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Community Health Workers at cross-roads: Systematic review of programmatic indicators including job satisfaction, attrition, training, quality of care and program outcomes

By

Dr. Salim Allana

Degree to be awarded: Master of Public Health - MPH

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ABSTRACT

Community Health Workers at cross-roads: Systematic review of programmatic indicators including job satisfaction, attrition, training, quality of care and program outcomes

By Dr. Salim Allana

Background: Strategies and policy framework for managing Community Health Worker (CHW) programs from a Human Resources (HR) perspective have been staggeringly slow or lacking altogether. We conducted a systematic review to identify factors that influence CHW job satisfaction / motivation, analyze how these variables affect their attrition rates and to compare quality of care between CHWs who receive training, retraining and supervision with those who do not.

Methods: Three electronic databases (Pubmed, Cochrane Library and Popline) were searched for published papers between 1966 and July 31, 2011. Original published papers on CHWs working in developing countries were included. Published studies identified through websites and institutional review articles were also reviewed and included. Reference lists of published CHW literature / systematic reviews were also hand-searched to obtain additional peer-reviewed published studies.

Results: Fifty-five manuscripts satisfied the inclusion criteria. These included 28 quantitative and 27 qualitative studies. Overall, study designs and their measured outcomes were variable. Passion for improving others' health (50%), career development (31.2%) and status within community (25%) were cited as the major job satisfying / motivating factors. Most common job dissatisfaction factors were low remuneration (43.7%) and inadequate material and financial incentives (12.5%), for CHWs working in paid and volunteer programs respectively. Nine studies provided information about attrition rates (overall rates: 11.8%-47%; annual attrition rates: 3.8%-4.8%), but these could not be compared because attrition rates across studies were non-uniform. Based on 12 comparisons from 10 studies that measured different CHW performance outcomes with varying study designs, training had a moderate effect of 23.8 %-points (range: -4.1, 37.0 %-points). There was a suggestion of a difference in training effect depending on the presence of supervision (effect of training alone: 26.7 %-points; effect of training plus supervision: 12.5%-points).

Conclusion: Themes identified and recommendations proposed in this review for supporting CHW programs from an HR perspective should be used as a trigger for meaningful deliberations and tangible actions by managers, policy makers and researchers. This is essential to develop and promote standard best practices for managing long-term sustainable CHW programs that would ultimately translate into enhanced health outcomes at the population-level.

Keywords: Community health worker, job satisfaction, attrition, training, supervision.

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TABLE OF CONTENTS

ABBREVIATIONS:

ARI	Acute Respiratory Infection
AWWS	Anganwadi Workers
CRHW	Community-Based Reproductive Health Worker
CHW	Community Health Worker
CHV	Community Health Volunteer
HR	Human Resources
HRH	Human Resources for Health
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IMCI	Integrated Management of Childhood Illness
LHW	Lady Health Worker
MeSH	Medical Subject Headings
MGDs	Millennium Development Goals
MoH	Ministry of Health
NGOs	Non-Governmental Organizations
PHC	Primary Health Care
WHO	World Health Organization
VHW	Village Health Worker

1. INTRODUCTION:

In order to reduce global disease burden, morbidity and mortality, over the past three decades many public health care initiatives, strategies and policy revisions have been debated, tested and implemented. The landmark Alma Ata Declaration of 1978 (World Health Organization [WHO], 1978) was centered around providing primary health care (PHC) and universal coverage for all without regard to specific diseases. The Declaration envisioned an overarching paradigm of improving health and social well-being based upon a comprehensive (horizontal) approach of integrating multiple levels of preventive and curative interventions, socio-environmental interactions, community-based participation and effective cross-sectoral collaborations. However focus on implementing this comprehensive PHC approach was marred by several reasons within one year of the Declaration (Lawn et al, 2008). First, with the overwhelming agenda of health demands, donor agencies, politicians and development experts considered the PHC or 'do all' approach as unrealistic and unfeasible in achieving universal coverage at the population level. Second, due to fiscal and workforce limitations and pursuing cost control policies, donor agencies diverted their funding priorities towards implementing more selective approaches or vertical (selective single disease focused) intervention programs. Donor agencies preferred these selective vertical intervention programs for being relatively reasonable, financially viable with rapid implementation and pragmatic oversight. Third, there was lack of advocacy and political will by governments and politicians in promoting the PHC approach for attaining universal coverage. Fourth, in the 1980s and 1990s, global political and economic instability, and changes in economic philosophy of health care lead to under-investment in the health sector (Hall & Taylor, 2003). This also resulted in low priority setting for the PHC approach. Fifth, there were growing fears

about the HIV/ AIDS pandemic in the 1980s and 1990s. Consequently, this heralded comprehensive global engagement and efforts, reallocation of resources and the creation of global funds like PEPFAR (The President's Emergency Plan for AIDS Relief, USA) and GFATM (The Global Fund to fight AIDS, Tuberculosis and Malaria) to address disease specific targets of HIV / AIDS, TB and malaria.

Despite the fact that the PHC approach could not completely take off in the 1980s and 1990s, donor agencies and policy experts continued to debate about the comprehensive and integrated PHC / horizontal versus selective / vertical approaches (Lawn et al., 2008; Oliveira-Cruz, Kurowski, & Mills, 2003). In the last decade since the United Nations Millennium Summit in 2000, the year 2008 which marked the 30th anniversary of the Alma Ata Declaration, and in the run up towards achieving the Millennium Development Goals (MDGs) by 2015, there has been a rejuvenated interest by policy experts and public health researchers in integrating both these vertical and horizontal intervention approaches. This has been based on the fact that synchronized efforts are required for treating disease specific outcomes along with health system strengthening and scaling-up universal access to PHC - neglecting any one approach is cost-ineffective and unsustainable (World Health Organization Maximizing Positive Synergies Collaborative Group, 2009; Ooms, Van Damme, Baker, Zeitz, & Schrecker, 2008; Lawn et al., 2008; Victora, Hanson, Bryce, & Vaughan, 2004). Further global health experts have opined that achieving WHO Millennium Development Goals (MGDs) by 2015 particularly with an aim to reduce global maternal and child mortality cannot be achieved by focusing on

HIV/AIDS, TB and malaria alone (Lewin et al., 2008; Lawn et al, 2008; Travis et al., 2004). Substantial evidence indicates that considerable progress has been made towards the WHO MDGs, yet achieving these targets by 2015 is farfetched for low-income countries, particularly those based in Sub Saharan Africa and South-East Asian regions. Approximately 20 - 40% of resources spent on health care are wasted which can be redirected towards achieving universal coverage (WHO, 2010). Forty nine low income countries need to increase their per capita spending by 87.5% on essential health interventions by the year 2015 compared to their current spending of US$ 32 per capita, in order to achieve the MDG targets (WHO, 2010). Therefore international development agencies, donor organizations, policy networks, task forces, national governments and local stakeholders need to work together through effective cross-collaborations. They need to address health system inconsistencies with effective use of allocated funds by strengthening country health systems and integrating and implementing a balanced mix of these two approaches for effective delivery of health care. (Task Force on Health Systems Research, 2004).

Moving forwards, in the new millennium more importantly in the last two to three years and in the face of an unrelenting global economic recession, low income developing countries in particular, face an array of tough and difficult choices in terms of allocation of limited financial resources within the health sector. These limited financial resources need to be generated through their own financial mechanisms, received in the form of loans, as aid from international donor agencies or as specific health interventions implemented by the private sector (nongovernmental organizations, or NGOs). This

evolution has led the focus of global health to gradually shift towards building and enhancing integrated health systems with inter-sectoral engagement, implementing a combined mix of vertical and horizontal health intervention approaches with extensive community participation in order to achieve or close the gaps towards achieving the MDGs (Waage et al., 2010; Lawn et al., Lewin et al, 2008; Mills, 2005, Task Force on Health Systems Research, 2004). [Appendix A: Trajectory of the focus on Primary Health Care].

Health workforce or human resources for health is one of the six building blocks of an effective health system (WHO, 2007). Despite the fact that on average, human resources consume up to 42 to 50 percent of a government's total health expenditure (WHO, 2006), developing countries often put little emphasis on human resource management with no comprehensive human resource strategies specifically defined to cater to the expanding needs of the health sector (Narasimhan et al., 2004). At the same time health systems globally and particularly in developing countries are marred by an irregular geographical distribution of skilled health workers. Countries with a higher burden of disease have a lower percentage of skilled health workforce compared to countries with comparatively lower burden of disease (WHO, 2006). Additionally an uneven internal distribution or lack of health workforce also exists especially within developing countries (uneven urban to rural distribution) where skilled health workers are either not available or are more concentrated in the urban areas and are less willing to serve in rural areas (where the need is highest). In their case study on Tanzania Munga & Maestad applied the Lorenz curve and Gini Index to methodically demonstrate that substantial disparities exist in the

allocation and distribution of health workers even across districts within the same country. This global and within country specific uneven distribution of skilled health workforce is due to several challenges and issues that revolve around financial compensation, inadequate incentives, workplace safety, lack of clear job descriptions and career ladder advancement, inadequate or limited training and loss of skilled health staff either to the private sector or through emigration each year to more developed countries (WHO, 2006; Chen et al., 2004; Joint Learning Initiative [JLI], 2004; Stilwell et al., 2003). According to the 'Working together for health' report published by WHO (WHO, 2006), a total of 4.3 million workers are required to fill the health workforce gap in 57 countries of which 36 are in Africa (WHO, 2007). Filling in this crucial gap of health workforce, will strengthen health care systems particularly in low income developing countries where they are most needed, and that too in rural populations, in order to promote equitable, affordable and universal access of health care for all.

Globally, there is a recognized shortage of skilled health professionals like doctors and nurses to provide primary health care and their need is most felt in rural and community settings. Burgeoning published literature links the potential and important role of trained community health workers (CHWs) in filling this ensuing gap for delivery of primary care health interventions. In their detailed review on CHWs, Bhattacharyya and coworkers (Bhattacharyya, Winch, LeBan, & Tien, 2001) have suggested that CHWs serve as a link between professional health workers and the communities in which they provide services and can help facilitate their communities to identify their health requirements which need most attention. Other studies have also highlighted the

importance of CHWs and have described their role as 'task shifting' (Bhutta, Lassi, Pariyo, & Huicho, 2010; Jimba et al., 2010; Lehmann & Sanders, 2007) towards providing universal access to primary health care. CHWs cannot substitute for highly skilled trained health workers like doctors and nurses. However globally over the years and particularly in low income developing countries, they have played a significant role in delivery of primary health care interventions to the population and communities that they serve (Gilroy et al., 2004; Gilson et al., 1990). There is a renewed global interest in the role that CHWs can play in the progress towards achieving the MDGs. This is because of their well-established role in improving primary care interventions for reducing maternal and child mortality rates especially in resource constrained settings (Bhutta et al., 2010; Lewin et al., 2010; Haines, 2007; Sazawal & Black, 1992).

According to the World Health Statistics 2011 report (WHO, 2011) an estimated 1.3 million CHWs have been members of an active health workforce in lower income and lower middle income countries between the years 2000 to 2010 with a density of 4.0 per 10,000 population in these countries. These figures are estimates which vary considerably and do not include CHWs working in the private sector, in unpaid positions, or in unregulated health systems (WHO, 2011). Globally CHWs have over 650 designations or titles (Lehmann et al. 2007), reflecting the diverse types of services that they provide in different countries, cultures and communities. They are hired on paid and unpaid (volunteer) positions depending upon the CHW program and its funding resources, both in the government and private sectors. CHWs provide a diverse continuum of primary health services with a generalist and specialist role, including preventive health

education, home visits, counseling on breast-feeding, nutrition, disease surveillance, maternal and child health (MCH) activities, environmental sanitation and management of uncomplicated childhood illnesses, malaria, tuberculosis (TB), HIV/AIDs, and sexually transmitted diseases [STDs] (Bhutta et al., 2010; Haines et al., 2007; Lehmann et al., 2007). Review of available research literature and reports on community health worker programs reveals that CHWs render services and deliver health care interventions for specific health care projects as well, with their main objective being to make available and improve delivery of primary health care and especially to act as a gateway in providing access to basic health education and care to those communities where the need is felt highest.

Existing retrievable publications and reports on CHW programs, whether programmatic individual descriptive experiences or systematic evaluations, show that attrition rate in CHWs programs varies from 3.2% to 77% (Bhattacharyya et al., 2001; Chevalier, Lapo, O'Brien, & Wierzb, 1993) due to multiple reasons, with higher rates noted in volunteer CHWs. Higher attrition rates are inversely related to job satisfaction and motivational factors (Mudor & Tookson, 2011; Hagopian, Zuyderduin, Kyobutungi, & Yumkella, 2009). Different studies have shown the substantial impact and relationship of job satisfaction on an individual's work performance, physical and mental health and life satisfaction (Rahman et al., 2010; Prosser et al., 1997). Thus, job satisfaction and motivational factors may significantly affect CHW performance and overall effectiveness of the CHW run programs, which in turn can broadly affect the communities or health system in which they serve.

With the increasing role of CHWs in primary health care and the need for sustainable CHW programs in developing countries, a systematic review of the evidence for factors related to job satisfaction and motivation, CHW performance, and program outcomes is needed. Previous reviews about CHWs that have been conducted, have summarized CHW programs as related to their selection, training, type of incentives provided, supervision, and impact assessment of the health interventions that they provide (Lewin et al, 2010; Lehmann, Dielemann, & Martineau, 2008; Haines et al. 2007; Lehmann et al. 2007). No data is available that assesses the relationship between job satisfaction / motivational factors and CHW performance or program outcomes. The current review aims to address this information gap by (1) identifying factors influencing CHW job satisfaction, (2) assessing the relationship between job satisfaction and attrition rates of CHWs, and (3) assessing the effect of additional / refresher training and supervision on quality of care and effectiveness of health services provided by CHWs. Information from this review will be useful for policy makers and managers of CHW programs in improving the operational workings and sustainability of these programs, in addition to their long term integration with the local and national health care systems.

2. STUDY OBJECTIVES:

Objectives of this review are to:

1. To identify variables that influence job satisfaction / motivation levels of CHWs
2. To examine the effect of CHW job satisfaction on their attrition rates
3. To compare †:
    a) Quality of care between CHWs who received additional/refresher training and those who did not receive additional/refresher training
    b) Quality of care between CHWs who had on the job supervision versus those who did not have any kind of supervision (monitoring)
    c) Outcome measures between areas served by CHWs who received additional/refresher training and areas served by CHWs who did not receive additional/refresher training

† Formal training and supervision, are two factors commonly used to improve CHW job satisfaction, on the overall quality of care and effectiveness of health services provided by CHWs. Training and supervision are of interest because they are commonly used to improve CHW motivation, and they have been described as important components for the scaling up and sustainability of CHW programs (Mudor et al., 2011; Crisp, Gawanas, & Sharp, 2008; WHO, 2006).

In order to further this thesis, information obtained from this review will inform our choice of indicators for CHW job satisfaction / motivation in our forthcoming mixed methods evaluation of a unique prototype CHW program in Pakistan. In short we

hypothesize that CHW job satisfaction / motivation is associated with attrition and overall CHW performance and productivity. Also based on these indicators that are specific to CHWs and their working environments, it will be essential to use the right kind of instrument for measuring job satisfaction, given the numerous instruments that are available to evaluate job satisfaction (van Saane, Sluiter, Verbeek, & Frings-Dresen, 2003).

3. COMPREHENSIVE REVIEW OF LITERATURE:

Community health workers (CHWs) are individuals with little or no formal education and are trained to provide basic health care and social services including health education and awareness within their own resident communities (Bhutta et al., 2010; Lewin et al., 2010; Standing & Chowdhury, 2008; Lehmann et al. 2007;). World Health Organization (WHO) defines CHWs as: 'CHWs are members of the communities where they work, should be selected by the communities, should be answerable to the communities for their activities, should be supported by the health system but not necessarily a part of its organization, and have shorter training than professional workers' (WHO, 1989). Further CHWs are either part of the broader government health system / national programs or work for private sector non-governmental organizations (NGOs) working in both paid or volunteer positions (Bhutta et al, 2010; Haines et al., 2007; Lehmann et al., 2007; Parlato & Favin, 1982).

History of CHWs being utilized to provide basic health care and social services can be traced back in literature to as early as the 1960s and 1970s. The 'barefoot doctors' in China (Sidel, 1972), auxiliary / village / volunteer health care workers in Tanzania, Venezuela, Niger, Cuba and Sudan (Standing et al, 2008; Hall & Taylor, 2003; Bennett, 1979; Benyoussef & Christian, 1977) are examples of low and middle income countries where this cadre of health workers were initially employed to make basic health care services available. Their services were utilized particularly in rural and underserved populations, where health systems were apparently weak and faced a mammoth human resource crisis of highly skilled trained physicians and nurses.

Almost over three decades after the Alma Ata Declaration (WHO, 1978), focus in global public health has again shifted towards the importance of primary health care by building integrated health systems with inter-sectoral engagement and increased community participation (Lawn et al., 2008). Consequently there is also a renewed interest in the potential role that community health workers can play in delivering and scaling-up of primary health care services especially in developing countries and regions where the need is highest. CHWs perform a diverse range of functions and there is a growing consensus among public health experts (Lewin et al., 2010; Haines et al., 2007) that CHWs are an essential component of the health workforce linking the health system with the community, and can play an important role in achieving the Millennium Development Goals (MDGs) particularly in countries and regions which are off-target (WHO 2011; Technical task force report: The Earth Institute, 2011; Bhutta et al., 2010; WHO, 2006).

CHW programs in developing countries have shown substantial and promising results in reducing maternal and child mortality rates (Table 1), delivery of preventive interventions like family planning, immunization, change for healthy behavior, community mobilization, providing basic curative case management for diarrhea, malaria, tuberculosis, acute respiratory infections (ARIs) HIV / AIDS and promotion of health education which have facilitated in reducing the disease burden (Iver et al., 2011; Bhutta et al., 2011; Lewin et al., 2010 ;Bhutta et al., 2010; Jerome & Ivers, 2010; van Ginneken, Lewin, & Berridge, 2010; Celletti et al., 2010; Datiko & Lindtjorn, 2009; Standing et al., 2008; Harvey et al., 2008; Baqui et al., 2008; Zachariah et al., 2007; Haines et al., 2007; Lehmann et al., 2007; Bang et al. 1999; Parlato et al., 1982).

Table 1: Outcomes of CHW Intervention Projects in Developing Countries

Reference, year	Country	Objective	Outcomes
Bang *et al.*, 1999	India	To assess effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India	Neonatal, infant, and perinatal mortality rates in the intervention area (net percentage reduction) compared with the control area, were 25·5 (62·2%), 38·8 (45·7%), and 47·8 (71·0%), respectively (p<0·001)
Manandhar *et al.*, 2004	Nepal	To evaluate effect of a participatory* intervention with women's groups on birth outcomes in Nepal. *Participatory intervention included training of female facilitators including CHWs through community based participatory learning in which perinatal problems were identified, discussed and addressed	Neonatal mortality rate was 26·2 per 1000 live births in intervention clusters compared with 36·9 per 1000 live births) in controls, adjusted odds ratio 0·70; 95% CI = 0·53-0·94. Maternal mortality ratio was 69 per 100 000 live births in intervention clusters compared with 341 per 100 000 live births in control clusters, adjusted odds ratio 0·22; 95% CI= 0·05-0·90
Stanback *et al.*, 2007	Uganda	To compare the safety and quality of contraceptive injections by community-based health workers with those of clinic-based nurses in a rural African setting.	95% of community worker clients were "satisfied" or "highly satisfied" with services. 85% reported receiving information on side-effects. No serious injection site problems were reported. No difference in the odds of CRHW clients continuing use compared to clinic-based clients, odds ratio, OR = 1.2; 95% CI: 0.8 - 1.9
Baqui *et al.*, 2008	Bangladesh	T o assess effect of a homecare model and a community care model on key health-care behaviors and neonatal mortality	Neonatal mortality was reduced in the home-care arm by 34% (adjusted relative risk 0·66; 95% CI 0·47–0·93
Datiko *et al.*, 2009	Ethiopia	To establish whether involving HEWs in TB control improved smear-positive case detection and treatment success rates in Southern Ethiopia.	Mean case detection rate was higher in the intervention than in the control kebeles (122.2% vs. 69.4%, p,0.001) and mean treatment success rate was higher in the intervention than in the control kebeles (89.3% vs. 83.1%, p = 0.012)
Bhutta *et al.*, 2011	Pakistan	To evaluate the effectiveness of a community-based intervention package delivered through LHWs for reduction of perinatal and neonatal mortality in a rural district of Pakistan	Intervention package was associated with a reduction in perinatal and newborn mortality of 15-20%

Keeping in view the diverse primary health care functions that CHWs perform, various studies and reports also advocate the important role that CHWs can play in 'bridging the gap' (van Ginneken et al., 2010; Standing et al., 2008; Lehman et al., 2007; Ofosu-Amaah, 1983) between their respective communities and the formal health care systems particularly in rural and underserved populations of developing countries faced with a recognized shortage of skilled trained health care workforce (trained doctors, nurses and midwives).

With increasing evidence that CHWs can be an effective resource in promoting and providing basic preventive and curative primary health care interventions and by increasing access to health care particularly in underserved and rural populations, many authors have cautioned that special attention and careful planning is required for operationalizing and implementing these programs for their sustainability and large-scale expansion (Standing et al., 2008; Lehmann et al., 2007; Hall et al., 2003). Some studies also suggest that several CHW programs, particularly large-scale government or national level programs in developing countries, have been unsuccessful or have collapsed in the past (Standing et al., 2008; Lehmann et al., 2007; Gilson et al., 1989;). These studies have identified several factors responsible for the ineffectiveness of these programs. Some of these factors include paradigm shift in global development policy (in the 1980 / 1990's) towards neo-liberal policies, economic downsizing and political reasons which shifted the focus of various governments from the primary health care (PHC) model towards single disease interventions and vertical program approaches resulting in underinvestment (Standing et al., 2008; Lawn et al., 2008; Lewin et al., 2008; Lehmann et al., 2007);

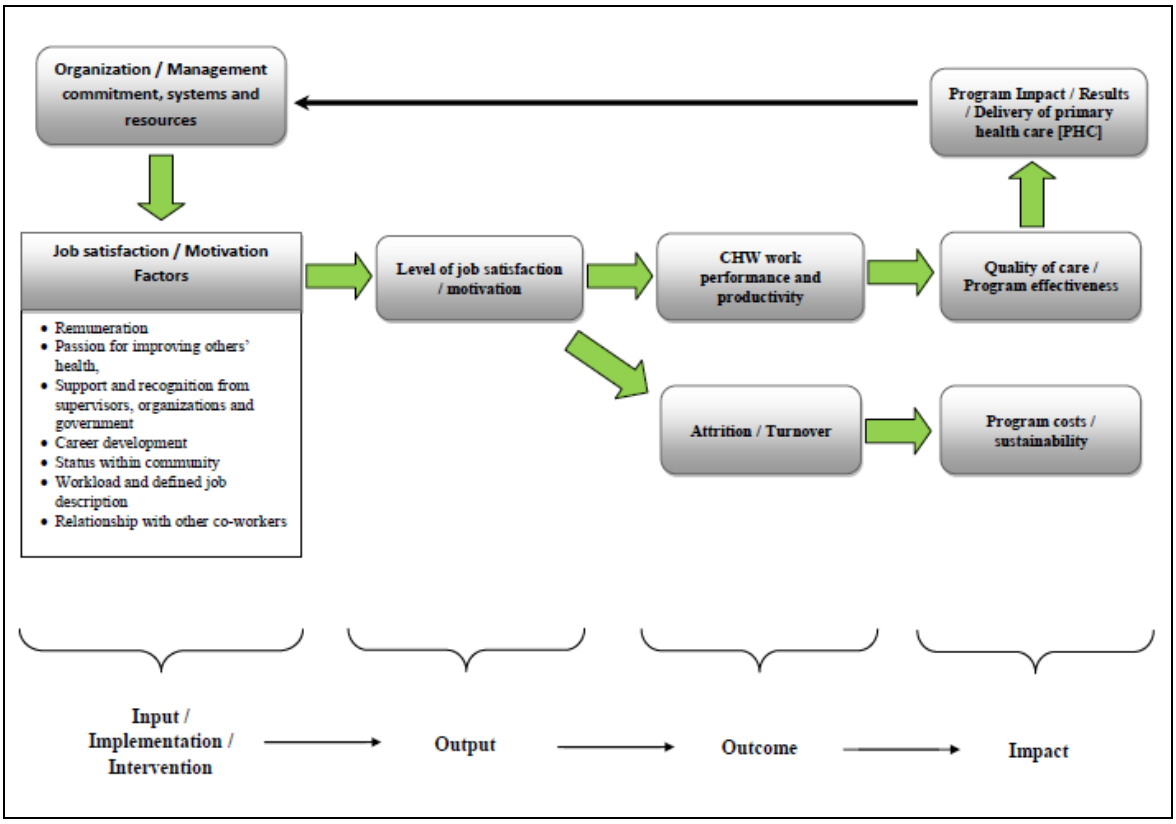
recruitment and selection of CHWs (Leihmann et al., 2007; Ofosu-Amaah, 1983;); unrealistic expectations and poor planning (Gilson et al., 1989); issues related to motivation, incentives and retention (Bhattacharyya et al., 2001; Chevalier el al., 1993; Bentley, 1989); and influence of community and health system on work performance of CHWs (Lehmann et al., 2007; Gilroy & Winch, 2006; Robinson & Larsen, 1990). Additional evidence also suggests that some CHW programs have failed in the past because the role of CHWs perhaps is underrated due to their ill-defined relationship with the broader health system and with other higher cadres of health professionals (Standing et al., 2008). Reason cited for this notion is that compared to other cadres of health staff they are at the tail end of the health workforce because of their poor economic status and with no or lower levels of education (Bhattacharyya et al., 2001). This is further influenced by their volunteer versus paid status (Maes, Kohrt, & Closser, 2010; Glenton et al., 2010; Walt, Perera, & Heggenhougen, 1989). This disconnect leads to inadequate support to CHWs from the health system and other cadres of health workers (Standing et al., 2008; Parlato et al. 1982; Lehmann et al., 2007; Teklehaimanot et al., 2007; Kitaw, Ye-Ebiyo, Said, Desta, & Teklehaimanot, 2007), resulting in high CHW attrition rates which affect sustainability, performance and large-scale expansion of these CHW programs in developing countries.

There is an emergent need to systematize, develop and strengthen sustainable CHW programs. This is because of the revitalized focus on implementing and integrating primary health care strategies and interventions within the broader health system along with community participation in order to achieve the MDGs targets. In developing

countries CHW programs are part of the pluralistic health systems which are influenced by distinct national level health sector policies, different socio-cultural settings, organizational structures / support, and dynamically changing political environments which influence health worker motivation, efficiency and service quality (Franco, Bennett, & Kanfer, 2002).

Literature reveals a paucity of studies that objectively evaluate programmatic issues associated with CHW job satisfaction levels and subsequently affects their work performance in developing countries. This review methodically analyzes and identifies CHW job satisfaction and motivation factors in developing countries associated with remuneration, material and financial incentives, status within community, recognition of work by the community, defined job description, workload, relationship with co-workers and other health staff, and career development (training and supervision), (Figure 1).

Figure 1: Conceptual Framework of Factors Influencing Job Satisfaction / Motivation of Community Health Workers



4. METHODS:

This review was undertaken in order to systematically identify, collate and evaluate published literature that details CHW job satisfaction / motivation in developing countries; and to compare quality of care between CHWs who received additional/refresher training and supervision versus those who did not receive the same.

A. Literature search strategy

Three electronic databases were selected for the purpose of reviewing relevant subject matter in published papers: (1) Pubmed, (2) Cochrane library, and (3) Popline. These databases were selected on the basis of commonly accessed databases by global public health experts which contain peer reviewed articles published in journals with high Institute for Scientific Information (ISI) impact citation indices, wide linkages with other high profile databases and because they are more accessible to global public health individuals working in developing countries. The review was also broadened to include publications from other sources including websites/search engines: (1) WHO, (2) Human Resources for Health [HRH] Global Resource Center, and (3) Google Scholar. We included original published research papers; however book reviews, obituaries and letters to the editor were excluded. Keywords were searched in the abstract and title of papers. The term 'community health worker' (medical subject headings [MeSH]) was used with a Boolean operator 'and' with the terms 'job satisfaction'[MeSH], 'motivation' [MeSH], 'supervision', 'training', 'remuneration' [MeSH], 'incentives', 'career development', 'job description' [MeSH] and 'performance'. Finally reference lists of obtained articles and

important published systematic reviews on CHWs were also hand searched for additional publications to be reviewed, provided they met the eligibility criteria.

B. Scope and inclusion/exclusion criteria of review

1. Type of CHW

This review included CHWs working in developing countries (definition of developing countries, World Bank 2011), who are hired on paid and unpaid (volunteer) positions irrespective of whether they are either part of the national government system or have been employed by the private sector NGOs. The review includes CHWs labeled with different designations or titles (Bhutta et al., 2010; Lehmann et al., 2008; Lehman et al., 2007; WHO, 2007) that are used globally in different countries (e.g., CHWs, lady health workers [LHWs], health extension workers [HEWs], lay community workers and community volunteers).

2. Type of outcomes

a. Job Satisfaction

Different theories have been used to define 'job satisfaction'. It can be defined as the degree or extent to which both intrinsic and extrinsic factors, categories and viewpoints of a job that affect the individual or employees' level of satisfaction. Locke (1976) defined job satisfaction as 'a pleasurable emotional state resulting from appraisal of one's job or job experience'. Rainey (1997) attributed this to how people feel about their job

and various aspects of their job. According to Spector (1997) the elements of a job can have differing degrees of importance, which can cause those elements to be weighted differently in assessing overall job satisfaction i.e. an individual can feel satisfied, dissatisfied or neutral about the different components or factors about a job. Because of variability in the definition of job satisfaction, 'satisfaction' was abstracted as defined in each study.

b. Attrition

Attrition is defined as the percentage of personnel leaving an organization or reduction in size of workforce over time. Chankova and co-workers (Chankova, Muchiri, & Kombe, 2009) have ascribed attrition of health workers as one of the major causes of human resource crises for health and have defined attrition as the number of health workers who permanently leave their job positions.

c. Quality of care and program effectiveness

The Institute of Medicine (IOM) defines quality in health care as 'the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge'. Quality of care encompasses all such elements or factors that are essential for improving overall health care outcomes with the objective of recognizing risk of disease, making appropriate diagnosis and treatment, scheduling required follow-up, stimulating appropriate

compliance or adherence to treatment protocols and algorithms, and increasing satisfaction of patients. Program effectiveness can be shown as decreasing complications, morbidity and mortality rates; decreasing overall cost of care (cost-effectiveness); and increasing equity and access to health care. Because of the variability in the definition of quality of care and program effectiveness, 'quality' and 'effectiveness' were abstracted as defined in each study.

d. Median effect size (MES):

Median effect size (MES) is defined as the median of effect sizes for all outcomes for a given comparison from a given study (Rowe A. et al., 2011). The general definitions of effect sizes were as follows:

a) Definition of effect size for dichotomous outcomes or outcomes that are expressed as a percentage for each subject

Effect size = (%POST – %PRE)intervention – (%POST – %PRE)control

b) Definition of effect size for outcomes that are continuous, but not obviously bounded (e.g., mortality rate)

Effect size = 100%*([POST – PRE] / PRE)intervention – ([POST – PRE] / PRE)control

Whenever possible, outcomes were abstracted in "positive" terms, so that the higher the value, the better the performance (i.e., effect size > 0 indicates improvement). For outcomes in which a decrease indicated an improvement (e.g., mortality rate), the effect size was multiplied by (-1) and then combined with other effect sizes in the analysis.

3. Type of factors hypothesized to affect job satisfaction / motivation

For this review, based on extensive analysis of existing literature, the following categories were used to identify, collate, and assess job satisfaction / motivation factors:

- Remuneration
- Material and financial incentives
- Possibility of future paid employment and promotion
- Status within community, community recognition, community support and respect for CHW work
- Career development (personal growth and development, training, supervision and acquisition of valued skills)
- Workload, utilization of time
- Defined and clear role (job description)
- Relationship with other co-workers and health staff
- Passion for improving others' health, community service, sense of achievement

4. Language

Relevant peer reviewed publications in English language were included for critical appraisal. Publications in languages other than English could not be translated due to resource constraints and therefore were excluded.

5. Study design

Publications with randomized controlled trial, case-control, cohort, observational, non-randomized controlled trials, interrupted time series, longitudinal and cross-sectional study designs were included in the review.

6. Timing

For studies identified through the search of electronic databases, all studies were included that were published between 1966 and July 31, 2011. During the same period, published studies identified through other methods including websites' search, research papers, institutional review articles, and reference lists, were also reviewed and included.

7. Exclusion criteria

Articles not published in English language were excluded because of resource limitations. To avoid bias, organizational reports and country specific reports / case studies were also excluded because they are neither peer reviewed nor are linked with impact citation indices. Further they do not follow specific study design methodologies. However published articles if cited in their references were hand searched for inclusion.

C. Data management

1. Data Collection:

Data collection was done using a data extraction form designed specifically for each of the study objectives.

2. Analysis:

i. For Objective 1:

- Frequency (%) of factors influencing job satisfaction / motivation were calculated. This enabled us to compare which factor(s) had the greatest influence on job satisfaction
- Comparison of 'percentage of CHWs that were satisfied' between 1) studies with remuneration listed as a motivating factor and 2) studies that did not list remuneration as a motivating factor
- Comparison similar (to the point above) of other most common factors reported in studies which listed them as motivating factors versus those reported in studies which did not list them as motivating factors
- Region wise summation of most common factors associated with job satisfaction / motivation (regions were defined as per WHO regional classification for e.g. WHO EMRO etc.)

ii. For Objective 2:

- Average range of attrition rates were calculated across studies

iii. For Objective 3:

- Quality of care was compared between CHWs who received additional/refresher training and those who did not receive additional/refresher training (data on duration of training was also collected)
- Quality of care was compared between CHWs who had supervision versus those who did not have any kind of supervision (monitoring)
- Outcome measures were compared between areas served by CHWs who received additional/refresher training and areas served by CHWs who did not receive additional/refresher training.
- The distribution of median effect sizes (MES) was displayed for: 1) all studies, 2) studies that investigated the effect of training only, and 3) studies that investigated the effect of training and supervision.

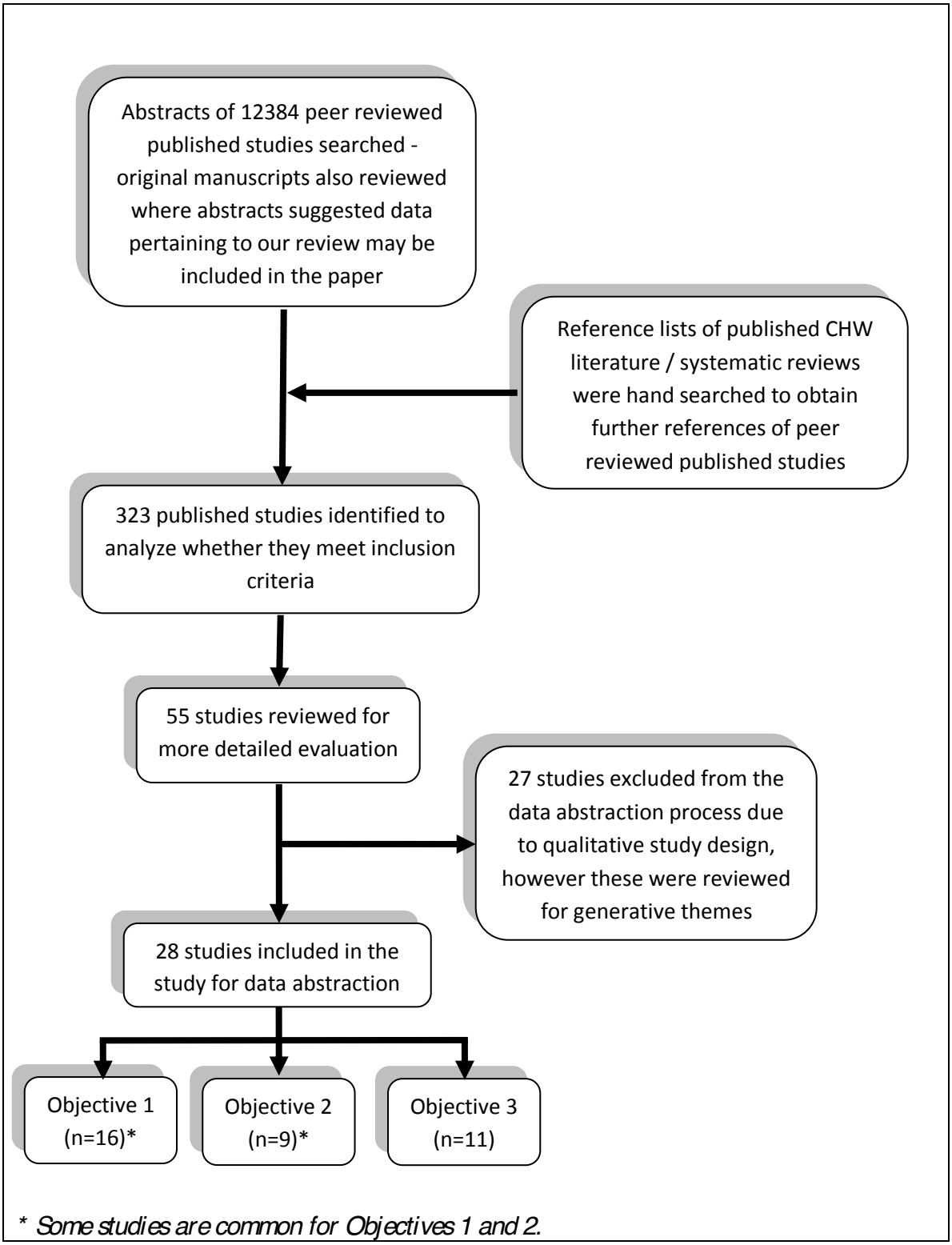
D. Institutional Review Board (IRB) Consideration:

This study is a literature review and did not involve human subjects' research; therefore no IRB consideration was required.

5. RESULTS:

We reviewed titles and abstracts of 12,384 published studies. Reference lists of published CHW literature / systematic reviews were also hand searched to obtain additional peer reviewed published studies. Of these, 323 potentially eligible studies were considered that warranted full review (Figure 2: Study Flowchart). 55 of these manuscripts were identified to be relevant to the research question and were included for more detailed evaluation. Of these, 27 studies were excluded from data abstraction process due to their qualitative study design; nevertheless these were reviewed for generative themes related to job satisfaction / motivation. Most of the studies (80%; N=55) were published during the period 2000 to 2011. Studies included represent low and middle income countries from five regions of WHO; African Region (45.5%; n=25), South East Asia Region (23.6%; n=13), Eastern Mediterranean Region (14.5%; n=8), Region of Americas (10.9%; n=6), and Western Pacific Region (5.5%; n=3).

Figure 2: Study Flowchart



Job satisfaction / motivation factors:

Themes related to job satisfaction / motivation, were identified in sixteen studies. Overall total number of CHWs was 2,621 (n=16 studies) (Appendix B: Summary of studies included for analysis). Ten (62.5%) of the 16 studies provided information for all three variables of interest i.e. total number of CHWs was 1428, and the percentage of satisfied CHWs was 67.3%. Across studies job satisfaction / motivation themes were co-related with remuneration, material and financial incentives, possibility of future paid employment and promotion, status within community / community recognition and respect for CHW work, career development (personal growth and development, training, supervision and acquisition of valued skills), workload and time utilization, defined and clear role (job description), relationship with other co-workers and health staff and passion for improving others' health. Additionally studies also reported eight other factors related to CHW job satisfaction / motivation. These were in addition to the nine themes hypothesized at the start of the review. These included religious and cultural beliefs / issues, availability of supplies, equipment, transport, job aids and training materials, pressures to financially assist patients with funds for travel and food, support and recognition from supervisors / organization / government and management, family support, competition from other health facilities, travelling distance to workplace, and lastly working environment (related to availability of electricity, noise etc.). Cross-country, region wise summation of most common factors associated with CHW job satisfaction / motivation are summarized in Table 2.

Table 2: Region* wise summation of most common factor associated with CHW job satisfaction / motivation (*Global World Health Organization (WHO) Regions)	
WHO African Region (n=6 studies)	
Countries*: Ethiopia (1) Nigeria (1) South Africa (2) Tanzania (1)	Most common factor: • Passion for improving others' health, community service and sense of achievement
WHO South East Asia Region (n=4 studies)	
Countries*: Bangladesh (2) Nepal (2)	Most common factor: • Status within community, community recognition
WHO Eastern Mediterranean Region (n=3 studies)	
Countries*: Iran (1) Pakistan (1) Somalia (1)	Most common factor†: • Material and financial incentives • Just right workload • Good relationship with co-workers • Passion for improving others' health, community service and sense of achievement *†There were more than one common factors*
WHO Region of Americas (n=1 study)	
Country: Colombia	Most common factor†: • Status within community, community recognition • Passion for improving others' health, community service and sense of achievement *†There were more than one common factors*
WHO Western Pacific Region (n=2 studies)	
Countries: Solomon Islands Taiwan	Most common factor†: • Career development, acquisition of valued skills • Passion for improving others' health, community service and sense of achievement *†There were more than one common factors*

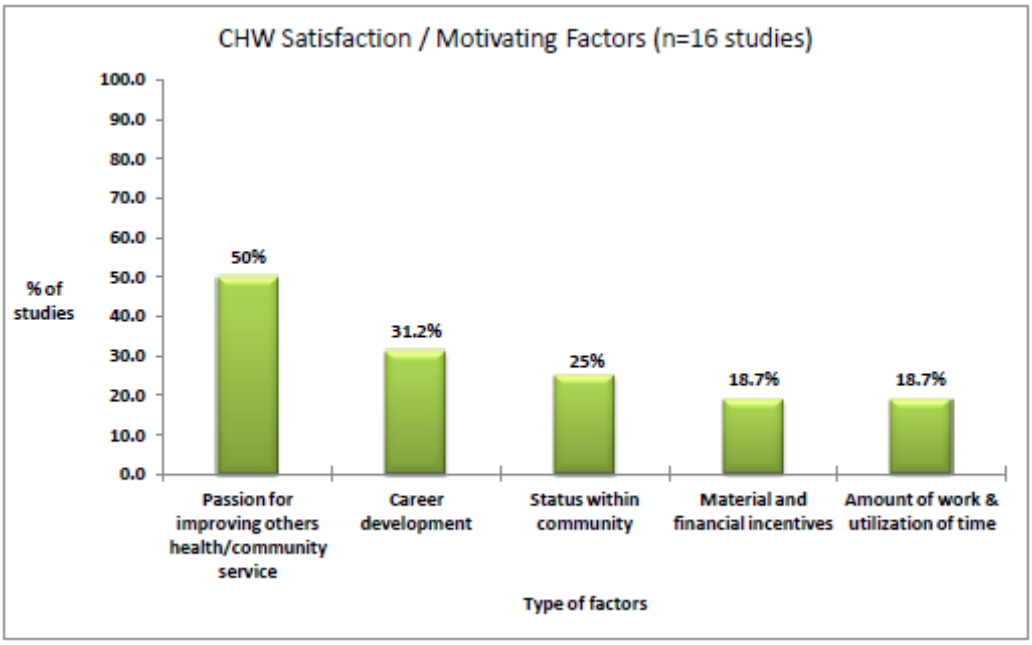
*Numbers in parenthesis indicate number of studies from a particular country

Passion for improving others' health and community service was identified in 50% of the studies (n=16 studies) as the most common job satisfying / motivating factor. CHWs felt a sense of achievement and pride in helping and serving their respective communities. Career development (31.2%), status within community (25%), material and financial incentives (18.7%), and efficient utilization of time (18.7%) were other most common CHW satisfying / motivating factors (Graph 1). Lower salary or remuneration was observed as the most common dissatisfying / de-motivating factor in 50% of the studies (n=16 studies). CHWs were discontent with the level of compensation provided in return for their services. This was further complicated by irregularity in payment of remuneration which caused displeasure and frustration amongst the CHWs. Inadequate incentives (31.2%), inadequate or lack of training and supervision [career development] (31.2%), increased amount of work (25%) and less support and recognition from the government / organization or program (25%) were other most common factors attributed to dissatisfaction / de-motivation (Graph 2).

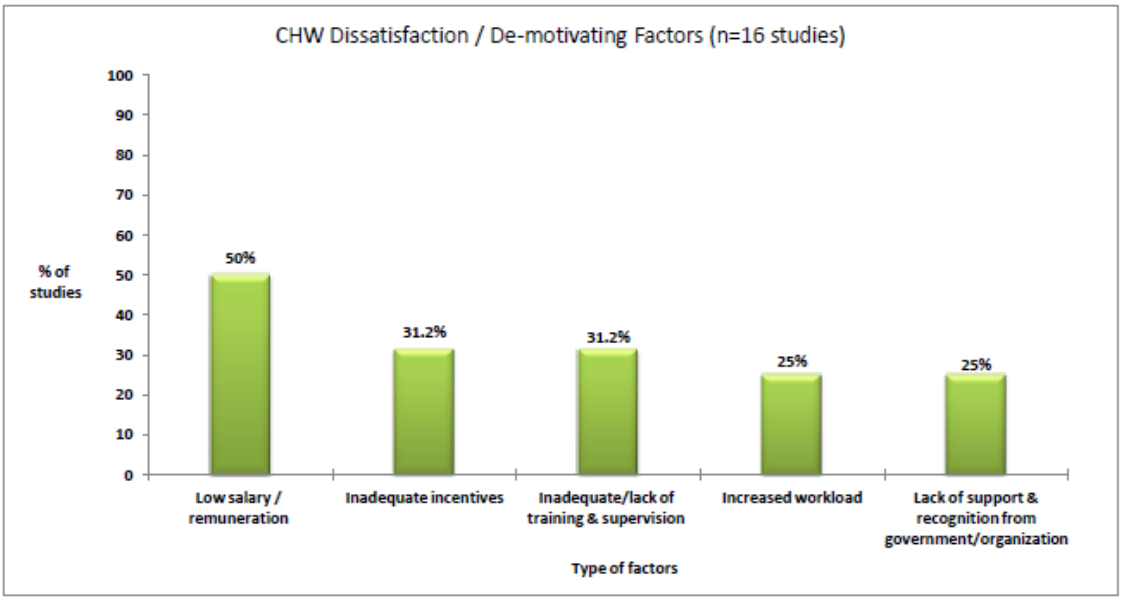
Of the 16 studies abstracted for the first objective, eleven were paid CHW programs while five were volunteer CHW programs. CHWs both as paid workers (31.2%, n=5/16 studies) or as volunteers (18.7%, n=3/16 studies) shared a comparable passion for community service and were motivated to provide health services to their communities (Graph 3). In contrast in the same series of 16 studies, most common dissatisfaction factors were low remuneration (43.7%, n=7/16 studies) and inadequate material and financial incentives (12.5%, n=2/16 studies) for CHWs working in paid and volunteer

programs respectively (Graph 4). Studies reported that CHWs expect something in return for the services that they provide.

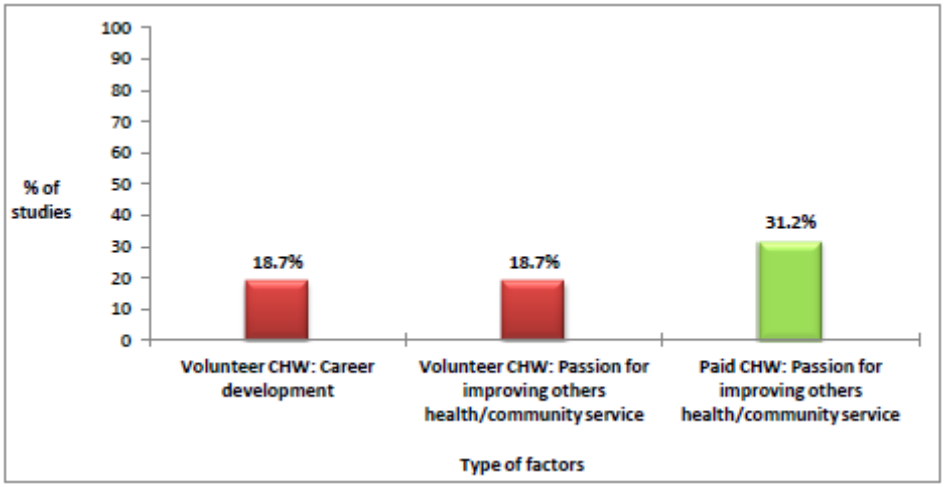
Graph 1: Most Common CHW Satisfaction / Motivation Factors



Graph2: Most Common CHW Dissatisfaction / De-motivation Factors

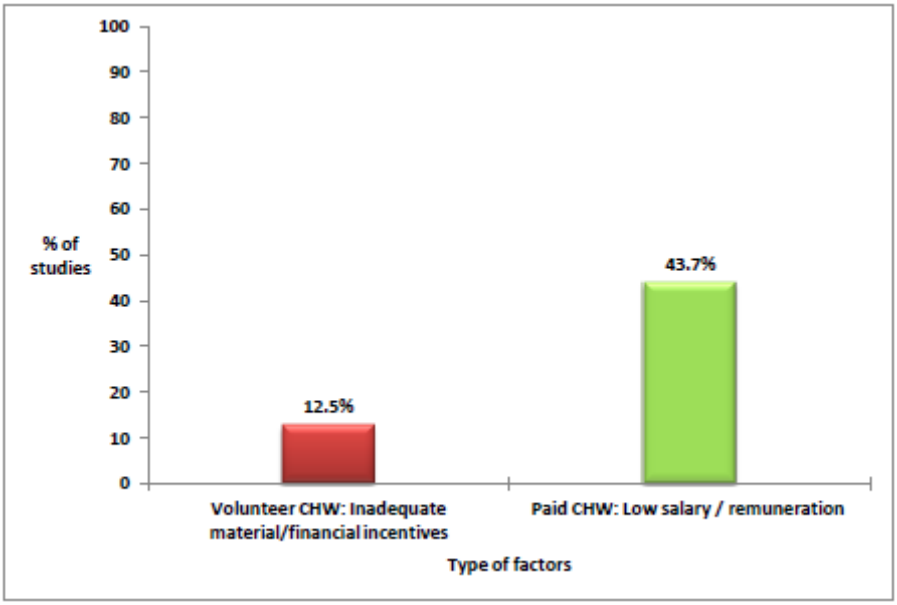


Graph 3: Comparison of Most Common Motivation Factors in Volunteer CHW Programs (5 studies) vs. Paid CHW Programs (11 studies) (n=16 studies)



Legend: Red bars denote 'Volunteer CHWs', Green bar denotes 'Paid CHW's

Graph 4: Comparison of Most Common De-motivation Factors in Volunteer CHW Programs (5 studies) vs. Paid CHW Programs (11 studies) (n=16 studies)



Legend: Red bar denotes 'Volunteer CHWs', Green bar denotes 'Paid CHW's

Attrition rates:

Nine studies provided information about CHW attrition rates. Overall attrition rates across these studies ranged from 11.8% to 47%, with a mean attrition rate of 28.2%. Five studies provided attrition rates for paid CHW programs (mean attrition rate of 31.5%, range 11.8% to 47%) compared to four volunteer CHW programs (mean attrition rate of 24.1%, range 22% to 28.2%). Annual attrition rates of 3.8% and 4.8% were reported by only two studies conducted in Nigeria and Solomon Islands respectively. No cumulative effect can be demonstrated across studies between attrition rate and number of CHWs satisfied / motivated and dissatisfied / de-motivated because attrition rates provided across majority of the studies show considerable variation over time, are non-uniform, do not document reasons for attrition and neither do they provide information regarding total numbers of satisfied or dissatisfied CHWs (Appendix C, last column: details of attrition rates as reported by individual studies). Of the nine studies, two provided information for all three variables of interest i.e. total number of CHWs, number of CHWs satisfied and number of CHWs dissatisfied. These two studies were conducted in Bangladesh (percentage of CHWs satisfied = 70%, overall attrition rate = 45.2%) and Somalia (percentage of CHWs satisfied = 100%, overall attrition rate = 11.8%). (Appendix C: Summary of CHW Attrition Findings).

Characteristics of additional training / refresher training and additional / regular supervision related to quality of care:

Eleven studies were included and reviewed. These studies reported discrete outcomes which included breastfeeding and lactation management, management of acute respiratory infections, treatment of perinatal depression, preparation of homemade sugar-salt solutions, nutrition education, clinical skills assessment, Integrated Management of Childhood Illness (IMCI) training, preparation and interpretation of rapid diagnostic tests (RDTs), stillbirth and perinatal mortality, worker adherence to clinical guidelines, and sepsis management in neonates (Appendix D: Summary findings from individual study specific interventions). Four (36.4%) studies had a 'post-only study with non-randomized control' design, three (27.2%) had a 'cross-sectional' study design while the remaining four studies had a 'post-only study with randomized controls' (9.1%), 'retrospective observational' (9.1%), 'pre-post study with non-randomized controls' (9.1%) and 'post only study with no controls' (9.1%) study designs. All (90.9%) but one study reported statistically significant impact of the interventions they employed (Appendix D: Summary findings from individual study specific interventions). Training of CHWs was reported by all studies. Duration of training across studies ranged from 3 hours to 18 months. Only one study reported that CHWs were trained in their local language (Davies-Adetugbo et al., 1997). Using multivariate analysis one study reported that there was no significant association between CHW refresher training/supervision (intervention) and CHW adherence to treatment-specific guidelines (S. Rowe et al, 2006). This same study also revealed that other non-intervention factors such as patient characteristics were significantly associated with overall adherence to treatment guidelines adherence. Effect

sizes for the impact of training were calculated on a percentage-point scale for each study. If a study had multiple outcomes then a median effect size (MES) was calculated for that study. From ten (90.9%) studies for which an effect size could be calculated (the 'post-only study with no controls' was excluded), 16 outcomes were abstracted. From these 16 outcomes, 12 MES were calculated and compared (Table 3 and Appendix D). There were more MES than the number of studies because two studies involved 2 intervention groups, and thus, for each of those studies, 2 MES were calculated (i.e., one MES for intervention group 1, another MES for intervention group 2). The median MES for training showed a moderate effect 23.8 %-points; [range -4.1, +37.0]. Comparison also suggested that MES for training of six studies was to some extent better compared to other studies (Graphs 5 and 6). Regarding supervision eight (72.7%) studies reported that CHWs were supervised. Five (45.5%, n=5/11) studies comprehensively described supervisory contact visits, days or follow-up with CHWs (A. Rahman et. al, 2008; Harvey et. al; S. Rowe et al., 2006; Chaudhary et al. 2005 & Curtale et al., 1995).

Combined median effect size of seven studies (in which CHWs received both training and supervision) was 12.5%-points (MES range: -4.1 to 37.0%-point change) compared to combined median effect size of 26.7%-points for three studies (MES range: 20.8 to 34.5%-point change) in which CHWs only received training but no supervision (Graph 7).

Table 3: Summary Findings of Studies with Focus of Interest on CHW Training, supervision and median effect size for training					
Std. #	Authors, year of publication	Study objective	Focus of Interest		
			Additional training / refresher training received	Worked under additional / regular supervision	Median effect size (MES) for training
1	Davies-Adetugbo *et al*., 1997	Training of community health extension workers in breastfeeding and lactation management and to evaluate its impact on breastfeeding knowledge and practice. [Ife South Breastfeeding Project (ISBFP)]	Yes	No	34.5
2	Hadi, 2003	To assess the role of management practices for acute respiratory infections (ARIs) in improving the competency of community health volunteers in diagnosing and treating acute respiratory infections among children	Yes	Yes	8.7
3	A. Rahman *et al*., 2008	To assess the effect of cognitive behaviour therapy-based intervention by community health workers on perinatal depression in women and to test the hypothesis that treatment of perinatal depression would lead to improved nutrition and other health outcomes in the infant	Yes	Yes	32
4	Yach *et al*., 1987	To determine whether village health workers (VHWs) could teach mothers to safely prepare homemade sugar-salt solutions	Yes	No	20.8
5	Curtale *et al*., 1995	To assess the ability of Community Health Volunteers (CHVs) in delivering a program Nutrition Education Intervention (NEI), which includes a greater number of activities, both curative and preventive, than that	Yes	Yes	30

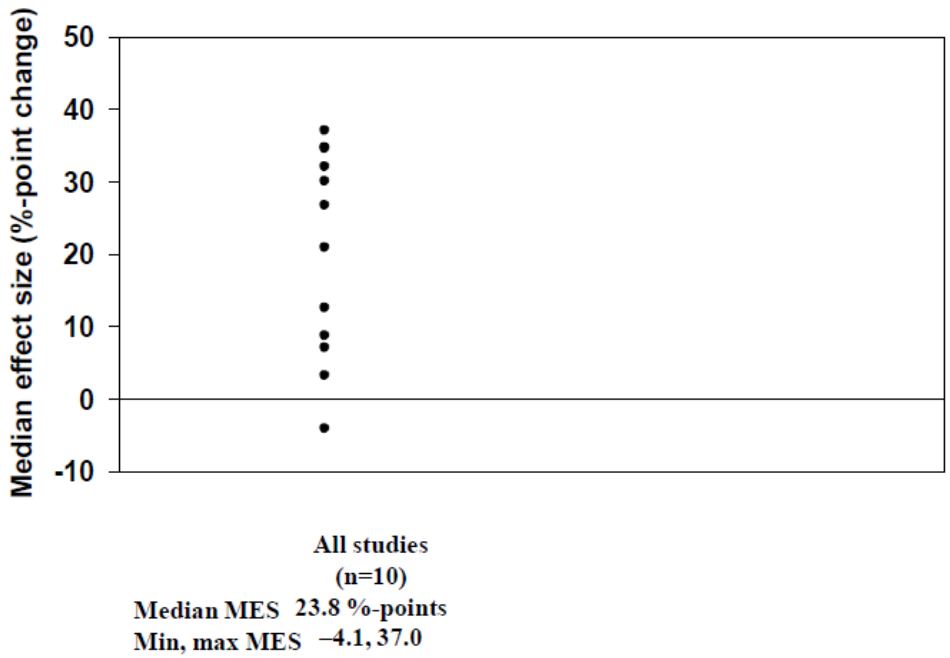
Table 3: Summary Findings of Studies with Focus of Interest on CHW Training, supervision and median effect size for training

Std. #	Authors, year of publication	Study objective	Focus of Interest		
			Additional training / refresher training received	Worked under additional / regular supervision	Median effect size (MES) for training
		presently delivered by the Ministry of Health (MoH)			
6	Carlough *et al*., 2005	Clinical skills assessment of maternal and child health workers (MCHWs) in Nepal	Yes	No	26.7
7	Chaudhary *et al*., 2005	To assess improvement in case management by training and follow- up* of anganwadi workers (AWWS). To assess the practice of skills learnt by basic health workers for 4 – 8 weeks and one year after IMCI training, and to identify the gaps in practices due to various constraints	Yes	Yes	Not applicable
8	Harvey *et al*. 2008	To determine: (i) whether Zambian CHWs could prepare and interpret rapid diagnostic tests (RDTs) accurately and safely using manufacturer's instructions alone; (ii) whether simple, mostly pictorial instructions (a "job aid") could raise performance to adequate levels; and (iii) whether a brief training program would produce further improvement	Yes	Yes	Group 3 versus 1 = 37 Group 3 versus 2 = 12.5
9	Bhutta *et al*., 2008	Impact of training lady health workers on stillbirths and perinatal mortality in rural Pakistan	Yes	Yes	'Intervention' training group = 34.6 'Control' training group = -4.1

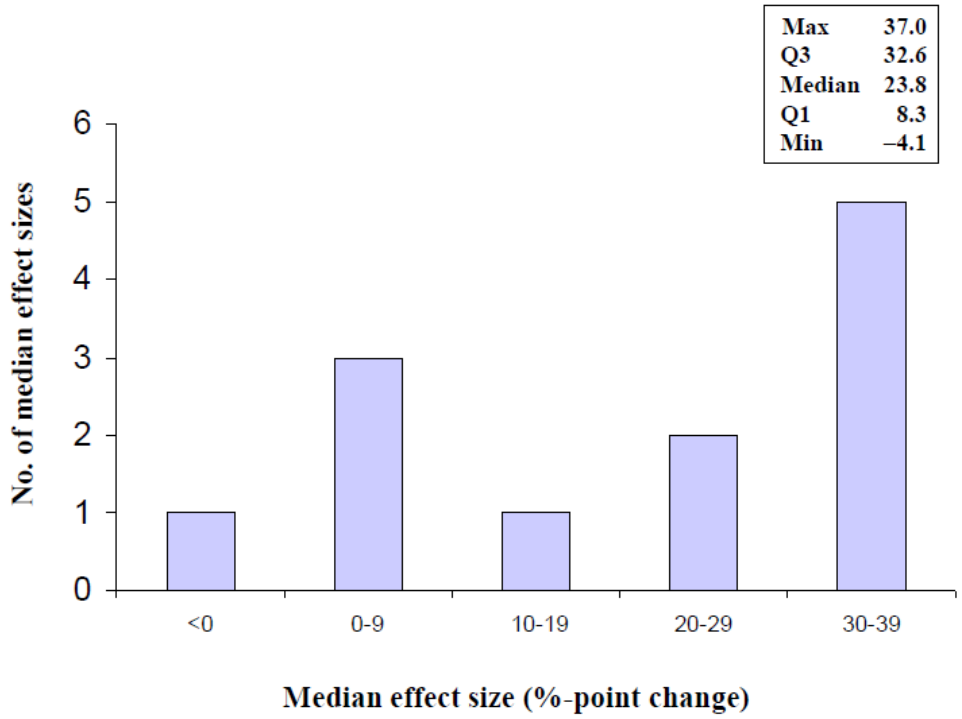
Table 3: Summary Findings of Studies with Focus of Interest on CHW Training, supervision and median effect size for training

Std. #	Authors, year of publication	Study objective	Focus of Interest		
			Additional training / refresher training received	Worked under additional / regular supervision	Median effect size (MES) for training
10	S. Rowe *et al*., 2006	To assess effect of multiple interventions on community health workers (CHW) healthcare practices. Determinants of overall guideline adherence among children seen by CHWs in the outpatient department at Siaya District Hospital, Kenya	Yes	Yes	1 refresher versus none = 3.2
11	Bang *et al*., 2005	To assess how effective is home-based management in reducing case fatality in neonates with sepsis	Yes	Yes	7

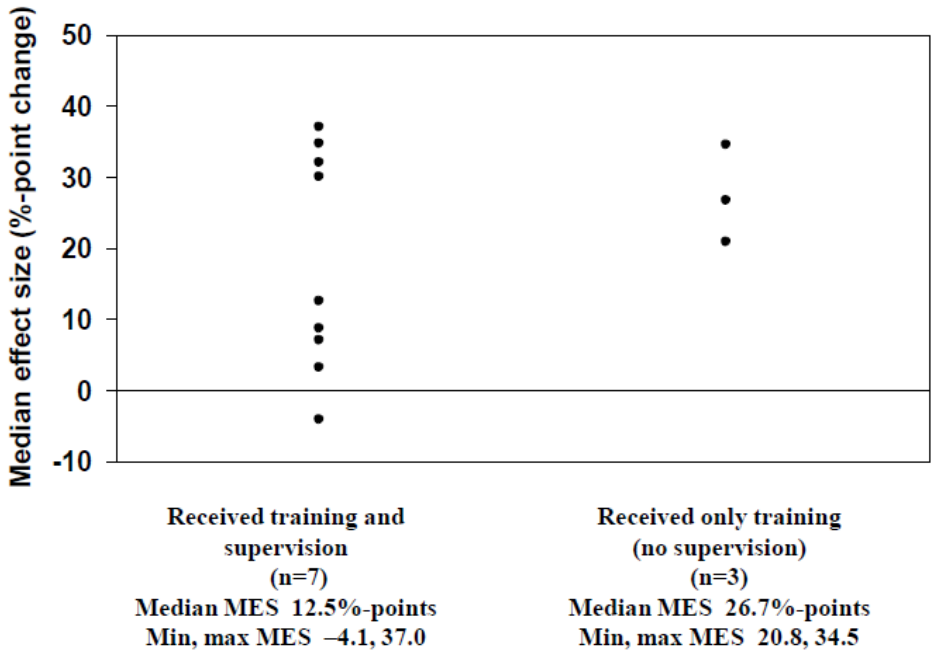
Graph 5: Summary of the Effect of Training



Graph 6: Frequency Graph Showing Distribution of the Effect of Training



Graph 7: Comparison Between Effect of Training + Supervision and Effect of Training (No Supervision)



6. DISCUSSION:

In this review we explored empirical evidence of the association between community health workers (CHWs) and job satisfaction / motivation, in peer-reviewed articles and systematic reviews published from January 1966 to July 2011. We also examined the impact of additional/refresher training and supervision on the overall performance of CHWs. Globally CHWs have long been recognized as an integral part of global public health delivery programs. And yet, there are too many countries in the developing world, where the aptitude to effectively manage this cadre of human resource base is underdeveloped. Finally based on the findings, this review has several implications discussed hereinafter. We also make recommendations for strengthening a sustainable framework to support CHWs in which their energy and allegiance for improving others' health can be motivated, mobilized and rewarded to the fullest potential.

CHW job satisfaction / motivation

Published literature on CHW job satisfaction and motivation is limited. This is due to several reasons. Epidemiological studies usually involve subjective selection of disease focused risk factors while ignoring the contextual aspects of human resource management of CHW programs. Another major issue has been the inadequate and lack of sustainable financing of such programs. CHWs are the lowest cadre of health workers and are usually considered as a low cost method of providing primary health care to underserved and indigenous populations – thus limited funds are allocated for such programs (Standing & Chowdhury, 2008). This impedes programs from employing

operational research techniques for evaluating such programs especially from a human resources perspective. Further most of the limited published studies that explore CHW job satisfaction and motivation have methodological and design problems. Factors that influence CHW job satisfaction and motivation are manifold. Simple study designs and associations fail to describe the wide gamut of potential factors and determinants that influence job satisfaction and motivation.

Cumulative results of this review indicate that CHWs had a moderate job satisfaction level of 67.3%. This finding is consistent with job satisfaction findings as reported in other limited published articles on CHWs job satisfaction (Ge, Fu, Chang, & Wang, 2011). Results from this review (n=16 studies) indicate that the most common job satisfying factors were passion for improving others' health / community service (50%), career development (31.2%) and status within community (25%) (Graph 1). CHW passion for improving others' health stems from the strong behavioral, socio-cultural values and practice of community service. This ethic perhaps emanates from the traditions of caring for others and volunteerism - a strong relationship which is deeply rooted between community health workers and providing voluntary services to their respective tribes and communities. This can be traced back historically to the bare foot doctors of China (Sidel, 1972). CHWs feel passionate about delivering health care services in a practical and culturally appropriate manner to meet the basic health needs of individuals within their own communities. The current series of articles (n=16 studies) show an almost equal percentage of studies (50%, 31.2% and 31.2%) that report dissatisfaction in CHWs related to lower remuneration, inadequate incentives and

discontent with career development (inadequate / lack of training and supervision) respectively (Graph 2). Among individual studies percentage of de-motivated CHWs ranges from 6.3% to 92.2% (n=10 studies). Type of dissatisfaction / de-motivating factors noted in this review are also consistent with the findings reported in a few published qualitative studies conducted to assess de-motivating factors among CHWs (Olang'o, Nyamongo, & Aagaard-Hansen, 2010; Muller, Murenzi, Mathenge, Munana, & Courtright, 2010; Schneider, Hlophe, & van Rensburg, 2008; Mkandawire, & Muula, 2005; Dieleman, Cuong, Anh, & Martineau, 2003; Upvall, Sochael, & Gonsalves, 2002; Ramirez-Valles, 2001).

In-depth evaluation of literature reveals a common theme of 'unrealistic or rising expectations' from CHWs in the form of salaries, stipends or in kind incentives in return for the services that they provide (Bhutta et al, 2010; Lehmann et al; 2007; Bhattacharyya et al., 2001). These expectations have always been intrinsically related to CHW programs and this is typical for both paid and volunteer based programs (Rahman et al., 2010; Haq, Iqbal, & Rahman, 2008; Suri, Gan, & Carpenter, 2007; L. Zerden, M. Zerden, & Billinghurst, 2006; Kironde, & Klaasen, 2002; Chevalier et al, 1993; Chaulagai, 1993). Our analysis of results from the same series of articles (n=16 studies) supports this proposition which shows similarities between the most common de-motivating factors between volunteer based CHW programs versus paid CHW programs (Graph 3). Lower remuneration packages (43.7%, n=16 studies) and inadequate material / financial incentives (12.5%, n=16 studies) are the most common de-motivating factors in paid and volunteer based CHW programs respectively (Graph 4). Frustration at the low stipend

received (Suri et al, 2007); irregularities of remuneration by source of payment (Cheavlier et al., 1993), dissatisfaction with inadequate and irregular salary (Haq et al., 2008) are some examples of studies that accentuate this issue. These results are supported by previous reviews and reports on CHWs published by Lehman et al. (2007) and Bhattacharyya et al. (2001). In their extensive report on CHWs, Bhattacharyya and coworkers (Bhattacharyya et al., 2001) also highlight the specific problems of long term sustainability of payments, irregularity and inequity related to payments among different CHWs programs. These specific problems confound the practice of providing CHWs with financial packages and incentives both in cash or kind.

CHW attrition:

Maintaining a motivated workforce is not a new concept in human resource management. Despite the prevalent acceptance and mobilization of CHWs in delivering basic health care services to their communities, effective programmatic and administrative management of this cadre of workforce is underdeveloped. We have taken a pragmatic approach in this review to examine CHW job satisfaction / motivation in addition to attrition. It is reasonable to suggest that job satisfaction / motivation are a product of heterogeneous factors (wages, working environments, status within community, career development etc.), rather than focusing on any one particular factor alone.

In-depth review of analyzed literature illustrates that attrition rates in CHW programs have been reported in a handful of previously published studies (M. Rahman et al., 2010;

Brown, Malca, Zumaran, & Miranda, 2006; Kironde et al., 2002; Curtale et al., 1995; Chaulagai, 1993; Chevalier et al., 1993) including reviews of country specific programs / reports (Lewin et al., 2010; Bhutta et al.; Lehmann et al., 2007; Glenton et al., 2010, Ofosu-Amaah (1983). Several studies and reviews have reported different CHW attrition rates. In their review on CHW incentives and disincentives, Bhattacharyya and co-workers (Bhattacharyya et al., 2001) have reported attrition rates ranging from 3.2% to 77%. In a recent 2010 study published in Human Resources for Health, M. Rahman et al. (2010) reported that of the total CHWs recruited; 45.2% dropped out of the project over a four year period whereas only 54.8% worked until the end of the project. In their qualitative study that focused on a female community health volunteer program in Nepal, Glenton and co-authors (2010) reported an annual attrition rate of 5% for this large volunteer program.

For the second objective, we examined CHW job satisfaction / motivation in conjunction with their attrition rates. Whilst it is recognized that there is lack of evidence for reporting CHW attrition rates, reporting formats for attrition rates also differ (Nkonki, Cliff, & Sanders, 2011). Results from this review indicate that attrition rates for CHWs are 3.8% to 4.8% per annum (from 2 studies) with overall program attrition rates ranging from 11.8% to 47% (from 9 studies) (Appendix C). It is important to note that main causes of attrition reported in literature generally revolve around issues related to remuneration (payment of wages) and material and financial incentives.

This body of evidence is by no means sufficient for managing a healthcare workforce based on standardized guidelines of human resource management. Limited reporting of CHW attrition and retention rates is due to the fact that health care interventions delivered by CHWs are mainly focused upon reporting impact of health related outcomes, morbidity, mortality and population demographics. And, this holds true for CHW programs managed by country specific governments as well as non-governmental organizations (NGOs) (Nkonki et al, 2011). Caution should be exercised when interpreting and comparing the limited evidence available for CHW attrition rates across published studies. Three distinct issues may contribute to the lack of evidence regarding CHW attrition. Not only do the published studies vary in research methodology, but in some cases selection of attrition indicators is also poorly defined. Furthermore attrition reporting statistics are also divergent across studies such as average annual and yearly attrition rates, proportions related to time-series or number of CHWs who are absent/have left the program (Nkonki et al, 2011; Chaulagai, 1993; Brown et al., 2006; Chevalier et al., 1993; Bamisaiye, Olukoya, Ekunwe, & Abosede, 1989). A lack of standardized reporting or usually missing data for attrition rates may be because of the programmatic costs involved in maintaining up-to-date CHW records. Further published studies, country specific reviews and case studies usually report CHW attrition obtained retrospectively from payroll / programmatic records - quality of which may vary considerably and in many instances are inconsistent.

Even though results of this review demonstrate scanty data on CHW attrition, one also needs to look at it from a different perspective. At a conceptual level, one may argue that

attrition may not necessarily be looked upon from a negative aspect. CHW attrition or turn-over can also be related to moving up to a higher or senior position within the same or different program or altogether being promoted to a different cadre of health worker for e.g. nurse aide (Chevalier et al., 1993). Alternatively CHWs may themselves initiate the attrition process for attaining higher professional education or attrition may also be initiated by the project itself either to promote CHWs to a higher position within the same project or terminate a few due to poor performance and / or on disciplinary grounds (Rahman et al, 2010). Improved reporting of CHW programmatic data would therefore help to determine and validate which attrition factors are associated with CHW motivation / de-motivation and what are the actual causes of CHW attrition, rather than just providing general attrition rates.

Quality of care, training and supervision:

CHWs often receive inadequate support for additional/refresher training and supervision from their respective programs and health systems (Standing & Chowdhury, 2008; Mathauer & Imhoff, 2006; Chaulagai, 1993; Gray & Ciroma, 1988). As reported earlier, lack of adequate training and regular supervision was one of the most common CHW dissatisfying / de-motivating factor (31.2%, n=16 studies) in this review as well. This ultimately may lead to attrition or affect their overall performance. The wide gamut of available evidence on CHWs mostly focuses upon intervention-disease specific processes of change, where interventions delivered through CHWs trained in a specific health delivery module are compared with a control group/area (which has no CHWs / no

intervention). Considerable progress has been made in reducing overall burden of disease and specific disease outcomes. This has been made possible by utilizing trained CHWs as a mechanism of delivery of specific primary health care interventions. It however should be borne in mind that this progress towards reducing global morbidity and mortality does not necessarily equate with improving effectiveness of training and supervision and overall performance of CHWs.

Both from a theoretical and pragmatic perspective, training and supervision are important aspects of managing a motivated and efficiently performing workforce. From broader human resources for health perspectives, regular training and sustainable supervision in CHW programs are important issues and merit more accurate assessment if performance and quality of services needs to be improved. Third objective of this review was to compare quality of care between CHWs who receive additional / refresher training and/or supervision versus those who do not receive the same. In this series of studies (n=11), all had heterogeneous outcomes (refer to Appendix D). These outcomes were analyzed by calculating effect sizes of training on a percentage-point scale in order to collate and summarize the median effect size for training across these studies. This allowed comparison of quality of care between providing additional / refresher training and/or supervision to one group of CHWs with another group of CHWs who did not receive the same. Based on the results of this review, MES for training across studies was moderate. However three studies predominantly had larger MES for training [Harvey et al., 2008 (Group 3 vs. 1); Bhutta et al., 2008 (intervention training group); and Davies-Adetugbo et al., 1997]. Largest effect size was from the Harvey et al., 2008 (Group 3 vs. 1) study

which had a 'post-only study with non-randomized control' study design to compare a group of health workers who received training, job aids, and supervision for a rapid diagnostic test for malaria with a group who received only the manufacturer's instructions for the rapid diagnostic test.

In this review, one cross-sectional study using multivariate and linear regression analysis showed no substantial impact of providing refresher trainings, supervision, job aids, drug supplies, and involving the community in CHWs' selection on CHW adherence to treatment-specific clinical guidelines (S. Rowe et al., 2006). Based on these findings and given the moderate MES for training, one can conclude that the evidence for the effectiveness of training is mixed and further investigation is needed to design and implement interventions to effectively support CHWs.

Interestingly our study showed a higher MES for training without supervision (26.7%) as compared to training combined with supervision (12.5%). This finding should be interpreted with caution because: 1) the effect of training could be confounded by factors such as the quality of the training, the presence of other interventions besides training or supervision, diversity of outcome types, and adequacy of study design (only one of the 11 studies included in our review had a randomized control group); and 2) there was a small sample of studies of the effect of training. Undoubtedly additional rigorously designed studies are needed to explore the full impact of providing CHWs with training,

supervision and other aspects of program support that ultimately will influence quality of care and program outcomes.

Finally, providing appropriate training and supervision to CHWs is important from a programmatic and management perspective, in order to improve overall performance and quality of both the CHW workforce and the program itself. Additional longitudinal studies (S. Rowe et al., 2006) are required for evaluating long term performance of CHWs. Therefore it is important to examine, validate and address all factors that are associated with CHW performance outcomes. Further research is also necessary so that health care managers and policy makers have access to critical information to responsibly design and manage CHW programs with effective use of health care resources.

Analogous to motivating other cadres of health workers, having a motivated CHW workforce is also fundamental for sustainable performance and improving their quality of services (A. Rowe, de Savigny, Lanata, & Victoria, 2005). This will have a direct impact in the field and on the wider community and population in general. Enhancing CHW performance in-turn can have a synergistic effect in decreasing the global burden of disease and providing universal access to primary health care - these being the major objectives of achieving WHO MDGs by 2015.

CHWs play a vital role in the delivery of primary health care. Yet problems associated with CHW motivation / job satisfaction are complex and manifold. In spite of making significant advances in reducing mortality and decreasing morbidity, even large well established CHW programs both in the government sector [like the Health Extension Worker (HEW) Program in Ethiopia (Teklehaimanot et al., 2007; Kitaw et al., 2007) and the Lady Health Worker Program in Pakistan (Hafeez, Mohamud, Sheikh, Shah, & Jooma, 2011; Haq et la., 2008) and those associated with nongovernmental organizations [like the Shasthya Shebika aka CHWs associated with BRAC in Bangladesh (Khan, Chowdhury, Karim, & Barua, 1998) and CHWs associated with the newborn care intervention trial (Projahnmo-1) conducted in Sylhet District in north-eastern Bangladesh, (Rahman et al., 2010) all have reported similar daunting challenges related to CHW program management involving de-motivation and attrition.

This in-depth review draws attention to the following critical elements of managing CHW programs both at the field and management level:

- CHW programs are a subset of broader structural organizations i.e. in-country national health systems and local / international non-governmental organizations; dynamics of these systems themselves vary considerably
- Working environments vary across programs. These include organizational culture, peer support, relationship with other co-workers and health facility staff
- Weak linkage with the broader health system, absence of prototype referral systems
- Unclear accountability systems
- Increased involvement of the community itself (e.g. community leaders) in the selection process of CHWs
- Differences in terms of local geographical, socio-cultural, religious and political perspectives
- Being the lowest cadre of health workers, less attention is paid to develop tangible support systems (training, supervision, incentives, career development etc.)
- Neglected programmatic and administrative management of CHWs programs
- Lack of program planning and sustainability of CHW programs - CHWs are often employed for short term intervention projects. When the project completes its life cycle, CHWs have no means of continuing to earn their livelihood
- Ill-defined job descriptions and career pathways. In some programs, CHWs have been reported to supervise TBAs and midwives while in other programs this is an opposite equation (Krueger, K., Akol, A., Wamala, P., Brunie, A., 2011).

- Overstretched and increased workload which also decreases program coverage, performance and overall quality of services provided
- Irregular or non-existent feedback from supervisors
- Lack of practical contextual training. Usually training provided is theoretical and courses on health education are provided as 'supportive courses'. Often training materials are not in the local language
- Lack of political will

Job satisfaction and motivation has widely been studied outside the health care domain (Mudor et al., 2011). Standard Human Resource Management (HRM) guidelines and practices also stress upon job satisfaction which enhance employee performance ultimately contributing towards organization excellence. Addressing job satisfaction will require a multi-faceted approach. Community recognition, career development (inclusive of training and supervision), defined job descriptions, organizational and community support, monetary and material incentives and plausible working environments are some of the core factors that affect CHW motivation / job satisfaction. Addressing these issues are challenging indeed and will require a coordinated effort on multiple fronts involving multiple stakeholders, international donor agencies, national and local governments, local communities and where possible representatives of community health workers themselves.

7. RECOMMENDATIONS/ FUTURE DIRECTIONS:

Evidence based strategic program planning, good management structures and policies, institutional support systems, well designed and coherent methodological study designs including longitudinal and mix method study evaluation, better reporting of CHW programs, proper documentation, empirical data collection and recording, continuing reassessment and evaluation of CHW programs are critical to make a substantial difference in motivating and revitalizing this cadre of health workers. This is absolutely essential if we are to address the challenges of global public health and make primary health care accessible to all.

Based upon reviewing the literature and our extensive field experience, following recommendations need to be further carried out and tested:

1. Provide ongoing support for CHW programs from multilateral organizations and consortiums. For example the recently formed 'Frontline Health Workers Coalition' (refer to reference section for website). This coalition was established in January 2012 to promote strategic investment in frontline health workers in the developing world.
2. Develop global guidelines for effectively managing CHW programs which also take into account expected needs, local socio-cultural, religious and political connotations. These guidelines should be flexible enough so that they can be modified as per in-country specific health systems and requirements.

3. Provide committed priority, continued support with policy improvement and proper implementation of these policies by all stakeholders.
4. Integrate CHW programs with human resource management guidelines which include standardized methods for selection, recruitment, performance based appraisal, promotion, adequate and regular payment of salaries / incentives and supportive supervision.
5. Streamline CHW designations and job descriptions.
6. Allocate funds, make resources available and provide matching funds for developing sustainable supports for CHW programs.
7. Provide CHWs with two way accessible communication systems with their supervisors.
8. Provide technical assistance to countries for developing sustainable CHW programs.
9. Develop high and sustainable standards for CHW program governance, management and human resource development.
10. Provide well performing CHWs with career development pathways and promotion to higher level professional opportunities.
11. Provide clear job descriptions and job aids.
12. Train CHW programs managers and supervisors so that they can provide proper and regular supervision.
13. Develop and employ a GINI coefficient that measures both global and in-country inequalities among CHW programs.

14. Ensure regular monitoring and evaluation of CHW programs. Lot quality assurance sampling methods can also be applied in cases of limited financial resources.
15. Empower community health workers through strong institutional and community support systems [Paulo Freire's theory of community based participatory action research methodology - CBPAR, (Shreshta, 2003).
16. Institutionalize the link between CHWs, primary health care centers and the broader national health care systems - Provide recognition to CHW programs in countries where they have not yet been included in the formal health care system.
17. Restructure CHW training curriculum. Incorporate core set of skills and information related to improving community health outcomes with added emphasis on health education training. A standardized training toolkit should be prepared and disseminated (similar to standard WHO IMCI guidelines) - Individual CHW programs can then choose the components that can be applied to their programs in addition provide ongoing refresher trainings.
18. Include development and management of CHW programs as part of the continuous quality improvement (CQI) effort both in private and public sector programs.
19. Develop a cross-sectoral global consortium of experts in the fields of public health, community health and development, health policy and management, epidemiologists, bio-medical researchers, behavioral scientists and human resources to conduct independent monitoring and evaluation (M&E) of CHW programs followed by subsequent certification CHW programs.

20. Include certification of CHW programs based on their training, management and support structures as a pre-requisite for obtaining IRB approval for research projects.

Synopsis of Developing a Prototype CHW Program (Field Practice and Research):

The Division of Maternal and Child Health at the Aga Khan University (AKU) in Karachi, Pakistan is a leading academic centre in the field of child health and survival. It is recognized both nationally and globally for excellence in education, public health research, clinical care, and use of evidence based approaches for health care planning and policy within Pakistan. The division has a large community outreach and research program with over 1,200 dedicated research personnel (including 510 CHWs) who are based in 14 nationwide satellite outreach centers.

This program recognizes the global and national struggles, lack of systematic attention and politicization over developing robust CHW programs. Along with my team, I have personally developed and pursued a conceptual plan for implementation and practice of developing sustainable support systems for all CHWs working in our community outreach program. After rigorous consultation with all our local community stakeholders and in-line with our own institutional policies and procedures, steps are now underway in implementing standardized Human Resources practices and strong management support systems for the CHWs. These include using benchmark selection and hiring procedures, annual appraisal system, frequent supervisor contact with continuous feedback,

transparent financial processes for regular and timely remuneration, training (in local languages including both basic and refresher courses), and securely maintaining all HR related records including data for resignation/attrition. Our goal has been that these strong support systems will promote a healthy working environment, create a strong cohesive link between the management and CHWs, increase CHW job satisfaction and motivation and above all will improve their overall performance. Mixed methods evaluation of these data is forthcoming.

8. STUDY CAVEATS:

One limitation of this review is that it included peer reviewed articles published in English language only. It would be important to include articles in other languages because community health worker programs invariably can be found in almost every country. Inclusion of the latter would perhaps further highlight the different variations that exist in CHW programs. However, this was beyond the scope of this review. Secondly, based on our specific objectives, sample size abstracted and included in this review is small. This is because of the limited body of published evidence that examines the association between community health workers with job satisfaction / motivation. Job satisfaction has been well researched in the fields of industrial and organization psychology (Saari & Judge, 2004). This however is limited in the health care sector for these frontline health workers. Most of the available evidence focuses on highlighting cost effectiveness and higher positive impact of CHW intervention programs on primary health care outcomes. Thirdly, factors associated with CHW job satisfaction and motivation, have been combined together in this review. This is because of two reasons: (a) published studies on CHW job satisfaction / motivation are very limited and (b) those studies that do report the same use them interchangeably. Job satisfaction and motivation are two separate constructs but are closely interrelated. Different psychological theories usually employ them together because both eventually affect work performance, output and productivity. For an in-depth analysis one would have to examine sub-factors related to both, individually as well as concurrently. Fourth, in our analysis of the effect of training on CHW performance, the summary measure MES included different outcomes

in different studies. Thus, MES comparisons might have been biased because some outcomes might be easier to improve than others.

9. CONCLUSION:

CHWs play a critical role in task-shifting and delivery of primary health care services. Yet, from a broader perspective, critical policy, effective programmatic and human resource management of this cadre of workforce is limited and often neglected. Our review highlights the general absence of this evidence-base. Three main conclusions can be drawn from this review. First, factors that CHWs commonly cited with job satisfaction and motivation included passion for improving others' health, opportunities for career development, and status within the community. Low remuneration and inadequate material and financial incentives were the core reasons for CHW dissatisfaction and de-motivation. From a programmatic standpoint, CHW programs could consider these factors when developing CHW programs, designing selection criteria or incentives and human resource management tools. Second, our review was unable to find quantitative evidence supporting the link between job satisfaction and attrition rates. A practical research agenda item would be to identify a level of job satisfaction, if any, that would promote high CHW retention. Also, proper documentation of CHW programmatic records especially attrition data is currently lacking in both scale and scope. Such data require careful analysis and are central in understanding CHW attrition. This in-turn could help donor agencies, policy makers and program managers to learn from their experiences in order to improve management of their respective programs. Third, in our review of studies of training and supervision, all studies involved training and/or supervision, but not supervision alone. Training appeared to have a moderate effect on CHW performance and health outcomes, and there was a suggestion that training alone had a larger effect on outcomes than training plus supervision. Though this finding is

intriguing, it should be further explored by considering quality of the training, the presence of other interventions besides training or supervision, diversity of outcome types, and adequacy of study design.

Appropriate levels of CHW job satisfaction and motivation, proper training, and re-training and supervision remain fundamental for the success of CHW intervention programs. In addition every CHW program operates in a diverse repertoire of settings. Solutions to these core themes are complex. Nevertheless focused operational research with strong institutional support in addressing these core themes is much required to provide the required data. Expansion and cross-program comparisons of these findings could make an important contribution to trigger tangible action by managers, policy makers and researchers. In all, CHW job satisfaction and motivation, training, and re-training and supervision have received little attention in the past. Longitudinal implementation and support of evidence-based strategies and interventions to address these programmatic constructs of CHW programs could have a profound impact on delivering primary health care to the communities that they serve.

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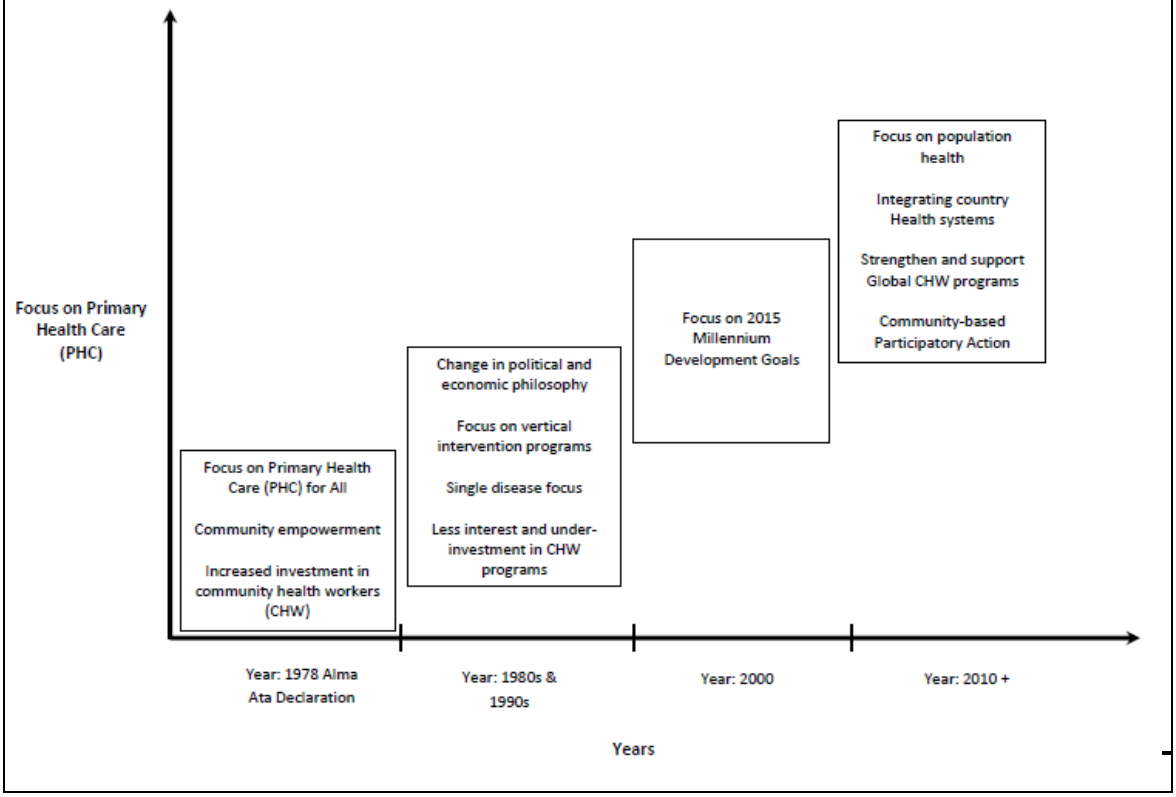
11. APPENDICES:

APPENDIX A

Trajectory of the Focus on Primary Health Care (PHC)



APPENDIX B

Appendix B: Summary of Studies included for Objective 1						
S. #	**Authors, year of publication**	**Country**	**Study Objective(s)**	**Study Design**	**No. of CHWs included in the study (n)**	**Institutional affiliation of CHWs/ Study site**
1	M. Rahman *et al*., 2010	Bangladesh	To examine factors affecting recruitment and retention of community health workers in a newborn care intervention in Bangladesh CHWs were part of a newborn care intervention trial ("Projahnmo-1"), conducted in Sylhet District	Quantitative self-administered questionnaire, employment and project records Qualitative in-depth interviews, FDGs and informal discussion with key project personnel	43	International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) / Sylhet District
2	Ahmed *et al*., 2009	Bangladesh	To address the knowledge gap regarding health worker qualifications, services provided, motivation, incentives and satisfaction with profession including CHWs	Quantitative nationwide health-care provider survey Qualitative interviews	240	Belonged to both NGOs and the Government / BRAC
3	Robinson *et al*., 1990	Colombia	To examine the relative influence of reward and feedback factors associated with the community compared to those associated with the health system on the performance of CHWs	Quantitative questionnaire	179	Government / Cordoba and Bolivar
4	Creanga *et al*., 2007	Ethiopia	To examine associations between community based reproductive health agents (CBRHAs')	Quantitative survey using standardized individual questionnaire	340	CHWs represented different NGOs i.e. Pathfinder International-

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S. #	**Authors, year of publication**	**Country**	**Study Objective(s)**	**Study Design**	**No. of CHWs included in the study (n)**	**Institutional affiliation of CHWs/ Study site**
			demographic, personality- and work-related characteristics and their capacity to provide integrated HIV and family planning services and serve large numbers of clients			Ethiopia, Abebech Gobena Yehitsanat Kibikebena Limat Dirijit and Oromiya Development Association / Amhara and Oromiya
5	Kebriaei *et al*., 2009	Iran	To investigate job satisfaction levels overall and in various areas among community health workers and to suggest approaches that could improve job satisfaction	Quantitative self administered questionnaire	74	Government / Zahedan District
6	Chaulagai, 1993	Nepal	To evaluate effectiveness of an urban community health volunteer program in sensitizing and motivating people for the improvement of health knowledge and skills and the use of services	Quantitative evaluation study	32	Government / Pokhara
7	Curtale *et al*., 1995	Nepal	To assess the ability of Community Health Volunteers (CHVs) in delivering a program Nutrition Education Intervention (NEI), which includes a greater number of activities, both curative and preventive, than that presently delivered by the Ministry of	Quantitative case control study	208	Government

Appendix B: Summary of Studies included for Objective 1						
S. #	**Authors, year of publication**	**Country**	**Study Objective(s)**	**Study Design**	**No. of CHWs included in the study (n)**	**Institutional affiliation of CHWs/ Study site**
			Health (MoH)			
8	Gray *et al*., 1988	Nigeria	To assist rural health program managers design strategies for reducing VHW attrition	Quantitative survey questionnaire interviews	70	Christian Missionary - Christian Reformed Church of Nigeria / Southern Gongola State
9	Haq *et al*., 2008	Pakistan	To assess the perceived level of job stress, personal efficiency and quality of service delivery by LHW and an attempt was made to understand factors which might be responsible for below optimal performance of LHWs	Quantitative questionnaire survey Qualitative FGDs	150	Government / District Rawalpindi
10	Chevalier *et al*. , 1993	Solomon Islands	To examine attrition rates and the reasons why village health workers leave their posts	Quantitative questionnaire interviews	335	Government
11	Bentley 1989	Somalia	To examine the Northwestern Somalia primary health care project which focused on the establishment of well-trained and well-supported CHWs at the community level. It also examines CHW remuneration	Quantitative: survey interview	85	Government* / Northwest region *UNICEF provided technical and financial assistance for program development
12	Kironde *et al*., 2002	South Africa	To explore factors that motivate lay volunteers to join tuberculosis (TB)	Quantitative questionnaire survey and documentary	347	Government / Northern Cape province

Appendix B: Summary of Studies included for Objective 1						
S. #	**Authors, year of publication**	**Country**	**Study Objective(s)**	**Study Design**	**No. of CHWs included in the study (n)**	**Institutional affiliation of CHWs/ Study site**
			control programs in high burden but resource-limited settings	review Qualitative FGDs and in-depth interviews		
13	Suri *et al*., 2007	South Africa	To examine the perspectives of CHWs to identify ways of improving the current CHW program to more effectively combat the spread of HIV infection and TB	Quantitative survey using standardized interview questionnaire Qualitative FDGs	115	Government / Outer West Region of KwaZulu-Natal
14	Zerden *et al*., 2006	South Africa	Understanding the needs, fears and motivations of front-line care workers in South Africa	Quantitative survey Qualitative FGDs and field observations	138	Thembalethu Home Based Care (THBC) - a community-based organization / Mpumalanga province
15	Li *et al*., 2007	Taiwan	To understand the relationship between job involvement, job satisfaction, and personality traits among community health volunteers	Quantitative questionnaire survey	213	Government / I-lan county, northern Taiwan
16	Ahluwalia *et al*., 2003	Tanzania	To evaluate community capacity building and empowerment initiative	Quantitative evaluation of project data Qualitative individual and group interviews	52	Joint collaborative project between CARE and the Government of Tanzania / Lake Zone, Mwanza region

APPENDIX C

Appendix C: Summary of CHW Attrition Findings								
S. #	**Author, year of publication**	**Country**	**Study objective**	**Study design**	**Total no. of CHWs**	**No. of CHWs satisfied**	**No. of CHWs dissatisfied**	**Attrition rates**
1	M. Rahman et al. , 2010	Bangladesh	To examine factors affecting recruitment and retention of community health workers in a newborn care intervention in Bangladesh †Sample size at the time of the survey	Mixed methods	43†	30	13	Over the course of the four-year project, a total of 73 CHWs were recruited. 40 CHWs worked until the end of the project whereas 33 dropped out of the project [attrition for 26 CHWs was initiated by CHW and/or family and attrition for 7 CHWs was initiated by the project*] *4 CHWs promoted to higher position and 3 CHWs terminated due to poor performance
2	Chaulagai, 1993	Nepal	To evaluate effectiveness of an urban community health volunteer program in sensitizing and motivating people for the improvement of health knowledge and skills and the use of services	Evaluation study	32	-	-	22 dropped out by the end of two years

APPENDIX C (cont.…)

Appendix C: Summary of CHW Attrition Findings								
S. #	Author, year of publication	Country	Study objective	Study design	Total no. of CHWs	No. of CHWs satisfied	No. of CHWs dissatisfied	Attrition rates
3	Curtale et al., 1995	Nepal	To assess the ability of Community Health Volunteers (CHVs) in delivering a program Nutrition Education Intervention (NEI), which includes a greater number of activities, both curative and preventive, than that presently delivered by the Ministry of Health (MoH)	Case control study	208	-	-	Out of 105 CHVs in the index (intervention) group, 13 were either absent or had dropped out Out of 103 CHVs in the reference (control) group, 29 had left their activity as CHV
4	Bamisaiye et al., 1989	Nigeria	To study the training and performance of village health workers and of the management of the scheme to which they belonged	Descriptive study	82	-	-	10 VHWs became non functioning over a period of 4 years, an attrition rate of 3.8% per annum
5	Gray et al., 1988	Nigeria	To assist rural health program managers design strategies for reducing VHW attrition	Operational research and analysis	70	-	-	From 1968 to 1983, 70 village health workers (VHWs) were trained. By 1983, however, it was apparent to the health program managers that VHWs had been leaving their jobs after serving a period of only one to three years. Attrition rate 41.4%

APPENDIX C (cont.…)

Appendix C: Summary of CHW Attrition Findings								
S. #	Author, year of publication	Country	Study objective	Study design	Total no. of CHWs	No. of CHWs satisfied	No. of CHWs dissatisfied	Attrition rates
6	Brown et al., 2006	Peru	To describe the profile of community health workers in rural Quechua communities from Ayacucho, Peru	Descriptive study	100	-	-	24 (24%) drop-out rate
7	Chevalier et al., 1993	Solomon Islands	To examine attrition rates and the reasons why village health workers leave their posts	Survey	335	-	-	Annual attrition rate of 4.8% from 1978 to 1991. Excluding 51 VHWs who had been promoted to nurse aides, the overall attrition rate was 47%
8	Bentley et al., 1989	Somalia	To examine the Northwestern Somalia primary health care project which focused on establishment of well-trained and well-supported CHWs at the community level. It also examines CHW remuneration and health effects of the project	Case study	85	85	0	Out of 85 CHWs trained overall 10 dropped out and were replaced [Over a period of 3.5 years]
9	Kironde et al., 2002	South Africa	To explore factors that motivate lay volunteers to join tuberculosis (TB) control programs in high burden but resource-limited settings	Cross-sectional study	347	-	-	Attrition rates among lay volunteers: 77(22%) dropped out of the program within one year of joining

APPENDIX D

Individual Study Specific Outcomes Related to Training and Supervision

Study #1

Authors (with year of publication)	Davies-Adetugbo *et al*. (1997)
Country	Nigeria
Study objective	Training of community health extension workers in breastfeeding and lactation management and to evaluate its impact on breastfeeding knowledge and practice. [Ife South Breastfeeding Project (ISBFP)]
Study design	Post-only study with non-randomized controls
Training received	Yes [refer to training section below]
Worked under supervision	No
Total # of patients observed in the study / total # of CHWs observed in the study	a) 206 mothers b) 132 PHC* workers
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	a) Post-delivery mothers who reported early initiation of breastfeeding (within 30 minutes of delivery) in the intervention area compared to the control area where no training activities were conducted b) Trained workers had better knowledge of and attitudes towards breastfeeding than untrained controls. Those who had been trained recommended early initiation of breastfeeding compared to untrained workers c) Trained workers recommended exclusive breastfeeding (i.e., the baby receives no other foods or fluids other than breast milk) for the first 4-6 months of life compared to untrained workers d) Difference in aggregate knowledge score (out of a total of 10 points) of PHC workers who gave correct responses to breastfeeding variables between trained and untrained health workers in the study area itself

Value of outcome in the trained / supervised (intervention group)	a) 32% b) 89% c) 98.5% d) 9.4, 95% CI: 9.1-9.7
Value of outcome in the untrained / unsupervised (control group)	a) 6% b) 46% c) 36.5% d) 7.6, 95% CI: 6.6-8.6
Effect size	a) 26%-points b) 43%-points c) 62%-points d) 1.8%-points Median effect size: 34.5 %-points
Statistical significance P-value / CI	a) 95% CI: 16-36% P-value < 0.001 b) 95% CI: 28-58% P-value < 0.001 c) 95% CI: 49-75% P-value < 0.001 d) P-value < 0.001
Training	A one-day community mobilization workshop was conducted. The workshop was designed as a 6-hour introductory course on breastfeeding and child survival. It was conducted in the local language. District-level training workshops were also conducted which consisted of 6 hours of instructions and 2 hours of demonstrations and practical. The PHC workers appreciated that the training workshops were given in the vernacular and that they had gained new knowledge and learned new skills that they planned to employ in their work

Note: PHC primary health workers of the ISBFP project included community health extension workers, traditional birth attendants, and village volunteer health workers.*

Study #2

Authors (with year of publication)	Hadi (2003)
Country	Bangladesh
Study objective	To assess the role of management practices for acute respiratory infections (ARIs) in improving the competency of community health volunteers in diagnosing and treating acute respiratory infections among children
Study design	Cross-sectional study [refer to training section below]
Training received	Yes, 68 (56.7%) received basic training
Worked under supervision	Yes, 87 (72.5%) were regularly supervised
Total # of patients observed in the study / total # of CHWs observed in the study	120 community health volunteers [CHVs]
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	Estimates of the differences in sensitivity of the volunteer diagnosis by basic training and supervision: a) Sensitivity among those who received training than those who did not b) Sensitivity among those who received regular supervision compared to those who received irregular supervision
Value of outcome in the trained / supervised (intervention group)	a) 71.9% b) 77.0%
Value of outcome in the untrained / unsupervised (control group)	a) 63.2% b) 49.4%
Effect size	a) 8.7 %-points b) 27.6%-points
Statistical significance P-value / CI	a) P-value <0.01 b) P-value <0.01
Training	Of the 120 CHVs, 68 (56.7%) of received three days of intensive basic training to identify, diagnose, and

	treat cases of ARI. The remaining volunteers received only one day of refresher training each month with all other volunteers. Training not intensive, was not provided by physicians, and took several months to complete. In addition, it was not possible to cover all topics of the basic training in the refresher courses

Study #3

Authors (with year of publication)	A. Rahman *et al*. (2008)
Country	Pakistan
Study objective	To assess the effect of cognitive behaviour therapy-based intervention by community health workers on perinatal depression in women and to test the hypothesis that treatment of perinatal depression would lead to improved nutrition and other health outcomes in the infant
Study design	Post-only study with randomized controls
Training received	Yes [refer to training section below]
Worked under supervision	Yes
Total # of patients observed in the study / total # of CHWs observed in the study	863 mothers
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	Effect of intervention on major depression in mothers*
Value of outcome in the trained / supervised (intervention group)	a) At 6 months after the intervention, 97 (23%) of 418 mothers met the criteria for major depression b) At 12 months after the intervention 111/412 (27%) mothers met the criteria for major depression
Value of outcome in the untrained / unsupervised (control group)	a) At 6 months after the intervention, 211 (53%) of 400 mothers in the control groups met the criteria for major depression b) At 12 months after the intervention, 226/386 (59%), mothers met the criteria for major depression
Effect size	a) –30 %-points; Adjusted odds ratio (aOR): 0.22 b) –32 %-points; aOR: 0.23 (Effect size < 0 indicates improvement)

Statistical significance P-value / CI	a) 95% CI for aOR: 0·14 to 0·36, P-value <0·0001 b) 95% CI for aOR: 0·15 to 0·36, P-value <0·0001
Training	Specialized training provided to the Lady Health Workers in the intervention arm was short (2 days followed by a 1 day refresher after 4 months). An important component of the training process was the monthly half-day group supervision, which, for this study, was provided by experienced members of the research team. Note: Mothers in the intervention clusters received the 'Thinking Healthy Program†' through specially trained Lady Health Workers. Mothers in the control clusters received an equal number of visits in exactly the same way as those in the intervention group, but by routinely trained Lady Health Workers. These health workers in both groups received monthly supervision, and were monitored by the research team to ensure that they were attending the scheduled visits. † A manual (with step by step instructions for each session) was used to train the health workers and for them to keep for reference. The intervention, called the Thinking Healthy Program, used cognitive behaviour therapy techniques of active listening, collaboration with the family, guided discovery (i.e., style of questioning to both gently probe for family's health beliefs and to stimulate alternative ideas), and homework (i.e., trying things out between sessions, putting what has been learned into practice), and applied these to health workers' routine practice of maternal and child health education.

** Effect of intervention on disability, functioning, and perceived social support scores in mothers was also statistically significant. The differences in weight-for-age and height-for-age Z scores for infants (effect of intervention on infant growth) in the two groups were not significant at 6 months or 12 months.*

Study #4

Authors (with year of publication)	Yach *et al*. (1987)
Country	South Africa
Study objective	To determine whether village health workers (VHWs) could teach mothers to safely prepare homemade sugar-salt solutions
Study design	Post-only study with non-randomized controls
Training received	Yes Village health workers in the 'experimental' villages participated in a training course on the use of home prepared sugar/salt solutions (SSS) whereas VHWs in the 'control' villages were not trained with respect to diarrheal disease control.
Worked under supervision	No
Total # of patients observed in the study / total # of CHWs observed in the study	Mothers were randomly selected and interviewed in a total of 647 villages
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	Treatment received for children with diarrhoea
Value of outcome in the trained / supervised (intervention group)	a) 76.6% of diarrhoea episodes were initially treated with a home-prepared sugar/salt solution b) 7.8% of mothers in the experimental villages treated their children using home remedies c) 2.6% of mothers in the experimental villages treated their children using enemas
Value of outcome in the untrained / unsupervised (control group)	a) 50.5% of diarrhoea episodes were initially treated with a home-prepared sugar/salt solution b) 28.6% of mothers in the control villages treated their children using home remedies c) 12.1% of mothers in the control villages treated their children using enemas

Effect size	a) 26.1%-points b) –20.8%-points c) –9.5%-points Median effect size: 20.8%-points (Effect size < 0 for indicators (a) and (b) indicates improvement)
Statistical significance P-value / CI	a) P-value <0.05 b) P-value <0.05 c) P-value <0.05
Training	A one-day workshop was conducted by one of the study authors and focused on teaching six points to on use of home prepared sugar/salt solutions (SSS) for treating diarrhea based on a six point agenda. These points were reinforced by role plays and group quizzes. Each VHW had the opportunity to practice preparing the solution prior to the completion of the workshop

Study #5

Authors (with year of publication)	Curtale *et al*. (1995)
Country	Nepal
Study objective	To assess the ability of Community Health Volunteers (CHVs) in delivering a program Nutrition Education Intervention (NEI), which includes a greater number of activities, both curative and preventive, than that presently delivered by the Ministry of Health (MoH)
Study design	Post-only study with non-randomized controls
Training received	Yes CHVs in the intervention (index) group received additional days of training compared to CHVs in the control (reference) group
Worked under supervision	Yes CHVs in the intervention (index) group received additional supervision compared to CHVs in the control (reference) group
Total # of patients observed in the study / total # of CHWs observed in the study	1443 respondent mothers 208 CHVs
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	Identify night blindness
Value of outcome in the trained / supervised (intervention group)	a) 99% CHVs identified night blindness b) 82% CHVs indicated dark green leafy vegetables (DGLV) as appropriate prevention and treatment night blindness c) 33% of the CHVs in the index group recognized fast breathing as a major sign of acute respiratory infection (ARI) d) 94% mothers were aware of the use of oral rehydration salt (ORS), said they would give it to their children with diarrhoea, if available e) 84% children (12-23 months of age) in the index group were fully immunized

Value of outcome in the untrained / unsupervised (control group)	a) 64% CHVs identified night blindness b) 33% CHVs indicated dark green leafy vegetables (DGLV) as appropriate prevention and treatment night blindness c) 3% of the CHVs in the index group recognized fast breathing as a major sign of acute respiratory infection (ARI) d) 76% mothers in the control group were aware of the use of oral rehydration salt (ORS), said they would give it to their children with diarrhoea, if available e) 66% children (12-23months of age) were fully immunized
Effect size	a) 35%-points b) 49%-points c) 30%-points d) 18%-points e) 18%-points Median effect size: 30%-points
Statistical significance P-value / CI	a) Identified night blindness P-value 0.0001 b) Indicated dark green leafy vegetables (DGLV) as appropriate prevention and treatment night blindness P-value 0.0001 c) Recognized fast breathing as a major sign of acute respiratory infection (ARI) P-value 0.002 d) Awareness of the use of oral rehydration salt (ORS), mothers said would give it to their children with diarrhoea, if available P-value 0.0001 e) Coverage in the percentage of fully immunized P-value 0.0001
Training	In total the reference CHVs received an average of five days' training versus eight days for the index CHVs, the difference entirely attributable to the NEI organized activities [Index CHVs received an additional average of 2.6 training days in nutrition organized by the NEI]

Note: Supervision: On an average index CHVs received 7.6 supervisory visits compared to 2.9 supervisory visits received by the reference CHVs

Study #6

Authors (with year of publication)	Carlough *et al*. (2005)
Country	Nepal
Study objective	Clinical skills assessment of maternal and child health workers (MCHWs) in Nepal
Study design	Cross-sectional
Training received	Of the 104 MCHWs assessed, 66 (63.5%) had received refresher training and the remainder did not receive refresher training
Worked under supervision	No
Total # of patients observed in the study / total # of CHWs observed in the study	104 MCHWs
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	MCHWs in both groups [i.e. those with refresher training -(RT) and those without refresher training (NRT) were assessed on six evaluation tools each of which was made up of five sentinel skills. The maximum score achievable was 30 points
Value of outcome in the trained / supervised (intervention group)	Mean score of RT MCHWs was 23.7
Value of outcome in the untrained / unsupervised (control group)	Mean score of NRT MCHWs was 18.7
Effect size	26.7%-points
Statistical significance P-value / CI	P-value <0.05
Training	Maternal and child health workers are local women aged 18 to35 who completed a 15-week course in maternal and child health. A 6-week refresher course in midwifery skills was offered. The refresher training was intended to increase skilled attendant competency, and it is expected that refresher-trained MCHWs will perform better in competency testing

Study #7

Authors (with year of publication)	Chaudhary *et al*. (2005)
Country	India
Study objective	To assess improvement in case management by training and follow- up* of anganwadi workers (AWWS). To assess the practice of skills learnt by basic health workers for 4 – 8 weeks and one year after IMCI training, and to identify the gaps in practices due to various constraints *After training follow-up was provided by the supervisors of AWWs. The first batch of 33 AWWs trained in January 2002 was followed up after 1 yr in January 2003. The same batch was given a 2nd follow up after 4-6 weeks of the 1st visit. A second batch of 21 AWWs trained in February 2003 were followed up 4-8 weeks after the 5 day training course in IMCI
Study design	Post-only study with no controls
Training received	Yes
Worked under supervision	Yes
Total # of patients observed in the study / total # of CHWs observed in the study	54 AWWS
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	Health Worker Performance on Case Management Task (Correct Treatment) a) 1st Follow up after 1 year b) 2nd Follow up after 1 month from 1st follow up (refer to 'a' above) c) 1st Follow up after 4-8 weeks
Value of outcome in the trained / supervised (intervention group)	Health Worker Performance on Case Management Task (Correct Treatment) a) 1st Follow up after 1 year: 47.9% b) 2nd Follow up after 1 month from 1st follow up (refer to 'a' above): 83.8%† c) 1st Follow up after 4-8 weeks: 81.8%†

Value of outcome in the untrained / unsupervised (control group)	Study had no control group. All health workers were trained
Effect size	-
Statistical significance P-value / CI	Health Worker Performance on Case Management Task (Correct Treatment): † P-value < 0.05 in comparison to 1st follow up after 1 year
Training	The AWWs were trained by using the adapted 5 day training WHO-SEARO package on IMCI for basic health workers. This training course helped the AWWs to acquire skills by 'hands on' practice for four days (3-4 hrs each day) and incremental learning under the guidance of facilitators who provided feedback throughout training

Supervisors of AWWs were given basic training on IMCI using the 5 days package for the basic health workers. For the follow up visits, the supervisors were trained using the 3 days follow up after training as per WHO guidelines. The training enabled the supervisors to carry out a systematic and supportive follow-up to observe case management, to reinforce skills and solve problems encountered during the implementation of IMCI by AWWS.

Study #8

Authors (with year of publication)	Harvey *et al*. (2008)
Country	Zambia
Study objective	To determine: (i) whether Zambian CHWs could prepare and interpret rapid diagnostic tests (RDTs) accurately and safely using manufacturer's instructions alone; (ii) whether simple, mostly pictorial instructions (a "job aid") could raise performance to adequate levels; and (iii) whether a brief training program would produce further improvement
Study design	Post-only study with non-randomized controls
Training received	Yes [refer to training section]
Worked under supervision	Yes, CHWs in the study training arm. First, a trainer demonstrated step-by-step how to carry out the test, from opening the test packet to reading the results. Next the trainer presented a module focused on appropriate finger-pricking technique. Participants (CHWs) then practiced the test on one another and received coaching from the trainer and several experienced assistants
Total # of patients observed in the study / total # of CHWs observed in the study	79 CHWs
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	a) Mean percentage for 16 RDT steps correctly completed* b) Mean percentage of test results interpreted correctly*
Value of outcome in the trained / supervised (intervention group)	a) Mean percentage for 16 RDT steps correctly completed Group 3 (CHWs using job aid plus training): 92% b) Mean percentage of test results interpreted correctly Group 3 (CHWs using job aid plus training): 93%

Value of outcome in the untrained / unsupervised (control group)	a) Mean percentage for 16 RDT steps correctly completed: Group 1 (CHWs using manufacturer's instructions): 57% Group 2 (CHWs using job aid only): 80% b) Mean percentage of test results interpreted correctly Group 1 (CHWs using manufacturer's instructions): 54% Group 2 (CHWs using job aid only): 80%
Effect size	a) Group 3 versus Group 1: 35%-points Group 3 versus Group 2: 12%-points b) Group 3 versus Group 1: 39%-points Group 3 versus Group 2: 13%-points Median effect size, Group 3 versus Group 1: 37%-points Median effect size, Group 3 versus Group 2: 12.5%-points
Statistical significance P-value / CI	All differences were statistically significant (P-value < 0.05)
Training	Only CHWs in the study's training arm participated in a three hour course in RDT preparation

** Adjusted for education, age, gender and experience*

Study #9

Authors (with year of publication)	Bhutta *et al*. (2008)
Country	Pakistan
Study objective	Impact of training lady health workers on stillbirths and perinatal mortality in rural Pakistan
Study design	Pre-post study with non-randomized controls
Training received	Yes, additional training provided to LHWs in the intervention group versus regular training of LHWs in the control group [refer to training section below]
Worked under supervision	Yes
Total # of patients observed in the study / total # of CHWs observed in the study	3747 pregnant women
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	a) Stillbirth rate (SBR) before and after the intervention in intervention villages b) Stillbirth rate before and after the intervention period in the control villages
Value of outcome in the trained / supervised (intervention group)	a) SBR 65.9/1000 vs. 43.1/1000 births before and after the intervention in intervention villages respectively b) SBR 58.1/1000 vs. 60.5/1000 births before and after the intervention period in the control villages, respectively
Value of outcome in the untrained / unsupervised (control group)	All LHWs were trained (either special training or regular training), there was no 'true' control group for training
Effect size	a) –34.6%-points, rate ratio (RR) = 0.66 before and after the intervention in intervention villages b) 4.1%-points, RR = 1.04 births before and after the intervention period in the control villages (Effect size < 0 indicates improvement)

Statistical significance P-value / CI	a) 95% CI for RR: 0.53–0.83; P-value < 0.001 b) 95% CI for RR: 0.84–1.30; P-value = 0.23 [not significant]
Training	All LHWs were trained (either special training or regular training), so there was no 'true' control group. LHWs in the non-intervention group received training for 18 months, including 3 months of lectures. LHWs in the intervention group received enhanced training which added an extra day every 3 months, making a total of 6 extra days

Note: Perinatal morality (PMR): 110.8/1000 vs. 72.5/1000 before and after the intervention in intervention villages, respectively. PMR: 94.64/1000 vs. 101.2/1000 before and after the intervention period in the control villages, respectively.

Study #10

Authors (with year of publication)	S. Rowe *et al*. (2006)
Country	Kenya
Study objective	To assess effect of multiple interventions on community health workers (CHW) healthcare practices. Determinants of overall guideline adherence among children seen by CHWs in the outpatient department at Siaya District Hospital, Kenya, February to March 2001
Study design	Cross-sectional survey with multivariable analysis
Training received	Yes, refresher training received [refer to training section]
Worked under supervision	Yes
Total # of patients observed in the study / total # of CHWs observed in the study	192 children (Outpatient consultations) 114 CHWs
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	Community health workers' adherence to clinical guidelines: comparison between weighted average overall guideline adherence score and number of refresher trainings the CHWs attended
Value of outcome in the trained / supervised (intervention group)	Weighted average overall guideline adherence score: 81.9% when CHWs attended one refresher training [No. of consultations = 40] Weighted average overall guideline adherence score: 79.2% when CHWs attended two refresher trainings [No. of consultations = 141]
Value of outcome in the untrained / unsupervised (control group)	Weighted average overall guideline adherence score: 78.7% when CHWs did not attend any refresher trainings [No. of consultations = 11]
Effect size	Difference between weighted average overall guideline score for CHWs with 1 refresher training and CHWs with no refresher training = 3.2%-points Difference between weighted average overall guideline score for CHWs with 2 refresher trainings

	and CHWs with no refresher training = 0.5%-points Change in adjusted average overall guideline adherence score per supervisory visit (range 1 to 15 visits) = –0.6%-points
Statistical significance P-value / CI	Not significant
Training	Of the 114 CHWs who participated in this study, 6 (5.3%), 23 (20.2%) and 85 (74.6%) attended no, one and two refresher training(s) respectively

Note: None of the main factors related to the quality improvement interventions (i.e. number of refresher trainings, adequacy of medicine supplies in the village, guideline flipchart use, number of supervisory contacts and community women's influence in CHW selection) were significantly related to overall adherence.

Study #11

Authors (with year of publication)	Bang *et al*. (2005)
Country	India
Study objective	To assess how effective is home-based management in reducing case fatality in neonates with sepsis
Study design	Retrospective observational study [Data for this study was obtained from the field trial of ‘‘Home-based Neonatal Care’’ (HBNC) in rural Gadchiroli, India]
Training received	Yes, VHWs were trained in stages [refer to training section]
Worked under supervision	Yes
Total # of patients observed in the study / total # of CHWs observed in the study	a) 1005 live births [Before training of VHWs in sepsis diagnosis and management], Pre-intervention period b) 5268 live births [After training of VHWs in sepsis diagnosis and management]
Definition of Quality-of-care / Program effectiveness outcome/ Health care initiative	Effect of Sepsis Case Management on % case fatality
Value of outcome in the trained / supervised (intervention group)	Case fatality: 16.6% and 9.6% before and after the intervention, respectively
Value of outcome in the untrained / unsupervised (control group)	No control group. All VHWs received training
Effect size	–7.0%-points (Effect size <0 indicates improvement)
Statistical significance P-value / CI	P-value for % Case fatality <0.02
Training	VHWs were trained in stages. In 1995 they were trained to take history, examine a mother and

	newborn, and record data. They monitored the neonates in their village during one year (April 95 to March 96). In May 1996, VHWs were taught to give intramuscular vitamin K. When they had given 10 injections to newborns in their village in the presence of the field supervisor without any error, they were certified to give injection vitamin K independently on the day of birth. In July to August 1996, VHWs were trained to diagnose and treat sepsis. They were repeatedly assessed by simulated exercises and retrained, until performance was deemed satisfactory. Beginning in September 1996, VHWs were permitted them to diagnose and treat sepsis as per guidelines.