

**TRAINING OF COMMUNITY HEALTH WORKERS:  
RECOGNITION OF MATERNAL, NEONATAL AND PEDIATRIC ILLNESS**

A thesis submitted to the University of Arizona College of Medicine – Phoenix  
in partial fulfillment of the requirements for the Degree of Doctor of Medicine

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Dedicated to my sister Kelly and her new pair of lungs – without your grace, strength and resolve I may never have stumbled into the wonderful world of medicine.

## ***Acknowledgements***

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## ***Abstract***

**Background:** This systematic review focuses on improving recognition and treatment of acute medical conditions in pregnant women, infants and children in low and middle income countries by Community Health Workers (CHWs). By examining critically selected articles from different electronic databases, this review seeks to organize and present the important characteristics of a training program aimed at reducing maternal, neonatal and childhood mortality.

**Methods:** Data in the form of peer-reviewed and published articles were collected using three public databases – PubMed, Ovid and EMBASE – using specific search terms. Greater than 300 articles were found using the specific search terms. Those articles were then processed through a series of inclusion and exclusion criteria resulting in a cohort of papers which were then individually analyzed for content.

**Results:** After critical analysis of all 15 publications included in the study, it becomes clear that training programs are incredibly diverse. These four aspects of training programs appear to be the most variable between the studies: size of the training program, length of the training program, training assessment and follow-up refresher courses.

**Conclusion:** Training programs that are shorter in duration or greater in class number do not seem to be any less effective than longer programs with fewer participants. Future studies should be performed in which one training program with identical training techniques, lengths, and focuses is taught in different regions. The impact that this study has on the literature is as follows: Training programs of shorter duration seem to be as effective as their longer counterparts. Finally, there is a clear need for more robust, standardized and geographically and culturally diverse training programs to more effectively study training methods.

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## ***Introduction and Significance***

The Alma-Ata declaration created at the 1978 International Conference on Primary Health Care in Kazakhstan established that health care is a human right that necessitates protection by all governments and stated that the most effective way of improving global health and reducing health disparities is via a focus on primary care. <sup>[1]</sup> This doctrine was subsequently adopted by the World Health Organization (WHO) and has been the focus of the multinational NGO for the last 35 years or more. <sup>[2]</sup> Primary care is, as defined by the American Academy of Family Physicians, care that “includes health promotion, disease prevention, health maintenance, counseling, patient education, diagnosis and treatment of acute and chronic illnesses in a variety of health care settings.” <sup>[3]</sup> One of the most effective ways of improving primary care in a community is by securing buy-in from that community, which can be done using community health workers. This systematic review focuses on improving of recognition and treatment of acute medical conditions in pregnant women, infants and children in low and middle income countries by Community Health Workers (CHWs). As there is limited data on each individual patient population, this project has a broader scope in covering pregnant women, neonates and children under the age of five in order to increase the power and relevance of the study. Specifically, this review explores the need for CHWs, their utility, training methods which have been demonstrated to be most effective and finally the limitations of CHWs. This qualitative systematic review follows a comprehensive review completed regarding the same topic.

Overall, low and middle income countries suffer a higher burden of infectious diseases and maternal mortality. <sup>[4]</sup> According to Figure 1 from the WHO shown below, it is clear that more resource poor countries suffer from greater proportions of acute and/or infectious disease. <sup>[4]</sup> For example, in low income countries the top three causes of death are all infectious and five out of the top ten are as well. In addition, complications due to pregnancy are the 7<sup>th</sup> and 9<sup>th</sup> leading causes of death in low income countries. This is compared to lower-middle and high income countries where it is apparent that with increasing resources, non-communicable chronic diseases predominate, like stroke and heart disease. <sup>[4]</sup> The disparities experienced by low income countries is even more apparent when separated into maternal, neonatal and childhood mortality rates.

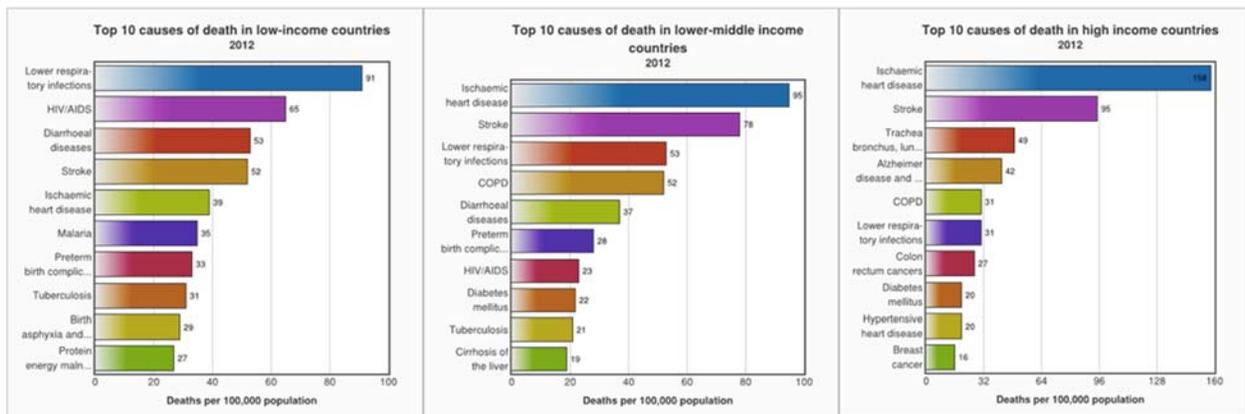


Figure 1 - Causes of Death in Low, Middle and High Income Countries

Maternal mortality is defined by the WHO as “the death of a women while pregnant or within 42 days of termination of pregnancy ... from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.”<sup>[5]</sup> A revealing statistic from a systematic analysis published in 2014 examining the major causes of maternal mortality indicates that over 99% of maternal deaths occur in developing regions. Of the total, 64% occur in Sub-Saharan Africa and 30% occur in Asia.<sup>[6]</sup> This huge disparity in the burden of maternal mortality is an unfortunate reality of global health. What is encouraging, however, is the fact that “developed” or high income countries enjoy a low burden of maternal mortality, indicating that maternal deaths are largely preventable. Looking at the breakdown of maternal deaths 27% of global maternal deaths were associated with hemorrhage, 14% hypertensive states of pregnancy, 11% infection, 9% complications of birth and labor.<sup>[6]</sup> See Figure 2.<sup>[7]</sup> These 4 conditions account for over 60% of maternal mortality, and can largely be prevented or minimized with proper medical intervention. For example, according to a 2008 meta-analysis the rate of postpartum hemorrhage in North America was 13.1% compared to an incidence of 25.7% in Africa.<sup>[8]</sup> The fact that rates of postpartum hemorrhage in North America are nearly half that of Africa indicates that with proper medical intervention, rates of maternal mortality can be decreased. In fact, since 1990 global maternal mortality was reduced by 50%<sup>[7]</sup>. But as demonstrated above, global disparities are still large and there is more work to be done to address these inequalities in maternal health.

Closely linked to maternal mortality, neonatal mortality is defined as death within the first 28 days of life<sup>[9]</sup> According to a 2014 report from UNICEF, developing regions have a neonatal mortality rate of 22 per 1,000 live births, compared to developed regions having a rate of just 3 per 1000. When looking specifically at sub-Saharan Africa, the neonatal death rate is 31 per 1,000 live births and the region accounts for 39% of the world’s 2.8 million neonatal deaths in 2013.<sup>[10]</sup> This is a rate that is 10 times greater than the average of developed nations. The majority, 35%, of these deaths are the result of premature birth complications, while a further 24% are caused by complications of labor and delivery.<sup>[10]</sup> Finally sepsis and pneumonia are

**Causes of maternal death in the world by percentage**  
Source: Say L et al. Global causes of maternal death, 2014.

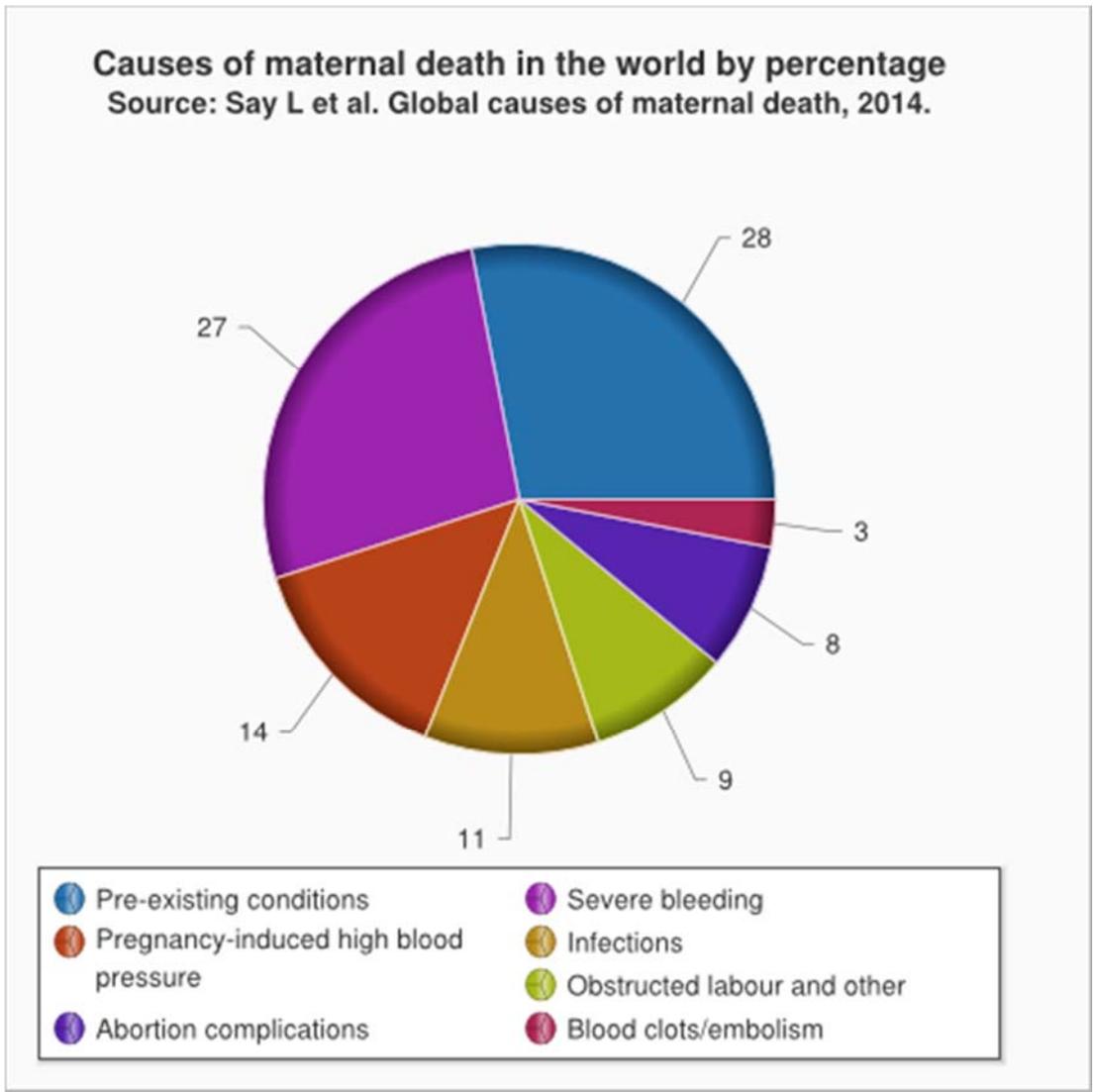


Figure 2 - Causes of Maternal Death [7]

responsible for 15% and 5% of neonatal deaths respectively. <sup>[10]</sup> These statistics are grim; however, progress has been made in the last 20 years with the number of neonatal deaths falling from 4.7 million to 2.8 million over the course of 1990 to 2013. <sup>[10]</sup> The issue that lies ahead is that in the next 35 years, estimates show Sub-Saharan Africa as being the region with nearly 40% of live births by 2050 meaning that without action, neonatal mortality numbers have the potential to rise. <sup>[10]</sup> Looking at these statistics it becomes apparent that preterm labor, complications of delivery and infections are all effectively dealt with and prevented in developed nations, low cost simple interventions could play a major part in reducing these mortality rates in developing nations.

According to an article published in The Lancet in October of 2013, 99% of deaths in children under 5 years of age occurs in developing countries, with pneumonia and diarrhea standing at numbers one and two respectively and topping the list of illnesses behind this staggering statistic. <sup>[11]</sup> On further investigation, there are 6 illnesses which make up 73% of mortality among children under 5 years old globally: acute respiratory disease (mostly pneumonia) (17%), diarrheal disease (17%), prematurity and low birth weight (11%), neonatal infection (9%), birth asphyxia and trauma (8%), malaria (7%). This data comes from the 2004 Global Burden of Disease Update. <sup>[12]</sup> These numbers are similar to the maternal, infant and neonatal mortality statistics, illustrating the need for intervention in developing nations. Figure 3, from a UNICEF report on child mortality, shows the global age distribution of deaths under the age of five. <sup>[10]</sup> As the majority of deaths in this age group is the result of acute infectious or preventable causes – prematurity, birth asphyxia and trauma – simple interventions to increase recognition and timely treatment of these illnesses have the potential to substantially reduce mortality rates. Community health workers are a cost effective means of addressing this problem in low income developing nations.

Using community health workers (CHW) to respond to the increased mortality rates in pregnant women, neonates and children under five years old has many advantages. First, the utility of CHWs is very broad – they can be trained to do a variety of tasks in a multitude of settings. Second, they are part of the community that they serve, giving them more incentive to stay. This is different from external physicians and nurses who may leave after their training to

Age distribution of global under-five deaths, 1990 and 2013 (percent)

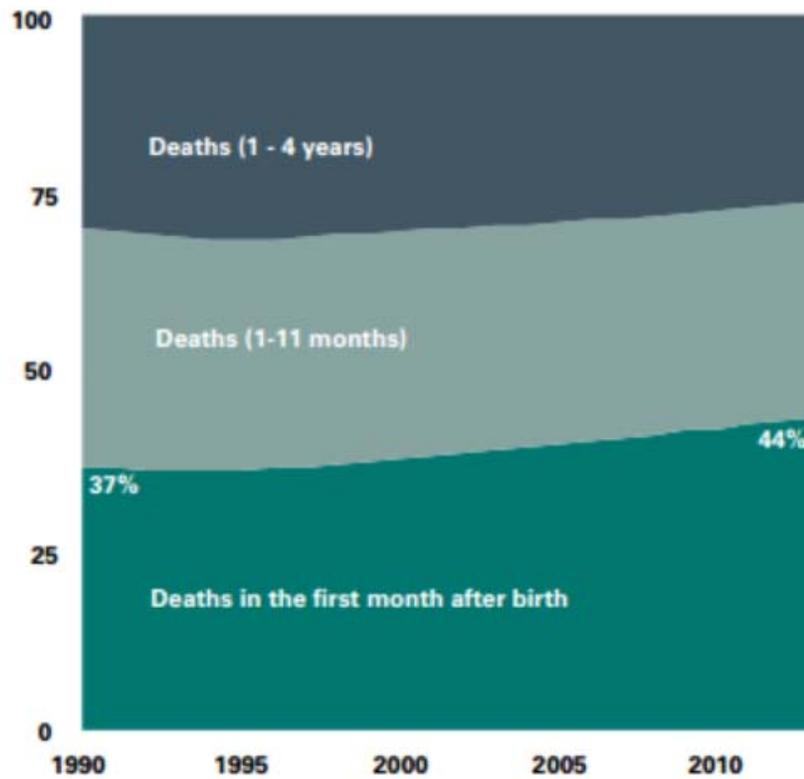


Figure 3 - Age Distribution of Under-Five-Deaths <sup>[10]</sup>

obtain more lucrative jobs elsewhere. It is widely accepted that training of and intervention by CHW has the potential to reduce maternal, neonatal and childhood mortality rates. What is less standardized, however, are the methods by which the community health workers are trained. The following review utilizes selected studies to highlight the characteristics of successful CHW training programs as well as recommendations for future projects and studies based on those previous training programs.

## **Methods**

Three databases were used to collect data for this systematic review. Data was collected periodically from January of 2014 through March of 2016 by searching specific terms on Ovid, EMBASE and PubMed. The specific terms used were: *“Community health workers, maternal health, neonatal health, childhood health, training program, neonatal emergencies, maternal emergencies, emergency care, pneumonia, infections, TB, malaria, hemorrhage, diarrhea, post-partum.”* The collected papers were read, excluded/included based on specific criteria, then critically analyzed for information. Over the course of the initial data collection over 300 articles were collected. At that time a basic screen for English language and relevance to the topic was applied and the total number of articles fell to 76. With the application of the inclusion and exclusion criteria this number was reduced to 15 articles appropriate for this systematic review. Inclusion and exclusion criteria are found below in Table 1 and an illustration regarding the article selection process is seen in Figure 4. Once the articles were collected they were critically analyzed for training methods, assessment of CHWs and impact of the training programs on the CHW and the communities in which they trained and worked. Results are found in the “Results” section as well as summarized in *Table 2*.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> <li>- Study performed in a low or middle income country.</li> </ul>	<ul style="list-style-type: none"> <li>- Study published before year 2000.</li> </ul>
<ul style="list-style-type: none"> <li>- Paper includes specific information regarding training program.</li> </ul>	<ul style="list-style-type: none"> <li>- Study performed in a resource rich setting.</li> </ul>
<ul style="list-style-type: none"> <li>- Study focuses on CHW training with respect to maternal, neonatal or childhood illness.</li> </ul>	<ul style="list-style-type: none"> <li>- Study does not describe training methods.</li> </ul>

*Table 1 - Inclusion and Exclusion Criteria*

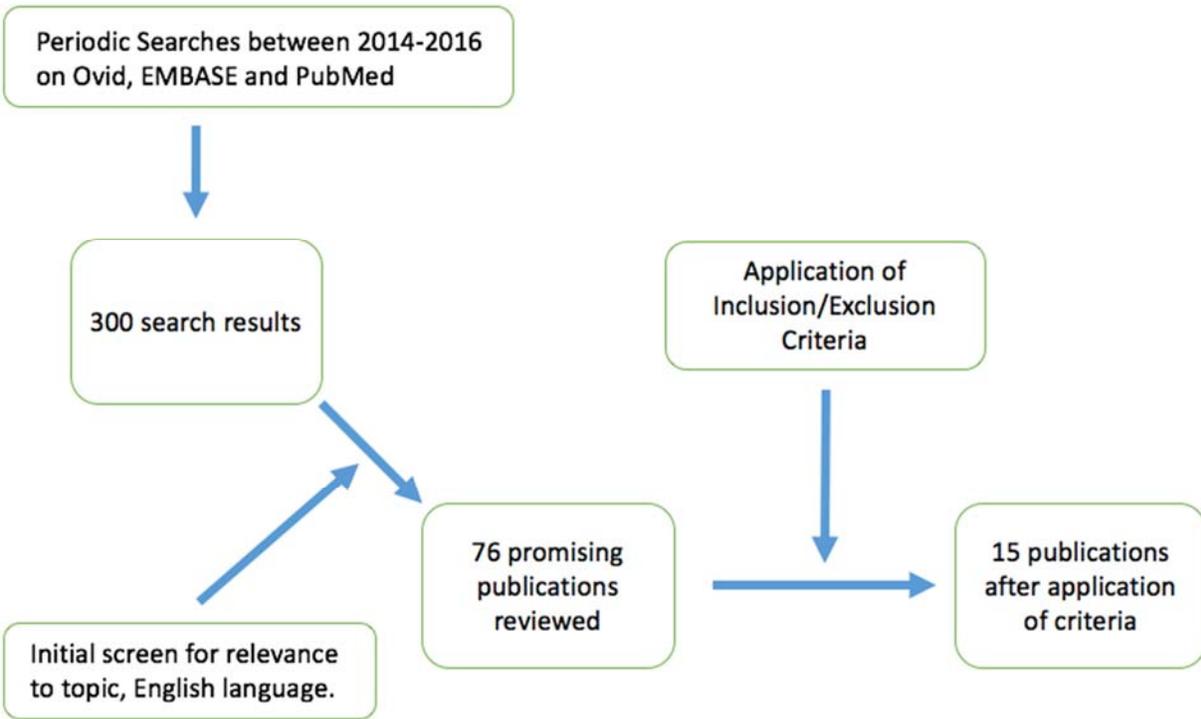


Figure 4 – Process for data collection and study selection

## **Results**

The results of this qualitative systematic review are detailed in *Table 2* and can be divided into several different categories. Four aspects of the training programs appear to be the most variable between the studies: size of the training program, length of the training program, training assessment and follow-up refresher courses.

The size of the training program varied considerably in this review. The largest study was the Nelson 2012 article in which over 700 CHW and 72 CHW trainers were trained which stands in contrast to the smallest study in which Anand in 2004 studied the training of 15 CHWs. The mean number of health workers trained in this selection of 15 articles is 143.4 and median of 59.5 workers and with a standard deviation of 186.9 workers. Every study was able to demonstrate an impact on the knowledge level of the CHW or a health benefit to the community in which the training took place, so there was no difference in numbers of CHWs trained and outcome of the studies.

The length of the training programs included in the study was also variable, but to a lesser extent – the length of the training programs had a range of 1 day of training to one month of training. The average length of training was 6.3 days with a median of 5 days and a standard deviation of 5.8 days. Of the 15 studies identified only one study examined length of training as an independent variable, the study performed in India in 2008 compared a 5-day training course to an 8-day training course and found the post-training assessment scores to be no different.

Assessment of training was performed in all of the studies examined – it is one of the only ways that an objective measure of a community health worker training program can be generated. This was the one metric that was consistent across the training programs, the only difference between some of the training programs was that several of the training programs assessed their trainees before training, after training and a period of time later to assess for long term retention of the material. The studies that assessed retention at a second time point after training were generally the programs that had refresher courses.

Refresher courses after training was a common element and a key component in one third of articles selected. In each of the 5 articles a refresher course of variable length was

administered anywhere from one months to three months later. The refresher courses generally focused on reviewing skills and information presented during the previous training sessions and were followed by repeat assessment of knowledge. One of the studies, Rowe 2006, demonstrated that while the initial course increased the quality of care that the CHWs were delivering, the follow up refresher courses did nothing to improve retention of knowledge. The remaining four training programs demonstrated increased retention of knowledge with follow-up courses.

**Table 2 – Studies included in Systematic Review**

Author /Date	Location	Number Trained	Training Methods	Length of Training	Assessment of Training?	Results
Fehling 2013 <sup>[13]</sup>	South Sudan	33 FHW	Needs assessment	5 days	No	NA
Nelson 2012 <sup>[14]</sup>	South Sudan	708 FHW, 72 trainers	Pictorial checklists and physical exam training.	8 days for trainers, 5 days for FHWs	Yes, OSCE assessment with pre & post-exam.	Mean OSCE scores were increased 2-3 months after training for maternal assessments while mean OSCE scores were unchanged 2-3 months post training for infant assessments.
Uzochukwu 2008 <sup>[15]</sup>	Nigeria	32 CHW	Classroom, simulation and clinical training.	4 days, 8 hours each	Yes, written exam and clinical observation, management compared to physician diagnosis and treatment.	Better able to assess and classify the child and begin proper treatment for malaria, measles, diarrhea and pneumonia.
Kelly 2001 <sup>[16]</sup>	Kenya	336 CHW	Classroom training with flowsheets and protocols, video and clinical training.	3 weeks with 1 week refresher course	Yes, clinical observation and interviews.	CHW post training clinical assessment scores did not improve after training.
Kumar 2008 <sup>[17]</sup>	India	35 CHW 8 days 50 CHW 5 days	Group discussions, video demonstration and role play.	5 days vs 8 days	Yes, written examination.	Post-training scores were increased identically for 5-day vs 8-day training.
Puette 2013 <sup>[18]</sup>	Bangladesh	179 CHW	Protocol training regarding severe acute malnutrition, monthly supervision visits and refreshers .	2 days	Yes, monthly supervision visits and interviews of CHW.	89% of CHW had >90% error free case management of severe acute malnutrition post training.
Ohnmar 2012 <sup>[19]</sup>	Myanmar	23 CHW	Educational flipchart training in recognition of malaria.	2 days	Yes, written test.	Increased diagnosis and proper treatment of malaria, no decrease in time to treatment.
Kalyango 2012 <sup>[20]</sup>	Uganda	125 CHW	Clinical scenarios, case reviews and written exams.	6 days	Yes, meeting with supervisors and written exams.	Training improved recognition of malaria and PNA.
Chaudhary 2005 <sup>[21]</sup>	India	54 CHW	Follow-up refresher courses after initial training with group discussion, video demonstration and role playing.	1 day after initial 5-day course.	Yes, record reviews, observation and supervisor assessments.	Follow-up refresher courses at shorter intervals help increase retained knowledge.
Anand 2004 <sup>[22]</sup>	India	15 CHW	Classroom training, video demonstration and clinical teaching.	3 days with a refresher training 1 month later.	Yes, pre-training assessment, post-training and refresher.	Training improved CHW knowledge and management – no mortality benefit in region.
Rowe 2006 <sup>[23]</sup>	Kenya	114 CHW	10 days of lectures, reviewing case scenarios and role playing, 5 days of clinical practice	15 days initial training with 6-15 day refresher course 3 months later.	Yes, clinical observation and interviews.	Training increased treatment quality, refresher course did not improve retention.
Thompson 2008 <sup>[24]</sup>	Armenia	387 CHW	Classroom-based teaching of clinical signs, symptoms and basic public health principles.	16 hours.	Yes, Evaluation of health literacy of the community in which trained workers lived.	Increase community's health literacy of breast feeding, immunization rates and HIV awareness in community.
Hamer 2012 <sup>[25]</sup>	Zambia	18 CHW	Lectures, role playing, supervised clinical practice and hands-on training with malaria lab test.	5 days with 2 day refresher course 6 months later.	Yes, Practical skills assessment.	CHW can accurately diagnose and treat malaria with rapid diagnostic tests.
Hadi 2003 <sup>[26]</sup>	Bangladesh	120 CHW	Classroom lectures concerning signs and symptoms of acute respiratory infections and record-keeping training.	3 days with a 1 day refresher 1 month post training.	Yes, CHW diagnosis compared with physician diagnosis.	CHWs are able to accurately diagnose and refer patients to higher levels of care.
Le Loux 2010 <sup>[27]</sup>	South Africa	65 CHW	Classroom-based training of growth chart completion, recognition of child abuse and helping mothers bond with their babies.	1 month	Yes, supervised home visits during month of training.	Statistically more infants reached normative weight in the group reached by the CHW.

## ***Discussion***

With the lack of standardization of training programs there is paucity of data in the literature to confidently state that one type of training program is more effective than others. However, what can be concluded is that training programs that are shorter in duration or greater in class number do not appear to be any less effective than longer programs with fewer participants. This allows us to suggest favoring shorter duration training programs as they will save resources and allow for greater numbers of CHW to receive training. In addition, assessment of training was a factor in every training program, thus, it is difficult to comment on whether this was of benefit as there are no studies without assessment to make comparisons. However, assessment of the CHW is one of the only ways to evaluate CHW learning, so it is likely important and necessary.

Another very common aspect of training CHW in recognition of disease in maternal, neonatal and childhood populations is a combination of classroom, didactic-type learning superimposed onto some aspect of clinical training. This type of training is common in most medical education in the United States for physicians and nurses and should likely be a continued element in training these types of healthcare workers.

A limitation to this study is the data quality. Many papers regarding training of community health workers were excluded from this study as the articles did not describe the methods by which the community health workers were trained. This is a function of no existing standardized training of CHW. A second limitation of this study is the difficulty with quantitative data analysis. Training community health workers and measuring the results of their training is very hard to describe in a quantitative manner, thus the data included in this systematic review is mostly qualitative data meant to establish and identify constructs common to successful training programs rather than provide objective data related to training. In order to perform a quantitative systematic review of training programs, there would need to be a standard of training and assessment followed by a number of different groups over a diverse geographic area.

### ***Conclusions and Future Directions***

The main conclusions to be drawn from this systematic review of the literature are as follows: training programs of shorter duration seem to be as effective as their longer counterparts and elements of repetition and evaluation are important characteristics that should remain commonplace in the training of community health workers. For training programs to be effective they should have a combination of didactic and clinical learning, and include assessments of learning. Finally, refresher courses continue to be an effective way to sustainably manage the increased knowledge of the trained community health workers.

Future studies need to be performed in which one training program with identical training techniques, lengths, and focuses are taught in different regions. In addition, training programs which have monitoring systems to evaluate changes in population health and wellness need to be developed so that a more robust, powerful set of data can be generated to analyze more quantitatively the best methods for training community health workers. At this point the data is fragmented. It is difficult to equate one study to the next, most studies examine either CHW retention of knowledge or the effect on the community but not both in concert. Standardization will make it much easier for future research to be done. Future studies should be performed in which one training program with identical training techniques, lengths, and focuses are taught in different regions. The impact that this study has on the literature is as follows: training programs of shorter duration seem to be as effective as their longer counterparts. Finally, there is a clear need for more robust, standardized and geographically and culturally diverse training programs to more effectively study training methods.

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## **Appendix 1 – Comprehensive Review**

### **Training Community Health Workers:**

#### *Maternal, Neonatal and Childhood Illness*

#### ***Introduction***

The Alma-Ata declaration created at the 1978 International Conference on Primary Health Care in Kazakhstan established that health care is a human right that necessitates protection by all governments and stated that the most effective way of improving global health and reducing health disparities is via a focus on primary care. <sup>[1]</sup> This doctrine was subsequently adopted by the World Health Organization (WHO) and has been the focus of the multinational NGO for the last 35 years or more. <sup>[2]</sup> Primary care is, as defined by the American Academy of Family Physicians, care that “includes health promotion, disease prevention, health maintenance, counseling, patient education, diagnosis and treatment of acute and chronic illnesses in a variety of health care settings.” <sup>[3]</sup> One of the most effective ways of improving primary care in a community, is by securing buy-in from that community, which can be done using community health workers. This comprehensive review focuses on the improvement of recognition and treatment of acute medical conditions in pregnant women, infants and children in low and middle income countries by Community Health Workers (CHWs). As there is limited data on each individual patient population, this project has a broader scope in covering pregnant women, neonates and children under the age of five in order to increase the power and relevance of the study. Specifically, this review explores the need for CHWs, their utility, training methods which show promise and finally the limitations of CHWs. A systematic review examining the current data on effective training methods is to follow this comprehensive review.

#### ***Global Mortality***

Overall, low and middle income countries suffer a higher burden of infectious diseases and maternal mortality. <sup>[4]</sup> According to the WHO resource poor countries suffer from greater proportions of acute and/or infectious disease. <sup>[4]</sup> For example, in low income countries the top three causes of death are all infectious and five out of the top ten are as well. In addition, complications due to pregnancy are the 7<sup>th</sup> and 9<sup>th</sup> leading causes of death in low income

countries. This is compared to lower-middle and high income countries where it is apparent that with increasing resources, non-communicable chronic diseases predominate, like stroke and heart disease. <sup>[4]</sup> The disparities experienced by low income countries is even more apparent when separated into maternal, neonatal and childhood mortality rates.

### *Maternal Mortality*

Maternal mortality is defined by the WHO as “the death of a women while pregnant or within 42 days of termination of pregnancy ... from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.” <sup>[5]</sup> A revealing statistic from a systematic analysis published in 2014 examining the major causes of maternal mortality indicates that over 99% of maternal deaths occur in developing regions and that of the total, 64% occur in Sub-Saharan Africa and 30% occur in Asia. <sup>[6]</sup> This huge disparity in the burden of maternal mortality is an unfortunate reality of global health – what is encouraging however, is the fact that “developed” or high income countries suffer a low burden of maternal mortality, indicating that maternal deaths are largely preventable. Looking at the breakdown of maternal deaths 27% of global maternal deaths were associated with hemorrhage, 14% hypertensive states of pregnancy, 11% infection, 9% complications of birth and labor. <sup>[6, 7]</sup> These 4 conditions account for over 60% of maternal mortality, and can largely be prevented or minimized with proper medical intervention. For example, according to a 2008 meta-analysis the rate of postpartum hemorrhage in North America was 13.1% compared to an incidence of 25.7% in Africa. <sup>[8]</sup> The fact that rates of postpartum hemorrhage in North America are nearly half that of Africa indicates that with proper medical intervention, rates of maternal mortality can be decreased. In fact, since 1990 global maternal mortality was reduced by 50% <sup>[7]</sup> – but as demonstrated above, global disparities are still large and there is more work to be done to address these inequalities in maternal health.

### *Neonatal Mortality*

Closely linked to maternal mortality, neonatal mortality is defined as death within the first 28 days of life <sup>[9]</sup> According to a 2014 report from UNICEF – developing regions have a neonatal mortality rate of 22 per 1,000 live births compared to developed regions having a rate of just 3 per 1000. When looking specifically at sub-Saharan Africa, the neonatal death rate is 31

per 1,000 live births and the region accounts for 39% of the world's 2.8 million neonatal deaths in 2013. <sup>[10]</sup> This is a rate that is 10 times greater than the average of developed nations. The majority, 35%, of these deaths are the result of premature birth complications, while a further 24% are caused by complications of labor and delivery. <sup>[10]</sup> Finally sepsis and pneumonia are responsible for 15% and 5% of neonatal deaths respectively. <sup>[10]</sup> These statistics are grim; however, progress has been made in the last 20 years with the number of neonatal deaths falling from 4.7 million to 2.8 million over the course of 1990 to 2013. <sup>[10]</sup> The issue that lies ahead is that in the next 35 years estimates show Sub-Saharan Africa as being the region with nearly 40% of live births by 2050 meaning that without action, neonatal mortality numbers have the potential to rise. <sup>[10]</sup> Looking at these statistics it becomes apparent that preterm labor, complications of delivery and infections are all effectively dealt with and prevented in developed nations, low cost simple interventions could play a major part in reducing rate in developing nations.

#### *Childhood Mortality*

According to an article published in The Lancet in October of 2013, 99% of deaths in children under 5 years of age occurs in developing countries, with pneumonia and diarrheal standing at numbers one and two respectively and topping the list of illnesses behind this staggering statistic. <sup>[11]</sup> On further investigation, there are 6 illnesses which make up 73% of mortality among children under 5 years old globally - They are: Acute respiratory disease - mostly pneumonia (17%), diarrheal disease (17%), prematurity and low birth weight (11%), neonatal infection (9%), birth asphyxia and trauma (8%), malaria (7%) - This data comes from the 2004 Global Burden of Disease Update. <sup>[12]</sup> These numbers are similar to the maternal, infant and neonatal mortality statistics, illustrating the need for intervention in developing nations. As the majority of deaths in this age group is the result of acute infectious or preventable causes – prematurity, birth asphyxia and trauma – simple interventions to increase recognition and timely treatment of these illnesses have the potential to substantially reduce mortality rates. Community health workers are a cost-effective means of addressing this problem in low income developing nations.

### ***Community Health Workers***

Using community health workers to respond to the increased mortality rates in pregnant women, neonates and children under five years old has many advantages. First, the utility of CHWs is very broad – they can be trained to do a variety of tasks in a multitude of settings. Second, they are part of the community that they serve, giving them more incentive to stay. This is different from external physicians and nurses who may leave after they are training to get jobs elsewhere. Finally, it costs far less to train a community health worker than it does to train medical professionals like physicians and nurses. By providing the community with workers from their own region, health of their community can be improved internally and hopefully in the future more advanced medical care can be phased in once a good community health system has been established.

Given the need to address the relatively high rates of mortality among pregnant women, neonates and children under 5 years of age, community health workers are a low-cost, effective and under-utilized resource in improving medical care. There are many studies which have examined training various types of unskilled community health workers to recognize and respond to various childhood illnesses. A very early study in 1992 demonstrated that it was effective to teach unskilled health workers in the recognition of pediatric pneumonia using a hospital based training program in rural Swaziland <sup>[13]</sup> A more recent study, published in 2005 found that in a study of 96 CHWs in Western Uganda the sensitivity and specificity of diagnosing pneumonia in children aged less than five years old was 75% and 83% respectively <sup>[14]</sup> Both of these studies demonstrate that with an acute disease process like pneumonia CHW can be trained to recognize acute medical conditions in children under the age of five.

With rapid recognition of the signs and symptoms of a frequently deadly illness such as pneumonia, there is a possibility that mortality rates can be decreased. In South Western Uganda, a study was done from 2006 to 2009 which trained 271 volunteers to become community health workers in a population of approximately 61,000 people. The study concluded that with high rates of retention, the newly trained community health workers successfully reduced rates of diarrheal illness, fever/malarial illness, as well as the prevalence of malnutrition as compared to the control group without CHW intervention. <sup>[15]</sup> This study

demonstrates the potential improvement that training community health workers in the recognition of pediatric illnesses could have on the mortality rate in low income counties.

A 2005 study done in the Gadchiroli district in India examined the effectiveness of training “village health workers” CHWs on the use manual resuscitation devices (bag valve masks and tube masks) in reducing neonatal deaths related to asphyxia. The group found that neonatal mortality in the area dropped by 65% as compared to births that were only attended by a traditional birthing attendant. <sup>[16]</sup> In addition, the intervention had a cost of \$13 USD per life saved over the course of the study. <sup>[16]</sup> Not only was the training of community health workers in this area of India able to reduce the neonatal mortality rate due to asphyxia, but it was also done cost-effectively – a great intervention for a resource poor setting with a high infant mortality rate.

Finally, a study which highlights the potential effectiveness of training community health workers in reducing maternal mortality describes a program in The Gambia in which 48 “village health workers” were trained in recognition of obstetric emergencies as part of an emergency ambulance service. The results of the program are still under study, but the data included in the article demonstrated that as a result of the CHW training, all the women (11 women) in the study with pregnancy induced hypertension survived, the majority (7/8 of the women) of women suffering from postpartum hemorrhage survived and all women (3 women) with infections during pregnancy survived. <sup>[17]</sup> This study is limited, however the rates of survival reported are very encouraging and are far better than the reported statistics for maternal mortality. This study demonstrates the beneficial effect that training community health workers in identifying and managing maternal/obstetric emergencies may potentially have on maternal mortality rates if widely implemented. A second study which highlights the utility of community health workers in improving maternal mortality examined the administration rates of misoprostol to reduce the incidence of postpartum hemorrhage in multiple developing countries. The review article concluded that distribution and administration of misoprostol was the greatest with CHW utilization and the authors stated that the maternal mortality rate derived from the meta-analysis of 18 separate studies performed in low income countries was as low as 59 deaths per 100,000 live births, much lower than the average rate (230 per 100,000)

in developing regions. <sup>[18, 7]</sup> Both of these studies demonstrate the utility and diversity of community health workers and highlight their ability to reduce maternal mortality in resource poor settings.

As seen in the examples provided above, it is widely accepted that training of and intervention by CHW has the potential to reduce maternal, neonatal and childhood mortality rates. Less agreed upon, however, are the methods by which the community health workers are trained. The following sections examine selected studies to highlight methods of training programs which are successful for specific disease processes and less successful for others.

### ***Training Methods of Community Health Workers***

There are many different ways of training community health workers in the community – some methods seem to more effective than others. How the information is presented and how the skills taught are practiced and the consistency of training, are variables that appear to change the efficacy of training programs. One common theme in many of the diverse training programs is the use of guidelines published by the WHO called the Integrated Management of Childhood Illness or IMCI. <sup>[19]</sup> The training programs that make use of these guidelines inform which specific disease processes and treatments are taught to CHWs in training. This comprehensive review will examine different aspects of training that seem to work well, and this information will be investigated thoroughly in the systematic review of the literature.

The manner in which educational information is presented is a major consideration in training community health workers. In many cases, pictorial representation of emergency medical situations and appropriate medical responses is a very effective way of circumventing both limited literacy in the population, as well as language barriers that might exist. Multiple studies demonstrate that with pictorial representations, community health workers can be taught to recognize various medical conditions such as danger signs, diarrheal illness and malnutrition. <sup>[20, 21]</sup> Another way of presenting information that is currently in use and demonstrates an increase in the knowledge of the CHWs are presenting video recorded exams, as was done in training CHW in Kenya. <sup>[19]</sup>

Finally, the most ubiquitous of all training methods described in the literature, and a method used in most medical training centers all over the world, is placement of the training community health workers in a clinical setting. This allows for hands-on training with a diverse array of clinicians and is a very common element to the more successful training programs for community health workers. <sup>[19, 22, 23, 24]</sup> When evaluating studies for specific types of training, it is difficult to attribute success to one specific method of training, most of the studies reviewed use multiple teaching techniques and tools. One general trend, in fact, is that training programs that utilize a diverse array of training methods, are generally successful in their training. The effectiveness of using different training methods merits further investigation and is further reviewed in the systematic review.

Another aspect of training that was very variable between studies was the length of time that the training took place as well as the follow up recurrent training. In some cases, training lasted as long as three weeks, most training programs were between 3-5 days, and some contained less than 20 hours of training. <sup>[19, 20, 21, 25]</sup> This variable training time seemed to be dependent on the topics covered. In the shortest training program, 16 hours, the goal of the project was to increase the general health literacy concerning newborn care, breast feeding, nutrition and the prevention of diarrheal illness. <sup>[25]</sup> This seems to indicate that with program goals aimed at increasing public awareness, shorter training programs are effective. One very interesting study done in India in 2008 examined the difference between a five-day training program and an eight-day training program and found that the eight-day training program showed no benefit in training over the five-day program, and cost substantially more than the shorter program. <sup>[26]</sup>

One factor in training that seems to be very important is how often, if at all, community health workers are retrained. Multiple studies point to recurrent training as very important in helping CHW retain and use the information they are taught. <sup>[20, 21, 23]</sup> One study published in 2005 on vaccine coverage rates implicated lack of recurrent training of CHWs on the low hepatitis B vaccination rates in rural Columbia. <sup>[27]</sup> A study done in rural India in 2005 demonstrates a very significant increase in knowledge with refresher training and provides good evidence that shorter follow up times between initial training and recurrent training leads to better retention of information by the CHW. <sup>[23]</sup> From the available literature, it seems that frequent refresher training of community health workers is a more important variable than the length of time spent training. Further examination of this is warranted and can be found in the systematic review as a follow up to this comprehensive review.

Despite all the good that training community health workers has been shown to have in developing regions, there are still issues that need to be addressed and further studied before definitive conclusions can be drawn concerning the training of community health workers. For example, there is evidence that the technique used to recognize pneumonia in children by community health workers all over the world may be inaccurate. The study indicated that counting respiration rates of children suspected of having pneumonia did not accurately predict

whether or not they actually had pneumonia. <sup>[28]</sup> This particular issue, does not specifically indicate a problem in training CHWs, but rather demonstrates that the techniques being taught to CHWs need more critical appraisal. Another major challenge to training community health workers is ensuring retention of those trained workers. There is evidence that attrition is a problem when programs do not take steps to ensure that CHWs stay in the community for a long period of time. <sup>[29]</sup> Finally, in the majority of studies covered in this comprehensive review, supervision of trained community health workers was not emphasized. Without supervision by a qualified medical professional, there is a possibility that under-trained, or misinformed CHW have the potential to cause more harm than good and as such more research is needed into the best way to supervise community health workers in austere locations.

## ***Conclusion***

The need for medical care in developing regions is apparent from data demonstrating disparities in mortality rates among pregnant women, neonates and children under the age of 5 years. Community health workers have demonstrated their utility and efficacy in a multitude of settings especially with regard to identifying and treating the aforementioned patient populations. With training programs utilizing evidence based guidelines for identification and management of various medical conditions, in addition to adequate training length and frequent recurrent training, CHWs have the potential to effect real change globally on maternal, neonatal and childhood mortality rates. More research is needed into the medical techniques taught to CHWs, retention of CHWs and finally the supervision of CHWs. It is the goal of this project to identify the most effective techniques in training CHWs with the hope of improving training protocols and methods and eventually improving the health of communities served by community health workers.

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