was launched in 1992 and has gradually scaled up to serve 70% of the rural population with more than 90,000 workers (15). Uganda began a national CHW program as part of its village health team strategy in 2003 (15). India initiated its Rural Health Mission in 2005, which involves support for 800,000 CHWs known as ASHAs (Accredited Social Health Activists), making it one of the world's largest CHW programs (15). In the past decade, as rigorous evidence has continued to accumulate on the effectiveness of interventions delivered by community-based workers, enthusiasm has grown for a stronger investment in CHW programs as a strategy to accelerate progress toward reaching the Millennium Development Goals for health established by the United Nations in the year 2000 to be achieved by the year 2015 (131).

South Africa provides an interesting case study in this regard. Although the country had developed a CHW cadre earlier, South Africa did not include CHWs in the first postapartheid health system because CHWs were seen as second-class care providers (134). However, with the expanded need for health care providers in the face of the AIDS epidemic and the availability of funding to support testing and long-term treatment of AIDS patients, CHWs have more recently become included in the vision for a more effective health system. South Africa is now remodeling the primary health care system on the basis of Brazil's system in which CHWs are foundational.

Although government interest in and commitment to CHW programming have waxed and waned over the past 50 years, international and national NGO health programs that use CHWs have grown steadily and have reported increasingly positive experiences.

ASSESSING THE EVIDENCE ON COMMUNITY HEALTH WORKER EFFECTIVENESS

Assessing the effectiveness of health programs on population health in general is a challenging methodological task. Many factors contribute to the health of populations, including social, political, and economic determinants, such as poverty and level of education. The difficult nature of measuring population health also complicates the assessment of CHW effectiveness. In this section we provide an overview of CHW contributions in addressing health priority areas. Health priorities for developing countries are based on those established by the United Nations for the Millennium Development Goals in the year 2000 (131). For our purposes here, we define health priorities in the United States according to the leading causes of death. The review draws on what we consider to be some of the most important research that addresses these issues, with priority given to recent research findings. When possible, we refer to findings arising from reviews of studies in a particular area.

Reduction of Undernutrition

The current evidence shows that CHWs have contributed to improving childhood nutrition, including the promotion of exclusive breastfeeding care and support for children with undernutrition and micronutrient deficiencies. Approximately one-third of the 6.8 million deaths occurring each year around the world can be attributed to undernutrition and the effects of undernutrition on children's long-term physical and mental development (16). One out of every four children in developing countries is undernourished. Evidence documenting the effectiveness of nutritional programs in improving nutritional status in populations is unfortunately quite limited, particularly for programs serving large populations. The contribution that CHWs have made or can make to the effectiveness of nutrition programs depends not only on the CHWs themselves but also on the efficacy of the nutritional intervention. One recent evaluation of a large-scale CHW program serving 1.1 million people in Mozambique demonstrated a one-third reduction in the prevalence of childhood undernutrition (35).

Exclusive breastfeeding during the first 6 months of life is recommended by the WHO for optimal nutrition during early life and for improved health outcomes, most notably the prevention of diarrhea (149). At present, only 25% of infants are exclusively breastfed during their first 6 months of life (16), and according to one estimate, 13% of under-5 deaths could be prevented by the universal practice of exclusive breastfeeding during the first 6 months of life, more than could be achieved by universal coverage of any other single intervention (59). According to one recent systematic review and meta-analysis of randomized controlled trials (RCTs), the odds of exclusive breastfeeding was 5.6 times greater in the group exposed to CHW interventions compared with the group that was not (49).

There is extensive evidence on CHWs' experience with identifying moderately or severely malnourished children in communities and assisting mothers in learning how positive deviants feed and care for their children (155). In the Positive Deviance Hearth Model¹, positive deviants are mothers in the same community with a similar socioeconomic status who have well-nourished children. The most significant example of the effectiveness of this model is from Vietnam, where early success in reducing severe malnutrition led to a scaling up of the program to two districts

¹The term hearth is used because the central component of this approach is to identify positive deviants to help mothers of malnourished children prepare nutritious foods from locally available sources.

with a population of 1.2 million people and a reduction in the prevalence of severe malnutrition from 19% to 4% (119, 120).

Community-based management of severe acute malnutrition (CMAM) involves providing ready-to-use therapeutic foods in the community and initiating inpatient care for children with complications. CMAM requires community mobilization and supplementary feeding programs where the level of acute malnutrition is high. CHWs play an important role in implementing these programs. Outcomes are similar to those provided exclusively at facilities, but at a much lower cost per child and with much higher levels of population coverage (1, 6, 8, 30, 83, 152).

CHWs can also play an important role in reducing micronutrient deficiencies. Micronutrient deficiencies in children, most notably due to a lack of vitamin A and zinc, are now responsible for an estimated 10% of the global burden of disease in children (14). The most recent meta-analysis of the effect of vitamin A supplementation on child mortality concludes that there is a 23% reduction in risk of death when a single droplet of vitamin A is provided to children every 6 months in places where there is clinical evidence of deficiency (45). CHWs are essential for ensuring that high-dose vitamin A capsules reach all children every six months in countries where deficiency is present (essentially all countries with high levels of under-5 mortality). Evidence also increasingly indicates that zinc supplementation provided to children on a daily basis leads to improved growth (55) and reduced mortality from diarrhea and pneumonia (158). The provision of micronutrients to pregnant women, principally iron, folate, and other minerals and vitamins, has been associated with favorable results for birth weight (14, 90, 112) as well as for mortality during early infancy, including for preterm infants (28, 29). When CHWs provide micronutrients through routine periodic contact with all families, the coverage rate is much higher than when micronutrients are provided in clinical settings (including drug shops).

Reduction of Mortality in Children Younger than 5 Years of Age

At present, 6.8 million children die each year before reaching age 5; 99% of these deaths occur in developing countries, and the great majority die from readily preventable or treatable conditions (130). The evidence regarding the effectiveness of CHWs in reducing under-5 mortality is substantial. A recent analysis has identified 45 different interventions that are effective for reducing under-5 mortality in low-income settings (57). According to programmatic experience and published reports, of these interventions, nearly three-quarters (32 interventions, or 71%) can be provided by CHWs.

Community case management of serious childhood illness. Numerous studies have demonstrated that CHWs can be trained to effectively diagnose and treat serious childhood illness, most notably pneumonia, diarrhea, and malaria. These three conditions are currently the cause of 41% of under-5 deaths (17).

Globally, pneumonia is the leading cause of under-5 mortality, responsible for 18% of deaths (17). An analysis of the combined results of seven published studies from Bangladesh, India, Nepal, Pakistan, the Philippines, and Tanzania demonstrated that the diagnosis and treatment of childhood pneumonia by CHWs can reduce the risk of death by 36% in children with pneumonia and can reduce by 24% the overall risk of death for all children living in geographic areas where the program exists (106). A more recent review of studies of community case management for pneumonia carried out by CHWs, published in 2010, concluded that the reduction in mortality from pneumonia could be as high as 70% (126).

Diarrhea is the second leading cause of under-5 mortality globally, currently accounting for 15% of under-5 deaths (17). The introduction of oral rehydration therapy in the 1960s to treat

dehydration from diarrhea using packs of oral rehydration salts (ORS) or a simple homemade solution of sugar, salt, and water or other recommended fluids is now estimated to save millions of lives each year and is used by mothers throughout the world without the assistance of CHWs. The practical application of this innovation so that CHWs can teach mothers to prepare ORS without having to rely on packets of ORS salts (which are rarely available and often cost money) has been a major advance in expanding access to this intervention (123). A recent review of the available evidence concludes that ORS may reduce diarrhea mortality by up to 93% (82). However, in developing countries only 32% of children younger than age 5 receive ORS (or a recommended home fluid) when they have diarrhea, and this percentage has not changed during the previous decade (129). Between 1980 and 1990, BRAC, a Bangladeshi NGO, trained 1,200 CHWs to make one visit to 12.5 million households nationwide to train one woman in the household in how to prevent diarrhea and how to prepare and administer homemade ORS. At the completion of the program, 90% of mothers knew how to prepare ORS; at present, Bangladesh has the highest ORS usage rate in the world, with a reported 81% of children with diarrhea given ORS in 2011 (26, 85).

Preventive strategies such as promotion of a clean home environment, access to safe water and adequate sanitation, good hygiene (most notably hand washing), exclusive breastfeeding during the first six months of life, and good nutrition are all important for reducing the incidence of childhood diarrhea, the severity of cases, and diarrhea deaths. CHWs can assist in the promotion of these activities (26). Current estimates are that hand washing, if practiced at the proper times and with soap or ash, could reduce the deaths of 1 million children each year (34). An RCT in which CHWs made routine weekly visits to all households to promote hand washing in an urban slum in Karachi, Pakistan, led to a 53% reduction in the incidence of childhood diarrhea and a 50% reduction in the incidence of childhood pneumonia (73, 74).

The WHO and UNICEF now recommend the addition of oral zinc for 10–14 days to the standard treatment of childhood diarrhea (151). Zinc decreases the proportion of diarrheal episodes lasting beyond 7 days, the risk of hospitalization, all-cause mortality, and diarrhea mortality (138). Although zinc treatment is just now being introduced in nonresearch settings, CHWs were used to implement the intervention in all the community-based efficacy studies performed to date.

CHWs can also contribute to reductions in child mortality from malaria. The effectiveness of the distribution and utilization of insecticide-treated bed nets in endemic areas in reducing under-5 mortality has been well established (68). In some settings, CHWs play an important role in bed net distribution and promotion of their appropriate use. Community case management of malaria by CHWs can also reduce overall and malaria-specific under-5 mortality (63, 114). With the emergence of rapid diagnostic tests for malaria, studies have shown that CHWs achieved clinical cures in 98% of childhood cases and adherence to medication treatment in 83% of patients (81, 99).

Interventions to reduce neonatal mortality. Newborn deaths now account for 41% of all deaths among children younger than age 5. The major causes of newborn mortality include preterm birth complications, birth asphyxia, and sepsis (71). In settings where most births take place in the home, CHWs can provide critical services that save lives. CHWs can identify pregnant women and provide them with basic education during prenatal home visits; promote clean delivery; provide essential newborn care; manage birth asphyxia (if they attend the delivery); assist with hygienic care of the umbilical cord; diagnose and refer or treat cases of newborn sepsis; and assist with healthy practices after birth, such as preventing hypothermia, preventing infection, and promoting immediate breastfeeding. An analysis of combined results of eight studies of home-based newborn care provided by CHWs indicates that these interventions can reduce newborn mortality by 24% (67). A meta-analysis of the published literature concerning the effectiveness of strategies for incorporating training and support of traditional birth attendants (TBAs) on

perinatal and maternal mortality demonstrated a 24–30% reduced risk of perinatal mortality and a 21–39% reduced risk in neonatal mortality (153).

There has been a decades-long experience of CHWs working with groups of women to achieve health benefits for them and their newborns. One early example of this was for the promotion of family planning in Bangladesh (47). In one strategy implemented more recently in various countries, the CHW meets with women in a village who are interested and who choose to come to a previously announced monthly meeting. The CHW builds self-awareness among participants and provides them with education about maternal and neonatal health through a participatory learning and action cycle. A systematic review and meta-analysis of seven RCTs undertaken in Bangladesh, India, Malawi, and Nepal demonstrated that women's groups practicing participatory learning and action led to a 23% reduction in neonatal mortality (97).

Impact of integrated interventions provided by community health workers on under-5 mortality. Child Health Days and Care Groups are two examples of integrated programs implemented using CHWs in low-income countries; each has demonstrated a favorable impact on under-5 mortality. Child Health Days are used in countries to deliver multiple maternal and child health interventions during focused periods of several days. The strategy is helpful in settings with large numbers of mothers and children who are not reached by routine services. CHWs are necessary to make these strategies work. In Somalia, for instance, a network of CHWs used for supplemental polio and measles immunizations delivered a package of services that included, in addition to the polio, measles, and diphtheria-pertussis-tetanus vaccine, deworming tablets, vitamin A, ORS, water treatment tablets (Aquatabs), and measurement of mid-upper-arm circumference to detect cases of severe malnutrition. One study estimated that in two rounds of Child Health Days, providing these services to more than 1 million children per round, ~10,000 deaths were averted and nearly 500,000 life years were saved (135).

The Care Group model is another type of participatory women's group approach in which a paid CHW meets regularly with a group of ~10 volunteer CHWs who each take responsibility for delivering health education to ~10 neighboring households. The group of volunteers is called a Care Group, and each Care Group meets every 2–4 weeks. During each meeting, the Care Group volunteers learn a new health education message to share with their neighbors. A variety of different messages are disseminated over the course of several years by these volunteers, who function as peer-to-peer educators. Published reports have demonstrated declines of under-5 mortality in the range of 42–72% (38, 94) as well as marked reductions in child undernutrition, as noted previously (35).

Improvement of Women's Health

We now have important evidence suggesting that CHWs can reduce maternal mortality and expand access to family-planning services. There are still 270,000 maternal deaths occurring each year, and 99% of these occur in developing countries (150). Furthermore, an estimated 215 million women who want to avoid pregnancy are not using an effective method of contraception. Forty percent of pregnancies that occur in developing countries are unintended, and 82% of those women with unintended pregnancies had an unmet need for effective contraception (48).

A systematic review and meta-analysis of RCTs of CHW-led women's groups practicing participatory learning and action in Bangladesh, India, Malawi and Nepal has demonstrated a 37% reduction in maternal mortality (97). A recent review of the effectiveness of CHWs in providing family-planning services concluded that CHWs can safely provide birth control pills and condoms, emergency contraception, and injectable contraception and that they can effectively promote the

standard days method and the lactational amenorrhea method. They can also effectively refer patients for long-acting and permanent forms of family planning (115). Similar evidence is now emerging from Africa for injectable contraceptives (66, 76, 96, 117). Community-based distribution programs, including a recently implemented program in Afghanistan, have increased by three- or fourfold (from 5–10% to 20–40%) usage of family-planning methods in areas where initial coverage is very low (53, 110).

Postpartum hemorrhage is the leading cause of maternal mortality globally, and 41% of births in developing countries (and 46% in sub-Saharan Africa) still occur at home, where ready access to treatment of postpartum hemorrhage is not available (130). Pilot studies have been conducted in isolated areas of Nepal and Afghanistan to assess the feasibility, safety, acceptability, and coverage of uterotonic protection (promotion of uterine contraction following delivery to reduce the risk of postpartum hemorrhage) achieved by the distribution of misoprostol tablets by CHWs during the prenatal period for women to take immediately following a home delivery (98, 105). In both cases, high rates of coverage of uterotonic protection were achieved (in 73% and 92% of deliveries, respectively), the intervention was safe, and patient satisfaction was high. In the Nepal study, there was a statistically significant decline in maternal mortality (98). Based on these and other data, the utilization of misoprostol for home births has the potential to reduce maternal mortality in these settings by 38–81% (121, 122).

Halting and Beginning to Reverse the Spread of HIV/AIDS

In 2010, there were 2.7 million new HIV infections, 34 million people living with HIV, and 1.8 million AIDS-related deaths worldwide. Only one-half of those in need of treatment (and only one-quarter of children and adolescents in need of treatment) were receiving it (128). Only 35% of pregnant women in low- and middle-income countries received an HIV test in 2010, and only 50% of pregnant women in need of treatment to prevent infection of their infant received it in 2010 (128).

Health system human resources in the developing world have been stretched, particularly in countries with a high prevalence of HIV/AIDS. CHWs have been integral in the fight against HIV/AIDS as a “cornerstone to the HIV response by international organizations and funding agencies” (157, p. 353). Initially, CHW home-based care programs were used to support primary care givers of people living with HIV/AIDS, to educate community members, and to provide counseling and general assistance, among other tasks. CHW services have now evolved into more comprehensive care (157). The WHO has identified 313 tasks that are essential for the prevention of HIV transmission, identification of HIV-positive individuals, provision of basic HIV clinical management, and initiation and maintenance of patients on antiretroviral therapy (ART). It recommends that 115 of these tasks can be performed by CHWs, highlighting the immense potential of CHWs in HIV services (145). CHWs fill diverse roles in HIV prevention and care, including provision of home-based, palliative care, voluntary HIV counseling and testing services, treatment preparation and support services, community mobilization, and HIV prevention/health promotion (108). CHWs are particularly important in mobilizing pregnant women to undergo HIV testing and encouraging them to adhere to treatment with ART as well as to practice exclusive breastfeeding (all of which are important strategies for reducing mother-to-child transmission of HIV).

Achievement of Universal Access to HIV/AIDS Treatment for All Who Need It

Awareness of the need for more human resources in sub-Saharan Africa became heightened following the emergence of HIV and the availability of ART services (10, 108, 156). A 2007 modeling

exercise to determine the human health resources required to provide universal access to ART by 2017 found that the number of human resources for health in sub-Saharan Africa in 2007 needed to double every year until 2017 in order to have a sufficient number to achieve universal access to care for HIV/AIDS (10). In many countries, lack of human resources for health care is, along with funding, the central barrier to attaining universal access to and coverage of HIV services (10, 156). CHWs have been identified as a key resource for increasing health system access (107, 157). Studies in Haiti, South Africa, and Uganda have found that CHWs improved ART adherence and treatment success (5, 12, 40, 156, 157).

Malaria Control

There were ~216 million cases of malaria in 2010 and 655,000 deaths, mostly among African children (146). Malaria-related services that CHWs can provide include provision of community education on malaria prevention and diagnosis, distribution of insecticide-treated bed nets, and provision of home-based management and preventive treatment of malaria. Rapid diagnostic tests are now available to assist with the diagnosis of cases. Numerous studies demonstrate that CHWs can accurately read the test results of these tests and provide appropriate treatment and follow-up based on the results (24, 32, 51, 89).

Tuberculosis Control

Tuberculosis is second only to HIV as the leading cause of death globally from a single infectious agent. In 2010, 8.8 million people developed clinical illness from tuberculosis and 1.4 million died. Patients with HIV infection are at greatly increased risk of developing tuberculosis, and 25% of deaths among people with HIV are from tuberculosis (147). Reducing transmission requires early detection because patients with active tuberculosis 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 patients do not develop drug resistance.

CHWs have played a central role in tuberculosis programs throughout the world, particularly in community-based Directly Observed Therapy, Short-Course (DOTS). CHWs have been employed to visit homes to detect symptomatic patients and facilitate sputum testing, to visit patients in their homes to ensure treatment compliance, to reduce stigma, and to assist in the treatment of patients in health clinics by, for instance, directly observing patients taking their medications (27, 142).

Evidence for Community Health Worker Effectiveness in the United States

The contributions of CHWs have not been limited to low-income countries. Studies of CHW interventions in the United States show largely positive effects on health outcomes, especially among low-income racial and ethnic minorities. Recent regulatory changes in the context of the Patient Protection and Affordable Care Act (“Obamacare”) have created a policy environment more amenable to the integration of CHWs into primary care settings where health care delivery and payment systems are largely fragmented; for example, for the first time in 2010, the US census listed “community health worker” as an occupation (9, 103, 133). Amid this policy landscape, CHWs have increasingly come to be seen as important members of community service and primary health care delivery teams (77, 91, 137, 154).

Hypertension control and reduction of cardiovascular risk factors. Nearly 1 in 3 adults in the United States, some 73 million people, have hypertension, but only 48% are receiving treatment

and only 33% have controlled levels of low-density lipoprotein cholesterol (a major risk factor for cardiovascular disease). Control is lowest among low-income adults and those with limited access to health care (22, 58). Hypertension is responsible for one in six deaths among adults (58).

CHW interventions have been effective in improving hypertension control and reducing cardiovascular risk among diverse, low-income populations in the United States. One review showed that seven of eight RCTs of CHW interventions demonstrated significant improvements in hypertension management (11, 20, 52, 69, 70, 79). In one RCT, patients receiving support from CHWs were twice as likely as controls to achieve blood pressure control goals (11). In another review, three studies were identified that assessed CHW contributions to hypertension control, and all three reported beneficial effects; however, reviewers raised issues with the design of some of the studies (18, 70, 136). One earlier study, in which home visits by a CHW was one of three interventions, demonstrated a mortality reduction in patients with hypertension (80).

In a review of CHW contributions to cardiovascular risk reduction, Fleury et al. (41) evaluated 20 studies. All but one of the studies showed significant improvements in at least one risk factor for cardiovascular disease (including six of seven RCTs). More recently, one RCT of cardiovascular risk reduction, including hypertension management, with treatment delivered by nurse practitioners and CHWs in an urban health center that treated primarily low-income, minority patients, demonstrated favorable results (2, 3, 80). Similarly, a recent CHW intervention in various urban and rural settings demonstrated positive outcomes for cardiovascular risk reduction in both public health and care delivery settings (65). In light of this evidence, a recent report from the Institute of Medicine has recommended that CHWs play a stronger role in linking communities to the health care system and in contributing to the care of community members with hypertension (58).

Diabetes control. At present, 25.8 million people in the United States (8.3% of the population) have diabetes, and this number is expected to grow in the future (21). Interventions involving CHWs as care team members have shown some benefit for improving diabetes control. One review identified 11 CHW studies reporting level of blood glucose control (as measured by hemoglobin A1C levels), and four reported significant improvement (86).

Two of four studies included in a review of CHW outcome effectiveness showed a statistically significant decrease in hemoglobin A1C levels compared with controls, whereas two showed no difference between CHW treatment groups and usual care (31, 43, 75). One review of the role of CHWs in improving diabetes outcomes concluded that studies generally support the use of CHWs in improving the “delivery of community-based care for patients and families living with diabetes” (54, p. 892). Of 16 studies reviewed, investigators noted that significant reductions in hemoglobin A1C values were reported in eight studies. A recent review of literature published in 2011 and 2012 assessing the evidence emerging from community-based participatory research approaches involving CHWs provided evidence of improved glycemic control or reduced risk of disease progression (2, 3, 7, 19, 43, 60, 61, 111, 116, 127).

Management of HIV infection. More than 1.1 million people in the United States are living with HIV infection, and almost 1 in 5 are unaware of their infection. African Americans constitute 12% of the US population but 44% of new HIV infections (23). One review of 16 studies that utilized CHWs to improve adherence to ART, primarily among low-income minorities, found reduced viral loads and increased CD4 counts in 13 of 16 reviewed studies, with statistically significant results in 7 studies. Notably, the review reported a positive association between the frequency of CHW-patient contact and improved clinical HIV outcomes, which they ascribe to

a possible “dose-response relationship between CHW exposure and improvements in HAART adherence” (62).

Cancer screening. Cancer accounts for nearly 1 out of every 4 deaths and is the second most common cause of death in the United States, exceeded only by heart disease (4). Numerous interventions to improve rates of screening for breast, cervical, and colorectal cancer have involved CHWs. One review of 15 studies examining such interventions found that CHWs were effective in improving rates of uptake of Pap smears (screening for cervical cancer) and mammography, although studies of CHW engagement with screening for other forms of cancer did not demonstrate a similar benefit compared with usual care (136). A more recent systematic review of CHW interventions aimed at improving rates of mammography screening found that CHWs were effective in certain settings and populations, particularly in urban settings and among participants who share the same race or ethnicity as the CHW (143).

CONCLUSION

The evidence cited here conclusively demonstrates that CHWs can be effective in improving population health in low-, middle-, and high-income countries. Unfortunately, they are still often considered as second-class, temporary solutions. However, the evidence increasingly demonstrates that they are now essential elements of population-based programs that improve health outcomes, even in high-income countries. When CHWs are appropriately selected, trained, and supervised, and when they are provided with appropriate supplies, medicines, and equipment, CHWs can improve key health-related behaviors, extend the accessibility of key services, and strengthen linkages between communities and health services. The evidence cited here indicates that CHWs should become an integral part of health systems as they strive to improve their quality, coverage, and impact on population health.

CHW programs are not stand-alone enterprises. Rather, they are a critical part of a larger system of activities that involve formal health programs, communities, and specific interventions that require an outreach delivery system. CHWs cannot achieve their full potential without the active engagement of communities as collaborative and supportive partners. CHW programs also require the full support of health systems to select appropriate technical interventions for them and to provide the training, supervision, and logistical support that these interventions require.

Everyone stands to gain when large-scale CHW programs work effectively. All stakeholders need to actively support CHWs in their roles and to address shortcomings in CHW program functioning and CHW performance. Large-scale CHW programs have faced many challenges that must be overcome, including lack of adequate financing, lack of adequate supervision and logistical support for supplies, medicines, and equipment, and lack of career growth opportunities for CHWs, all leading to high rates of turnover of CHWs. A recent review addresses the issues large-scale CHW programs face and how they might be addressed (93). Governments, civil society (including NGOs), communities, international health organizations, technical organizations, and donors need to rally behind the groundswell of support that is beginning to transform health systems. With adequate support, CHWs can play a foundational role in reaching every household and every person to promote healthy behaviors and to provide both essential services and referrals that help people to access the services they need in a convenient, high-quality, and cost-effective manner. Political pressure needs to be brought to bear to ensure that policies and regulations enable CHW programs to reach their full potential, including ensuring that the funding for these programs is sufficient and sustainable in the long term. Monitoring and evaluating CHWs and

CHW programs are essential to identify shortcomings and to make continued improvements in CHW programs. 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 in many cases will involve CHWs.

The recent growing enthusiasm for CHW programs has kicked off a campaign (<http://1millionhealthworkers.org/>) to train one million CHWs in Africa—1 for every 650 rural inhabitants (37). The observation that Frankel made two decades ago (42)—that our knowledge of the effectiveness of large-scale CHW programs in low-income countries and how to strengthen them is limited—remains true today. Thus, one of the key challenges for the future is to learn how large-scale CHW programs can become as effective as possible in improving the health of the populations they serve. Overcoming this challenge will be essential to avert the difficulties that befell large-scale CHW programs in the 1980s. In the United States, as the Patient Protection and Affordable Care Act is fully implemented in 2014, increased opportunities will become available to test the effectiveness of approaches to expand access to and improve the quality of primary health care services in programs that incorporate CHWs as members of the health team.

Clearly, as our global society moves forward, CHWs will be indispensable not only to improve population health, but ultimately to achieve health for all.

DISCLOSURE STATEMENT

The authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENTS

The authors express their appreciation to the MDG Health Alliance and to the USAID-supported Maternal and Child Health Integrated Program (MCHIP) for their financial support, which made this work possible. We are grateful to anonymous reviewers for helpful comments and to Richard Kumapley and Katharine Shelley for assistance in creating **Figure 1**.

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