

**WHAT DO COMMUNITY HEALTH WORKERS NEED TO  
PROVIDE COMPREHENSIVE CARE THAT INCORPORATES  
NON-COMMUNICABLE DISEASES?**

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**A thesis submitted in fulfilment of the requirements  
for the degree of Doctor of Philosophy**

**School of Public Health, Sydney Medical School  
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**2019**

# DECLARATION

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The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

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Marwa Abdel-All

10/07/2019

**“To my mother, Samia El Barawy – for her enduring love and unconditional support.  
And to my late father – Dr Ahmed El Taher, who I have never had the pleasure of  
meeting him. I am sure he would have supported me throughout my journey and  
would have been proud of me”**

# ACKNOWLEDGMENT

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I am particularly thankful to my primary supervisor Associate Professor Rohina Joshi for her encouragement, support, patience and direction throughout the journey. I would also like to thank my associate supervisors Professor Stephen Jan and Dr Seye Abimbola; I would not have completed this PhD journey without their continued support throughout this process.

A special thank you to my friends and colleagues at the George Institute who provided me with space and time when I needed it.

My sincerest thanks goes to my family back home in Egypt. My brother Mohamed and his family, my aunties and uncles. Their love, support, and pride in my achievements have been tremendous.

My cute twin nieces Mariam and Malak, thank you for being the source of joy in my life.

I am fortunate to have the support of all my loving friends here in Sydney, who I consider as my second family. I am thankful to all their invaluable support and encouragement.

# TABLE OF CONTENTS

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<b>AUTHORS' CONTRIBUTIONS .....</b>	<b>1</b>
<b>ETHICS CLEARANCE .....</b>	<b>2</b>
<b>ABSTRACT .....</b>	<b>3</b>
<b>PUBLICATIONS ARISING FROM THIS THESIS .....</b>	<b>8</b>
<b>PART ONE: INTRODUCTION.....</b>	<b>9</b>
CHAPTER ONE: THE HISTORY AND ROLE OF COMMUNITY HEALTH WORKER OVER TIME .....	10
<b>PART TWO: TRAINING COMMUNITY HEALTH WORKERS FOR NON- COMMUNICABLE DISEASES PREVENTION AND CONTROL .....</b>	<b>30</b>
CHAPTER TWO: EFFECTIVENESS OF COMMUNITY HEALTH WORKER TRAINING PROGRAMS FOR CARDIOVASCULAR DISEASE MANAGEMENT IN LOW-INCOME AND MIDDLE-INCOME COUNTRIES ...	31
CHAPTER THREE: EVALUATION OF A TRAINING PROGRAM OF HYPERTENSION FOR ACCREDITED SOCIAL HEALTH ACTIVISTS (ASHA) IN RURAL INDIA.....	69
<b>PART THREE: FACTORS INFLUENCING THE MOTIVATION AND RETENTION OF THE ASHAS IN THE WORKFORCE.....</b>	<b>101</b>
CHAPTER FOUR: THE DEVELOPMENT OF AN ANDROID PLATFORM TO UNDERTAKE A DISCRETE CHOICE EXPERIMENT IN A LOW RESOURCE SETTING.....	102

CHAPTER FIVE: WHAT DO INDIA’S ACCREDITED SOCIAL HEALTH ACTIVISTS WANT – FINDINGS FROM A DISCRETE CHOICE EXPERIMENT .....	115
<b>PART FOUR: PERSPECTIVES OF THE KEY STAKEHOLDERS OF THE ASHA PROGRAM .....</b>	<b>141</b>
CHAPTER SIX: WHAT DO ASHAs NEED TO PROVIDE COMPREHENSIVE CARE THAT INCORPORATES NON-COMMUNICABLE DISEASES? – FINDINGS FROM A QUALITATIVE STUDY IN ANDHRA PRADESH, INDIA .....	142
<b>PART FIVE: DISCUSSION, FUTURE DIRECTIONS AND CONCLUSION .....</b>	<b>167</b>
CHAPTER SEVEN: DISCUSSION AND CONCLUSION .....	168
<b>APPENDICES .....</b>	<b>185</b>
APPENDIX I. DISCRETE CHOICE EXPERIMENT QUESTIONNAIRE.....	186
APPENDIX II. PUBLISHED MANUSCRIPTS.....	197

# AUTHORS' CONTRIBUTIONS

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The work presented in this thesis has been carried out by the candidate under the supervision of Associate Professor Rohina Joshi, and co-supervisions of Professor Stephen Jan and Dr Seye Abimbola. This included planning of research, design of component studies, ethics committee submissions, the collection, management, analysis and interpretation of data, preparing the first draft of each manuscript and facilitating the finalisation of the final manuscripts for submission to peer-reviewed journals. The candidate is primary author on all publications. The candidate researched and wrote the introduction and conclusion sections.

This thesis has benefited from multidisciplinary collaboration. The relative contributions of all co-authors are specified at the beginning of the relevant chapters.

Marwa Abdel-All

10/07/2019

As supervisor for the candidature upon which this thesis is based, I can confirm that the authorship attribution statements contained in each chapter are correct.

Rohina Joshi

10/07/2019

# ETHICS CLEARANCE

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All of the empirical research included in this thesis has been approved by a Human Research Ethics Committee in each of the studies' jurisdictions.

The study presented in chapter three is based on an analysis of data collected through a cluster randomised feasibility trial to improve the control of hypertension in rural India (CHIRI). The Approval for the overall study was obtained from The Centre for Chronic Disease Control, India; Christian Medical College, Vellore, India; Sree Chitra Tirunal Institute for Medical Sciences and Technology, India; Health Ministry Screening Council, India; Rishi Valley Ethics Committee, Rishi Valley School, Madanapalle, India; Monash University, Australia and Indian Council of Medical Research, Delhi, India.

The research conducted for chapters four, five and six was approved by The George Institute Ethics Committee of The George Institute for Global Health, India.

Ethical approval was not required for chapters one, two and seven.



# ABSTRACT

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Non-Communicable Diseases (NCDs) such as heart disease, stroke, cancer, chronic respiratory diseases and diabetes are the leading cause of premature death and disability worldwide, accounting for 60% of all deaths globally and 80% of NCD related mortality occurring in low and middle-income countries (LMICs). Health systems in LMICs have been oriented toward maternal and child health, and infectious illnesses as these were the main causes of morbidity and mortality until recently. Over the last decade, health systems in LMICs have recognized the need to address NCDs, and have restructured health services to include relevant prevention and control strategies. Health workforce is one of the key building blocks of health systems; however, most LMICs have a shortage of physicians. In addition, the available health care providers are unevenly distributed within countries with the majority concentrated in urban regions compared to rural regions where large proportions of the population reside. This poor distribution and shortage of physicians has led some countries to rely on task shifting, where tasks normally performed by qualified health professionals are transferred to other health providers with a lower level of education and professional training.

In 1978, the Declaration of Alma-Ata included trained community health workers (CHWs) and traditional medical practitioners as part of the health team as a fundamental step towards comprehensive primary care. Since then, CHWs have been a cornerstone of health systems in several countries with over 26 different CHW programs identified in the literature across more than 24 LMICs. Traditionally, CHWs

do not hold formal professional certification but receive job-related pre-service training. However, there is a lot of variation across countries where some countries require CHW certification before they can start performing their roles. CHWs reside in the community where they work, and are usually volunteers and sometimes receive financial compensation for receiving training and performance-based incentives for health related activities. CHWs can enable essential health care services to be provided in a cost-effective manner. They have been instrumental in reducing maternal and neonatal mortality rates through their presence for home births and making referrals for emergency obstetric care, and by promoting vaccination uptake, breastfeeding, and education about infectious disease. More recently, CHWs have been useful in HIV/AIDS prevention and control, educating communities and performing tasks such as screening, counselling and supplying antiretroviral drugs. With the increasing prevalence of NCDs and to meet changing community health needs, CHWs are sought to provide a similarly appropriate care for NCD risk factors control. While CHWs may not replace qualified health providers, they can play a considerable role in improving health outcomes by educating, screening, referring and following-up individuals at high risk of NCDs. CHWs have been trained in some settings to screen, educate and follow-up patients with NCDs or people at increased risk of NCDs. However, there is a need to better understand how to support CHW programs to be more effective and sustainable. There is knowledge gap in terms of the CHWs current capacity, working conditions, training provided for NCD prevention and control, remuneration, supervision and other upstream challenges facing CHWs and the health systems.

The literature suggests that there is a range of context-specific factors which can have an impact on the performance of CHWs and the quality of the care they provide.

Some of these factors include the remuneration schemes employed, the workload, task complexity, lack of clarity in job description, and other essential factors such as interpersonal relationships between CHWs and other members of the primary health care team. CHW programs operate differently across and within countries. Evidence-based policy interventions are required to inform policy decision to ensure effective CHW program implementation.

This thesis applies a mixed-methods approach to explore the capacity of the CHWs and the system support necessary to facilitate the CHW's role in providing comprehensive, community-oriented, continuous primary health care which includes prevention and control strategies for NCDs. Part One provides an insight into the historical background of CHWs and how their role has evolved due to global health needs. With the expanding role of CHWs to incorporate NCDs, part two throws light on training of CHWs for NCDs in LMICs. Chapter two presents results of a systematic review about the effectiveness of training CHWs for cardiovascular disease prevention and management in LMICs. The chapter findings demonstrate the importance of having interactive and culturally adapted training sessions to make the training easier to follow and understand by the CHWs. The findings also highlight the need for evaluating the knowledge and skill-set of the CHWs to capture the training impact; and the necessity of scheduling refresher training at regular intervals to ensure knowledge retention. Chapter three demonstrates the importance of using an evaluation framework such as Kirkpatrick's evaluation model to evaluate the effectiveness of training among CHWs. Using an evaluation framework, not only assesses the knowledge change but rather employs multiple measures to assess knowledge, skills and behaviour change of the CHWs. This allows for a more comprehensive interpretation of the training outcomes. The qualitative data involved in Chapter three

provided insight on the low morale and discontent of the CHWs with their working conditions.

In part three, I use a discrete choice experiment (DCE) to provide evidence of effective interventions that can keep the CHWs motivated and retain them in the workforce. Chapter Four explains the process of designing a DCE for Accredited Social Health Activists (ASHAs), who are CHWs in India. It also provides evidence of the feasibility of using Android computer tablets to display the DCE for the CHWs. In chapter five, I examine the relative importance of stated preferences of ASHAs to remain in service using a DCE survey. Career progression was found to be the main influencing factor for ASHAs in addition to fixed salary and other non-financial factors such as priority free family health-check and reduced workload. The findings demonstrated that the ASHAs sociodemographic characteristics such as their education level plays a key role in shaping their preference profile. These findings can inform future policy decisions of evidence-based recruitment and retention strategies that are applicable to the local context.

CHWs have proven to be effective in providing a wide range of services including NCDs care. However to optimize the performance of CHW programs, we need to understand the system level support needed and the strategies necessary to be considered in the design and operation of CHWs' programs. Part four, investigates the policy and implementation elements and system level support needed to enable the CHWs in rural India to provide comprehensive primary health care that incorporates NCDs. Chapter six uses policy review and qualitative research to understand the policy and implementation gaps, current capacity, working conditions and challenges faced by ASHAs in providing NCDs care to their community. It provides an overview

of the perspectives of the key stakeholders of the ASHA program including ASHAs, ANMs, primary care doctors, community members, and district medical officers. Findings revealed that ASHAs are unrecognised as formal members of the NCDs delivery team, however they are overburdened with extensive NCDs tasks without receiving training or remuneration for these tasks. ASHAs remain to be volunteers that receive performance based remuneration and are not covered by any of the workers' rights or laws. However, ASHAs remain enthusiastic about helping their communities and aspire to be recognised as formal employees of the health system with a potential career progression pathway. The concluding chapter summarises the key findings, discusses the main themes emerging from the thesis and outlines the future research directions and policy recommendations.

# PUBLICATIONS ARISING FROM THIS THESIS

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## CHAPTER TWO

Abdel-All M, Putica B, Praveen D, Abimbola S, Joshi R. Effectiveness of community health worker training programmes for cardiovascular disease management in low-income and middle-income countries: a systematic review. *BMJ Open*. 2017 Nov 1;7(11):e015529.

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## CHAPTER FOUR

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## CHAPTER FIVE

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## CHAPTER SIX

Abdel-All, M., Abimbola, S., Praveen, D. Joshi, R. What do Accredited Social Health Activists need to provide comprehensive care that incorporates non-communicable diseases? Findings from a qualitative study in Andhra Pradesh, India. *Human Resources for Health* 17, 73 (2019)  
doi:10.1186/s12960-019-0418-9

**\*\*Published manuscripts for Chapters TWO, THREE, FOUR, FIVE and SIX are available in**

**Appendix II\*\***

# **PART ONE: Introduction**

# **CHAPTER ONE: The history and role of community health workers over time**

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## **CHAPTER OVERVIEW**

This chapter presents an overview of how the role of community health workers has developed through history and shaped according to the communities' needs. It also gives a brief background on the Accredited Social Health Activists (ASHAs), the community health workers of India. The chapter finishes with an outline of the research aim and objectives, and a description of the research methods used in the thesis.



## **Community health workers**

The World Health Organization defines Community health workers (CHWs) as “health workers who reside in the community where they work, selected by, and answerable to the community for their activities, supported by the health system but not necessarily part of its organization, and have shorter training than professional workers”.<sup>1</sup> CHWs are a diverse category of health workers that perform a range of basic health services and are referred to by different terminologies across various countries. Traditionally they do not hold formal certification, but receive standardised job-related training of a shorter duration than health professionals. They typically reside in the communities where they provide their services and therefore have an in-depth understanding of the community, culture and language and tend to provide culturally appropriate health services to the community.<sup>2</sup> They can be unpaid volunteers or receive performance-based honorariums for doing specific tasks or sometimes salaried employees of the health system. They have proven to be effective in increasing access to healthcare services and generating positive health outcomes especially in resource-constrained settings.<sup>2</sup>

## **History of the health workforce**

Lay healers (or informal health care providers) may have existed a long time ago starting in the stone age and ancient history.<sup>3</sup> The practice of healing and looking after the sick was always carried out by a variety of practitioners which began informally but was progressively formalised. In ancient Egypt, for example, magicians and priests carried out what would later become the physician’s role, while ‘barbers’ were responsible for the bloodletting practices such as pulling teeth and lancing boils which would later become the surgeon’s role. Further, archaeological excavations revealed the roles of “wise women” who were skilled to detect and combat spirit possession,

which was perceived to be the main cause of illness at the time. These wise women would also act as midwives and also as nurses preparing herbal concoctions, spider webs for sores and grass plasters for wounds.<sup>4</sup> Women healers also enjoyed a respected social status well into ancient Greek history.<sup>3</sup>

However, starting from the Roman era, women healers lost their respected social status due to gender and class inequalities, especially as the role of “physicians”, who were male, became more prominent in society. Women healers were hence regarded as belonging to a lower social level, as they were mainly available in villages to serve the poor. Women healers usually inherited or acquired their learning and skills from the traditions and folklore over generations and in some instances by observing the physician during their home visits. In the late middle ages (1200-1500 AD), as a result of the translation of the Islamic and Greek medicine,<sup>5-7</sup> establishment of medical schools led to the advancement of medical profession in Europe.<sup>8</sup> This created the need for educated nurses, consequently, the Catholic Church started offering professional nursing program for nuns.<sup>9</sup> In order to suppress competition with emerging medical professions, women healers (lay healers) were persecuted in the “witch-hunts” campaigns on the authority of monarchs and the medieval church. They were often accused of murdering and poisoning the patients and were hanged or burned alive.<sup>3</sup> But there was also a gender dimension to this discrimination, as women were denied access to universities or academic training due to their gender.<sup>8,9</sup>

### **Licensed medical practice**

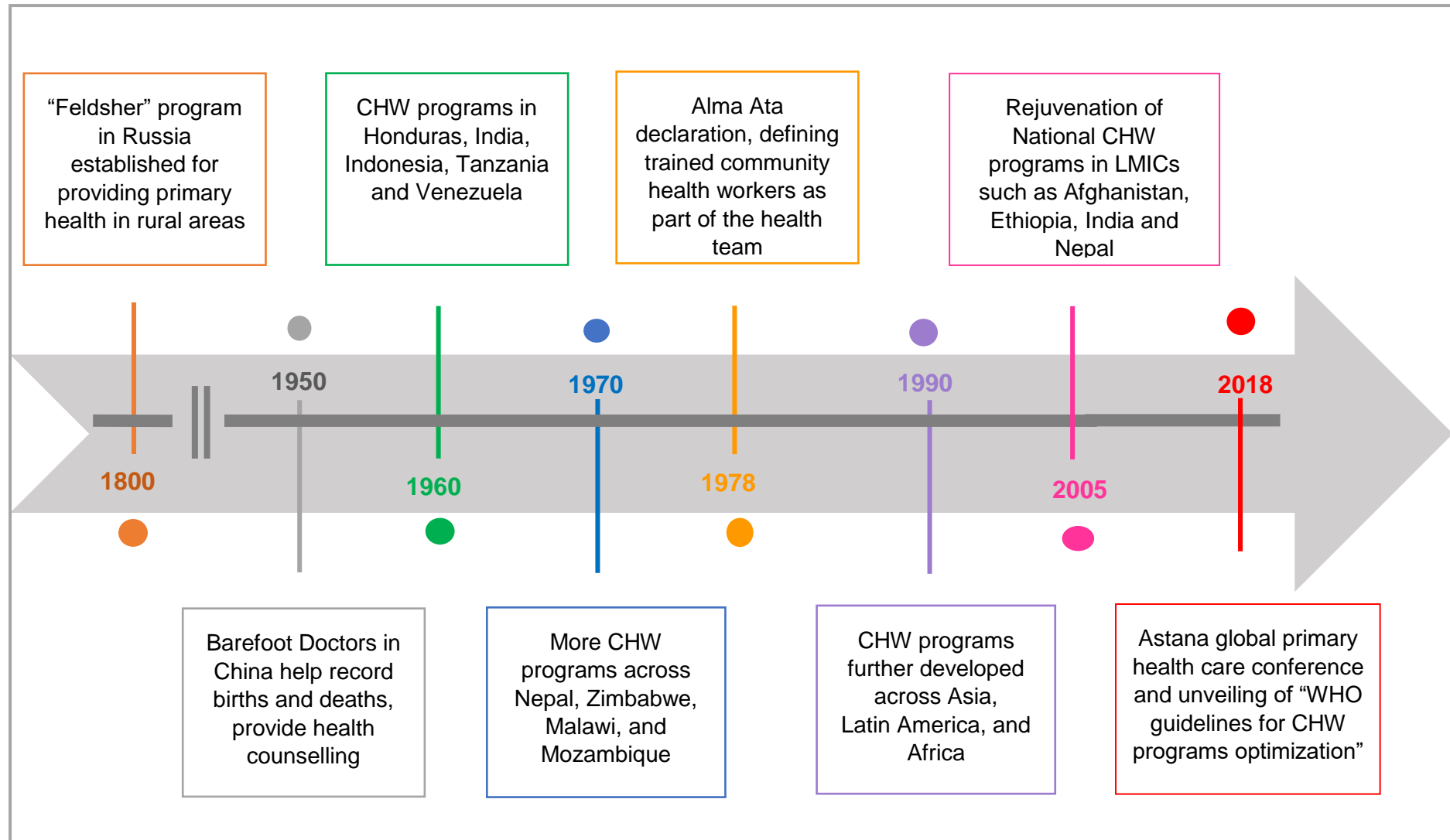
By the twelfth century, traditional healing practices were evolved into more advanced medical practice. While the quality of healthcare improved as the practice of medicine was restricted to licensed physicians, it restricted access and made health care

affordable only to the elite of the society. Physicians lived and practiced in towns and paramedics who were initially trained to assist physicians moved to rural regions.<sup>10</sup>

### **The evolution of community health workers**

The Russian Feldhsers were the first known CHWs in the early 1800s.<sup>11</sup> They were literate and received three years of formal training in primary healthcare and midwifery. The next known CHWs came from China in 1950, where uneducated farmers were trained for three months to provide essential primary healthcare to their communities including health education, immunisation and basic medical care.<sup>12</sup> These CHWs were known as “Barefoot Doctors”, and inspired the global primary healthcare movement<sup>13</sup> due to their success in reducing infant mortality rates in addition to effective control of common infectious diseases. Approximately two million Barefoot Doctors were trained to serve the rural Chinese population, focusing on preventive care, health education, and strategies that empowered communities to be responsible of their own health problems.<sup>14</sup> Many countries followed China’s lead and initiated CHW programs between 1960s and 1970s. These included Indonesia, India, Nepal, Tanzania, Zimbabwe, Malawi, Mozambique, Nicaragua, Honduras and other countries in Latin America. In addition, several non-governmental organization (NGO) also initiated CHW programs in many low-income countries, such as Haiti and Pakistan.<sup>15</sup> See Figure 1 for history of CHW programs.

**Fig 1. Timeline of Community Health Worker Programs in LMICs** <sup>16</sup>



## **The Declaration of Alma-Ata – defining the role of CHWs in Primary Health Care**

In the 1960s and 1970s, many developing countries experienced political changes and acquired their independence from colonial powers. Newly formed governments focussed on improving health care, education and other essential services with limited resources. They established medical schools and hospitals in the cities, leaving the rural regions behind, which led to large rural-urban gaps in infant mortality rates and maternal mortality rates.<sup>17</sup> People residing in rural regions relied on local CHWs, who were soon recognised for their efficiency in providing health care for specific health interventions like oral rehydration and immunisation.<sup>18</sup> These countries' experiences with the CHW programs informed the emergence of the concept of “primary health care”, within the international health discourse, incorporating equity and access to affordable preventive and basic curative services for everyone. These principles were adopted by the World Health Organization and served as an intellectual foundation to the international Alma-Ata conference in 1978<sup>19</sup> declaring health as a human right comprising complete physical, mental and social well-being for sustained economic and social development of countries worldwide; prioritising primary health care as a fundamental step towards comprehensive care by bringing health care as close as possible to where people live and work. In addition, the declaration explicitly defined trained community health workers and traditional practitioners as part of the health team. Promoting collaboration of governments and international organizations worldwide to achieve the stated goals health for all by the year 2000.<sup>20</sup>

Inspired by Alma-Ata, governments supported CHW programs proliferated around the world. Programs ranged from large-scale initiatives as in Brazil, Peru and Nicaragua

to small-scale programs initiated by non-governmental organizations in countries such as Haiti and Pakistan.<sup>21</sup>

## **Health Sector Reform**

The global recession in the 1980s impacted public health systems, especially primary care in several LMICs which needed financial support and skilled management. As political interest and commitment into comprehensive primary health care declined, CHW programs encountered implementation difficulties leading to collapse of some CHW programs such as Nepal's Female Community Health Volunteer (FCHV).<sup>15</sup>

In the early 1990s the World Bank initiated the Health Sector Reform approach,<sup>22</sup> emphasising on the role of the private sector in health care delivery and private health insurance aiming to reduce government expenditure. Developing countries had to adopt the new economic reform in order to receive funding from international donors. The idea of comprehensive primary care was replaced by selective primary care with investment into disease specific vertical programs.<sup>18</sup> These reforms were in stark contrast to the declaration of Alma Ata and the concept of equity to health service access.

## **Global experience of CHW programs**

CHWs received global recognition for their contributions in improving health outcomes for maternal and child health and infectious diseases through better access to health care. This influenced many LMICs across the globe to create large-scale national CHWs programs as in the case of Afghanistan, Ethiopia, Nepal, India, and Nigeria among other LMICs. These programs vary in their design and implementation strategies as each of them is adapted to the local cultural and social context. The main

role of CHWs is to link the community to the formal health system, alongside educate, screen and follow-up individuals in the community.

CHWs were trained to deliver selective primary health care programs, including maternal and child health care, and prevention of infectious diseases like malaria, tuberculosis and HIV/AIDS. CHW programs have made a substantial contribution towards achieving the United Nation's Millennium Development Goals (MDGs).<sup>15</sup> Research studies demonstrated the effectiveness of CHWs in delivering care to reduce maternal and child mortality rates,<sup>23</sup> improving access to care, improving adherence to medicines<sup>24</sup> and being cost-effective.<sup>21</sup> This emerging evidence has reignited interest in CHW based programs and now on its 40<sup>th</sup> anniversary, the World Health Organization (WHO) released new guidelines to optimize CHW programs.<sup>25</sup>

### **Health transition and re-engineering the health workforce**

Most LMICS are facing a dual burden of disease due to epidemiological transition, urbanisation and an aging population. In 2014, NCDs accounted for 41 million deaths annually, of which 15 million deaths were premature; and over 85% of these premature deaths occurred in LMICs.<sup>26</sup> The leading causes of NCDs deaths are cardiovascular disease, diabetes, cancer and respiratory diseases. The United Nation's Universal health coverage (UHC) and Sustainable Development Goals (SDG 3.4) aim to reduce NCDs by 30% by 2030. In order to achieve this target, the world needs 18 million additional health workers.<sup>27</sup> One way of achieving SDG 3.4 is to utilise the current workforce and retrain them to provide comprehensive instead of selective primary health care. This strategy was effective in combating HIV/AIDS in sub-Saharan Africa<sup>28</sup> and over the last decade has been shown to be effective in providing NCD related services such as screening for cardiovascular risk factors,<sup>29</sup> controlling

hypertension and blood sugar level, cervical cancer screening,<sup>30,31</sup> health education, and tobacco cessation.<sup>32,33</sup> Most of the evidence for NCD related CHW programs comes from research studies, which often are implemented in ‘artificial environments’ with strong financial and supervisory support. There is limited evidence about the effectiveness of CHW programs and the role of CHWs in NCD related national programs. As countries roll out these initiatives, lessons will be learnt in implementing these programs and methods to train, retrain and sustain CHWs.

### **Research Objectives**

In this thesis, I aim to review relevant literature and analyse empirical data to inform health workforce strategies to address the growing burden of NCDs in LMICs and the substantial need to incorporate CHWs into comprehensive primary health care provision. In addition, I explore the upstream system related factors and what the health system can do to sustain CHWs and motivate them to provide good quality, essential care to the communities who often do not have access to health care.

In order to unpack the contextual and upstream health system related factors that influence CHW initiatives, I studied one of the largest CHW programs globally, the Accredited Social Health Activists (ASHAs) of India, with almost one million ASHAs across India. In addition, India was chosen due to existing research networks which facilitated my research projects.

### **Accredited Social Health Activists (ASHAs) – India’s community health workers**

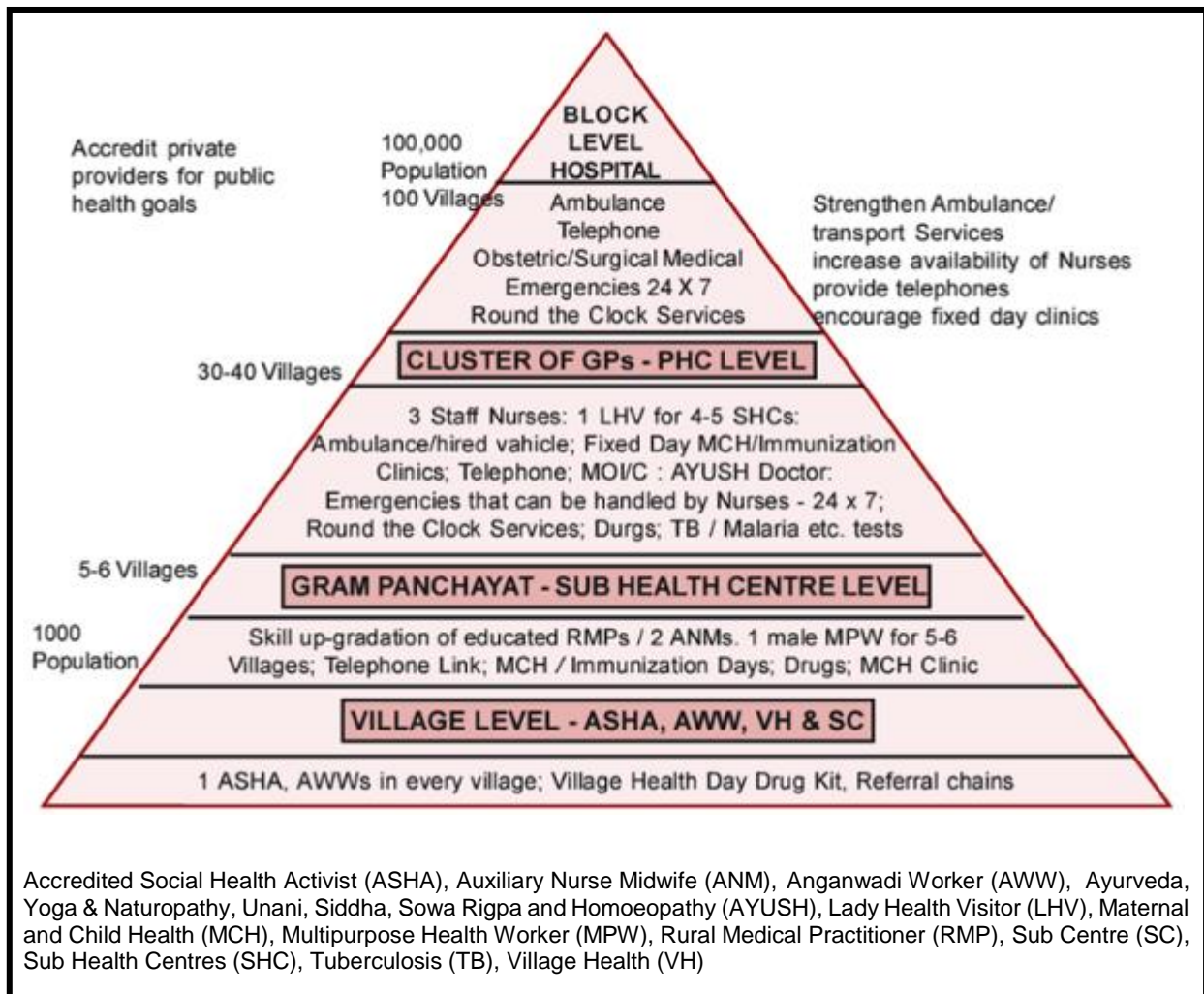
The Indian government established the National Rural Health Mission (NRHM) in 2005, aiming to provide equitable and affordable healthcare to the rural occupants with



a focus on maternal and child health. This has helped India to have a significant progress in improving survival rates among preventable diseases and maternal and child health care.<sup>34</sup>

One of the key components of the NRHM is Accredited Social Health Activists (ASHAs), the female community health workers of India.<sup>35</sup> Each ASHA supports a population of 1000 people for better access to public health services, act as a health educator, and link the community to the health system. In addition, ASHAs increase the community awareness of determinants of health such as nutrition, sanitation and hygiene.<sup>35</sup> In most states of India, ASHAs are volunteers who receive financial compensation for attending training and performance-based incentive for providing specific tasks like immunisation, referral of pregnant cases to health centres and escorting women for institutional deliveries.<sup>36,37</sup> On average ASHAs were expected to earn (1000 Indian rupees equivalent to 20 AUD ) per month. However, in some States of India like Telangana and Haryana, ASHAs receive a basic salary or honorarium in addition to their performance-based compensation which can be up to (4500 Indian rupees equivalent to 92 AUD). The ASHA program is an all- female cadre, this is in recognition of cultural norms and the fact that female CHWs would be more acceptable in reaching female beneficiaries for maternal and child health services. Furthermore, the voluntarily nature of the role and the limited remuneration structure would not be attractive to men, who are considered the primary earners in the rural Indian context.<sup>38</sup> They are directly supervised by auxiliary nurse midwives (ANM), who manage them (see Figure 2), process their payments and attend weekly meetings with them at the local health centres.<sup>39</sup>

**Fig 2. The National Rural Health Mission Illustrative Structure** <sup>34</sup>



The health service based responsibilities of ASHAs range from health education, community sensitization to new initiatives, referrals to health centres and supporting medication adherence for infectious diseases like tuberculosis through the Directly Observed Treatment, Short Course (DOTs) program.<sup>35</sup> The main function of ASHAs however is to support the ANM in delivering care for pregnant women and supporting child health activities like immunisation.

India like other developing countries is facing a rising burden of NCDs. The rapid urbanisation concomitant with the increase in life expectancy, will impose a great risk

on the health of the populations which in turn will impact economic development of the countries.<sup>40</sup> This is more evident among the poor populations mainly living in rural and remote areas experiencing rapid demographic and epidemiological transition accompanied by lack of access to good quality health services.

In order to attain the United Nation's Universal Health Coverage (UHC) and achieve progress towards Sustainable Development Goals (SDGs), India has launched the National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke (NPCDCS) in 2010 to combat non-communicable diseases.<sup>40</sup> This program was introduced as a pilot in 100 Districts and is currently being rolled out in the country. NPCDCS aims to prevent and control common NCDs through a team-based approach incorporating ASHAs at the community level. Based on the ASHA's distinctive capacity to deliver culturally adapted care; they are trained to increase health awareness among their communities and help in the early detection and management of chronic diseases like cardiovascular disease, stroke, diabetes and cancer, in addition link the identified cases with the health system for follow-up.

More recently in 2014, the Indian government initiated the comprehensive primary health care (CPHC) program. CPHC is thought to reduce morbidity and premature mortality among the population and eventually reduce the reliance on secondary and tertiary centres for primary care needs by providing access to essential health care at the community level. This requires trained primary health care teams, incorporating ASHAs and other frontline health workers to ensure continuity of care at the household level.<sup>41</sup>

In the context of NPCDCS and CPHC, and the need for strengthened health services via an expanded role of ASHAs, this thesis will explore the current capacity of the

ASHAs, challenges in delivering primary care, and how they can be supported by the health systems to be part of a health care team, which provides comprehensive, continuous, community oriented care. The research objectives are described below:

1. Objective One:

Examining the effectiveness of CHWs' training programs for non-communicable diseases in LMICs with a focus on cardiovascular disease and its risk factors (Part Two):

- Chapter Two: Systematic review investigating the effectiveness of CHW training programs for cardiovascular disease management in low and middle-income countries.
- Chapter Three: Evaluation of the effectiveness of a training program for ASHAs to prevent and control hypertension in three rural communities in India using the Kirkpatrick Evaluation Model.

2. Objective Two:

Investigating the factors influencing the motivation and retention of the ASHAs in the workforce (Part Three):

- Chapter Four: Development of a technology enabled discrete choice experiment (DCE) for low-literacy CHWs in India
- Chapter Five: Conducting a DCE among ASHAs to identify the key motivational factors (and their relative importance) that may help retain ASHAs in service.

### 3. Objective Three:

Exploring the perspectives of the key stakeholders of the ASHA program on the role of ASHAs in delivering CPHC that incorporates NCDs. (Part Four):

- Chapter Six: Desk analysis of current Indian policies for NCDs service provision, in addition to a qualitative study among stakeholders of the ASHA program at Guntur, a district of southern India. This will provide a detailed understanding of the policy and implementation gaps in the region and explore challenges experienced by ASHAs to deliver Comprehensive Primary Health Care that incorporates NCDs.

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**PART TWO: Training community health workers  
for non-communicable diseases prevention and  
control**

# **CHAPTER TWO: Effectiveness of community health worker training programs for cardiovascular disease management in low-income and middle-income countries**

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## **CHAPTER OVERVIEW**

This chapter reports the results of a systematic review evaluating the effectiveness of CHW training programs for cardiovascular disease management in LMICs. The chapter consist of a single manuscript titled: 'Effectiveness of community health worker training programmes for cardiovascular disease management in low-income and middle-income countries – a systematic review.

CHWs are increasingly being tasked to provide basic services for the prevention and control of cardiovascular disease and its risk factors in LMICs. However, little is known about the training necessary for them to accomplish the new role. This systematic review demonstrates that CHWs can be trained effectively for CVD prevention and management. However, the effectiveness of CHW training varies depending on context such as CHW demographics, study settings, and content and method of training). Well conducted mixed-methods studies are needed to provide reliable

evidence about the effectiveness and cost-effectiveness of training programs for CHWs.

## **AUTHOR CONTRIBUTION**

MA, BP and RJ have all made substantial contribution to the concept, design, analysis and interpretation of the data. BP drafted the protocol under the supervision of RJ. BP and MA independently conducted the search, screened the titles, abstracts and keyword of publications retrieved to identify publications that appeared to meet the inclusion criteria before screening the full texts for final inclusion. RJ arbitrated any disputes regarding the inclusion of papers. MA and BP extracted the data, and contributed towards the interpretation of the results. MA wrote the first draft. RJ conceived the research question, supervised the review and approved the final version of the manuscript. DP and SA provided critical input towards the manuscript. All the authors reviewed the final draft of the manuscript for journal submission, and helped draft the responses to the reviewers' comments. MA prepared the final draft of the manuscript for publication.

## **PUBLICATION DETAILS**

Abdel-All M, Putica B, Praveen D, Abimbola S, Joshi R. Effectiveness of community health worker training programs for cardiovascular disease management in low-income and middle-income countries: a systematic review. *BMJ Open*. 2017 Nov 1;7(11):e015529.

## **BACKGROUND**

### **Cardiovascular Diseases in developing countries**

Globally, the burden of non-communicable diseases (NCDs) is rising with the cause specific mortality fraction due to NCDs estimated to be 69% in 2030 compared to 59% in 2002.<sup>1</sup> This shift is largely driven by a demographic and epidemiologic transition, coupled with rapid urbanization and nutritional transitions in developing countries.<sup>2</sup> Currently, cardiovascular disease (CVD) is the leading cause of morbidity and mortality in the developed and developing countries alike, with a greater burden being felt by the latter, as they carry a higher proportion of premature deaths from cardiovascular events.<sup>3,4</sup> Most health systems in low- and middle-income countries (LMICs) are unprepared to manage the increasing burden of CVDs as their health systems are often focused on infectious diseases and maternal and child health, rather than chronic diseases.<sup>5,6</sup>

### **The health workforce for CVD**

Access to primary care for CVD prevention and treatment in LMIC can often be challenging<sup>7</sup> as these countries have the highest global disease burden and tend to experience some of the greatest shortages in physicians and health workers.<sup>8</sup> For example, there are 2.3 health workers per 1000 population in Africa, and 4.3 per 1000 population in South-East Asia compared to 18.9 and 24.8 per 1000 in Europe and the Americas respectively.<sup>9</sup> A maldistribution of these health workers often exist with a higher concentration of health workers in urban areas (more than 65% of physicians, 60% of nurses, and 58% of other health workers) compared to rural regions where large proportions of the population resides (45% of the population).<sup>9-11</sup> This poor

distribution and shortage of health professionals has led some countries to rely on trained community health workers (CHWs), who take on specific tasks for the prevention and management of diseases.

### **Community health workers**

The World Health Organization (WHO) defines CHWs as individuals who perform functions related to health-care delivery; have shorter training than professional health workers, are community members, selected by and answerable to the community for their activities and are usually supported by the health system but not necessarily a part of its organization. Typically, they are trained for specific tasks such as provision of antenatal care or immunisation and often do not hold any formal certifications.<sup>12</sup> CHWs have been effective in providing essential health care services in a cost-effective manner.<sup>13,14</sup> They have been instrumental in reducing maternal and neonatal mortality rates through their presence in at-home births and making referrals for emergency obstetric care,<sup>15-17</sup> and by promoting vaccination uptake, breastfeeding, and education on infectious diseases.<sup>18,19</sup> More recently, CHWs have been useful in HIV/AIDS prevention and control, educating communities and performing tasks such as testing, counselling and prescribing antiretroviral drugs.<sup>20-24</sup> This transfer of responsibilities onto CHWs is commonly referred to as task shifting, which is common in regions with limited access to physicians.<sup>25-27</sup> This increase in responsibility has been noted throughout the global health community, and it is not uncommon for CHWs to hold different titles based on the country where they work or the tasks for which they are responsible (such as non-physician healthcare worker, lay health worker, traditional birth attendant, accredited social health activist, Barangay Health worker, etc.).<sup>12</sup>



Over the last 10 years, CHWs have had an increasing role in CVD prevention and control.<sup>28-32</sup> Although research into the effect of CHWs in CVD prevention and control is relatively new, there is emerging evidence which yields promising results.<sup>33-36</sup> There is considerable amount of data and manuals available to help train CHWs for management of infectious diseases and maternal and child health in LMIC;<sup>37-39</sup> however, there is a lack of evidence based information regarding the content and method to train CHWs for CVD prevention and control.<sup>40</sup> Effective training and re-training are essential for the knowledge and skill-set required for good quality performance. This systematic review aims to provide comprehensive insight into CHW training programs for CVD prevention and control, and provides an evidence base for the effectiveness of training programs in the LMIC context.

## **METHODS**

A protocol was written to define the inclusion and exclusion criteria and the methods for the review prior to data extraction in accordance to the PRISMA guidelines.<sup>41</sup> Five data bases including Medline via OvidSP, Global Health via OvidSP, ERIC via OvidSP, Embase via OvidSP, and CINAHL via EBSCO were reviewed.

### **Inclusion and exclusion criteria**

The population considered for this systematic review was CHWs in LMICs. Synonyms for CHWs included in the search were taken from the WHO report on CHWs,<sup>12</sup> and other terms based on literature reviews.<sup>42-44</sup> A medical librarian was consulted to ensure integrity of our search. The review included intervention studies which offered training programs for CHWs in CVD and cardiovascular risk factor prevention (screening, health promotion) or control (monitoring, management). Papers included

were specific in what type of training methods were used, i.e. which topics were covered, length and outcomes of the training programs, etc. Studies were limited to CVDs and their modifiable risk factors including high blood pressure, diabetes, dyslipidaemia, alcohol consumption, tobacco use and physical inactivity. (A complete list of free text search terms and subject headings are available at Supplementary Material S1). The comparator variable for this paper included pre-service training and the outcome of interest was an improvement in skills and knowledge of CHWs in the prevention and control of CVDs and their risk factors after the training program. Types of studies included were pre-post observational studies, and randomised controlled trials published till 31 December, 2016. Papers in all languages were searched and those in a language other than English were translated. If a study was reported in more than one paper, information from all the papers was included in the review, but the study was counted once.

Studies were limited to those which were explicit in specifying what type of training was done and reported pre-post test scores for CHWs. They included countries classified during 2015 as low-, lower-middle, and upper-middle income countries in the World Bank's Income Classifications.<sup>45</sup>

### **Data collection**

After agreeing on the search strategy to be used, two authors (BP, MA) reviewed the literature and extracted the data independently. The number of studies included at each stage of literature search was agreed upon between the two authors to ensure no papers were missed and discrepancies were dealt by consensus. (Figure 1) Data was collected on a pre-specified excel sheet after approval of all reviewers, with variables clearly outlined. The first paper to be included was extracted independently

then the data was compared between authors to confirm what was to be expected to report for each variable. This sheet was modified to include all information that was important as data extraction continued. Weekly meetings were held between the data extractors to discuss any disagreements about the inclusion of a paper. If any disagreements, a third author (RJ) was asked to adjudicate. At the end of data extraction, all reviewers met to note any discrepancies and agree on the final data extraction. The references of all the included papers were checked for additional relevant papers. When necessary, corresponding authors of included papers were contacted regarding missing information in the published papers. Quality of studies was assessed and papers were critically appraised using Effective Public Health Practice Project (EPHPP)'s Quality Assessment Tool.<sup>46</sup> The Tool provides an overall methodological rating of the studies of strong, moderate or weak as per six components including selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts. Studies were rated strong if the study population was representative of the target population; had a robust study design such as a randomised controlled trial; controlled for confounding, used validated data collection tools, and had a low drop-out rate of the study participants. Two authors (BP, MA) followed the quality assessment tool and rated the studies independently and discussed discrepancies by consensus. No study was excluded based on the quality assessment.

### **Data analysis**

To demonstrate the change in knowledge and skills among CHWs, pre- and post-test scores and post intervention scores, published in the eight papers were used to evaluate the effectiveness of training. No additional statistical analysis was done as

individual test scores were not available and scores were not standardised across the eight studies. All studies were reviewed and a narrative synthesis was conducted to assess the studies comprehensively. The data were tabulated to explore the relationship between and within the included studies. Themes from the qualitative data reported were used to assess the CHWs perception and experience of the training. A meta-analysis was not performed due to heterogeneity of the studies.

## **RESULTS**

### **Characteristics of included studies, CHWs and trainers**

The initial search yielded 928 citations published between the period of 1959 and 2016. After removing duplicates 858 titles and 187 abstracts were screened. Ninety studies were assessed for a full-review, of which eight studies were included. Figure 1 outlines the systematic review process. The selected studies were conducted between the year 2000 and 2013, and published between the year 2007 and 2015. Four of the studies were conducted in rural or semi-urban areas and four studies did not mention details about the study site.<sup>47-50</sup> None of the studies discussed the cost of training involved or the cost-effectiveness of the training.

The studies included Community Health Workers from Bangladesh, Guatemala, Mexico, South Africa<sup>51</sup> and Thailand,<sup>52</sup> Community Health Agents from Brazil,<sup>48</sup> Cadres Posbindu and Community Health Centre staff from Indonesia,<sup>49</sup> Barangay Health Workers from the Philippines,<sup>53</sup> Lady Health Workers from Pakistan<sup>54</sup> and Healthcare Volunteers from Iran<sup>50</sup> and Thailand.<sup>47</sup> The number of trained health workers varied from 35<sup>52</sup> to 299<sup>54</sup> and were mostly women (75-100%). The education of CHWs varied from primary school<sup>47,53</sup> to Master Degree holders.<sup>51,52</sup> In most studies,

the health workers were part of the health system receiving a salary, except in Guatemala where a monthly incentive was provided<sup>51</sup> and Iran and Thailand, where CHWs were volunteers from the community.<sup>47,50</sup> The training team included health professionals,<sup>51</sup> project officers<sup>54</sup> and researchers.<sup>48</sup> Four studies did not provide details about the trainers.<sup>47,49,50,52</sup> Detailed characteristics of the CHWs and trainers are provided in Table 1.

**Table1: Characteristics of Community Health Workers and Trainers**

Study	Type of Health workers (Country of study)	Number of CHWs	Sex	Age	Education	Relation to health system	Trainers
Abrahams-Gessel S et al, 2015 <sup>51</sup>	Community Health Worker (Bangladesh, Guatemala, Mexico & South Africa)	64	84% Females	Not reported	B: Secondary to Master's Degree, G: Secondary, M: Secondary, SA: Secondary	B: NGO employed G: NGO employed M: Government employed SA: NGO employed	Health professionals: physicians, nurses, and nutritionists
Da Silva SSB E et al, 2010 <sup>48</sup>	Community Health Agents (Brazil)	37	90.9% Females	50% of CHWs were up to 40 years	Secondary (67.3%)	Government employed	Researchers
Fatmah F, 2014 <sup>49</sup>	Cadres Posbindu and Community Health centre staff (Indonesia)	45	100% Females	Mean age 43.3	Primary (26.7%) Secondary (46.7%) Diploma (26.7%)	Government employed	Not reported
Ku GM V et al, 2014 <sup>53</sup>	Barangay Health Worker (Philippines)	87	Not reported	Not reported	Primary (8%), Secondary (42%), University (50%)	Government employed	Principal investigators and trained nurses
Nishtar S et al, 2007 <sup>54</sup>	Lady Health Worker (Pakistan)	299	100% Females	Not reported	Not reported	Government employed	Heartfile Officer (project officer)
Sangprasert P, 2011 <sup>47</sup>	Healthcare Volunteer (Thailand)	75	75% Females	Mean age 49.5	Primary (56.4%), Secondary (30.1%), Diploma (9.7%), University (3.8%)	Volunteers	Not reported
Seyed Emami R et al, 2011 <sup>50</sup>	Health Volunteer (Iran)	80	100% Females	Not reported	Primary (39.0%) Secondary (48.1%) University (12.2%)	Volunteers	Not reported
Sranacharoenpong K et al, 2012 <sup>52</sup>	Community Health Care Worker (Thailand)	35	97% Females	25-34y – (17%), 35-44y – (63%), 45-54y – (20%)	Diploma (5.7%), University (88.6%), Master's (5.7%)	Government employed	Not reported

Note: B (Bangladesh) / G (Guatemala) / M (Mexico) / SA (South Africa)

NGO (Non-governmental organization)

## Details regarding training methods

Studies used different approaches to develop the curriculum and disseminate knowledge. Training methods included interactive modes like problem-based learning, classroom discussions, demonstrations, media presentations, role-plays, as well as self-training quizzes and assignments, which were either online<sup>52</sup> or paper based.<sup>51</sup> Training designs included the T5 instructional learning design (Tasks, tutorials, tools, topics, and teamwork) allowing interactive learning,<sup>55</sup> or adapting existing education and training materials available from high income countries.<sup>51</sup> In one of the studies, CHWs were trained alongside nurses on hypertension, its treatment and its burden through interactive classes.<sup>48</sup> The training varied, from 2.5 hours<sup>50</sup> up to 40 hours<sup>52</sup> over a four to six month period. (Table 2) Training took place at the local health units in four studies<sup>48,50,52,54</sup> while the other three studies did not mention details about the training site. Training focused on CVD and its risk factors, healthy lifestyle and dietary habits and physical activity. Four of the studies<sup>47,51-53</sup> trained CHWs on anthropometric measurement skills and their interpretation and one study trained CHWs to use a BMI (Body Mass Index) metric tool for nutritional status assessment of the elderly.<sup>49</sup> None of the studies made their training materials publicly available. Please see Table 3 for details about training content of each study.

**Table 2: Training methods and duration for CVD and its risk factors management for CHWs in LMICs**

Study	Training details	Duration of training program	Methods of training (workshop, online)
Abrahams-Gessel S et al, 2015 <sup>51</sup>	Non-invasive screening of cardiovascular risk score	Hours of training not reported (2 weeks training over 4 months)	Lectures and interactive lessons. On-site training for anthropometric measurements, BMI and CVD risk score calculation
Da Silva SSB E et al, 2010 <sup>48</sup>	Hypertension knowledge and basic skills practices development	16.5 hours (11 sessions fortnightly over 6 months)	Lectures and practical sessions
Fatmah F, 2014 <sup>49</sup>	Obesity and hypertension knowledge BMI metric tool measurements	11 hours (2 days)	Lectures and interactive sessions. On-site training for BMI metric tool measurements.
Ku GM V et al, 2014 <sup>53</sup>	Diabetes knowledge and basic skills practices development	32 hours	Lectures, two-way demonstrations, hands-on workshops
Nishtar S et al, 2007 <sup>54</sup>	Cardiovascular disease prevention	6 hours	Interactive training workshops
Sangprasert P, 2011 <sup>47</sup>	Hypertension knowledge and basic skills practices development	Not reported	Lectures and group discussions
Seyed Emami R et al, 2011 <sup>50</sup>	Health education about physical activity	2.5 hours (3 weekly sessions)	Lectures, group discussions
Sranacharoenpong K et al, 2012 <sup>52</sup>	Hypertension knowledge and basic skills practices development	40 hours (16 sessions, over 4 months)	Lectures and group discussion, problem-based learning e-learning and online support Community-based application Assignments and self-evaluations



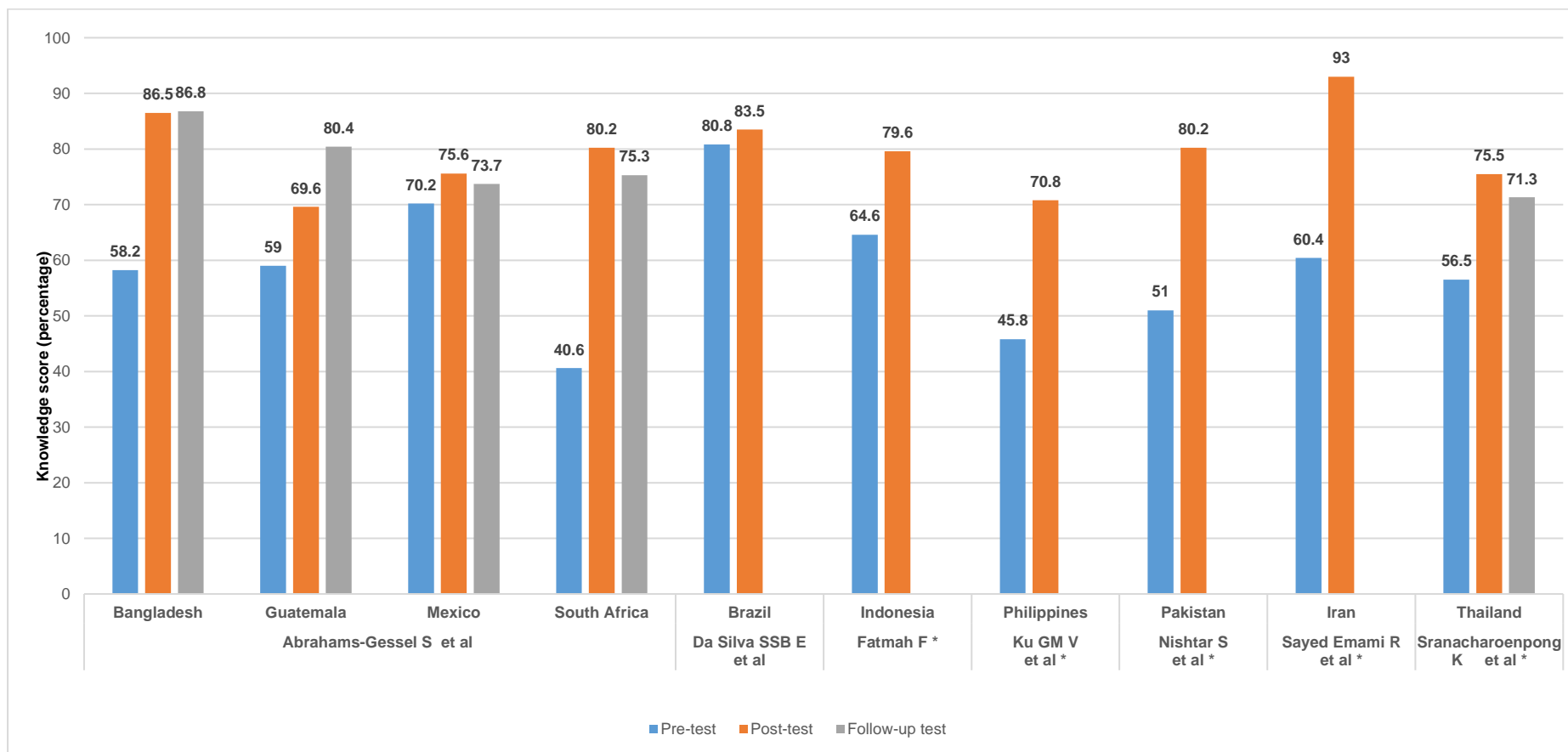
**Table 3: Training content for CVD and its risk factors management for CHWs in LMICs**

	<b>Knowledge</b>	<b>Skills</b>
<b>Abrahams-Gessel S et al, 2015<sup>51</sup></b>	Cardiovascular disease and its risk factors	Blood pressure measurement Weight and height measurements and BMI calculation Obtaining a 5-year CVD risk score using a "Risk scoring Chart"
<b>Da Silva SSB E et al, 2010<sup>48</sup></b>	Hypertension and its treatment, Epidemiological data regarding hypertension to clarify its problem, Healthy lifestyle promotion, Treatment adherence and its importance	N/A
<b>Fatmah F, 2014<sup>49</sup></b>	Obesity risk factors and consequences Balanced Nutrition and Salt restriction Physical activity for the elderly Hypertension and its risk factors	BMI meter tool measurements for nutritional status assessment
<b>Ku GM V et al, 2014<sup>53</sup></b>	Diabetes diagnosis and management Foot care Diabetic diet and dietary counselling Physical activity	Anthropometric measurements (weight, height, waist and hip circumference), BMI and waist-hip ratio calculation and their interpretation. Blood pressure and blood glucose measurement, Psychosocial skills development (active listening, patient and family empowerment and social mobilization)
<b>Nishtar S et al, 2007<sup>54</sup></b>	Blood pressure measurement importance and desired frequency, Healthy life style and its role in preventing CVD and its complications	N/A
<b>Sangprasert P, 2011<sup>47</sup></b>	Health promotion and health education practices Healthy dietary habits Physical activity Relaxation skills	Blood pressure measurement Weight, height and waist and hip circumference measurements BMI calculation and its interpretation
<b>Seyed Emami R et al, 2011<sup>50</sup></b>	Food and nutrition Healthy eating and physical activity Current challenges for physical activity Overcoming barriers for a healthy lifestyle adoption	N/A
<b>Sranacharoenpong K et al, 2012<sup>52</sup></b>	Healthy dietary habits and providing proper dietary recommendations Physical activity and motivating at-risk population	Weight, height and waist circumference measurements and their interpretation

## **Impact of the training on knowledge and skills**

All the studies assessed the knowledge<sup>47-54</sup> and five of them assessed knowledge and skills<sup>47,49,51-53</sup> before and after the training sessions. In addition, two studies evaluated the effect of training at 3-6 months<sup>51</sup> and 8 months after the intervention study.<sup>52</sup> Pre- and post-training mean scores were reported by all studies as a measure of effectiveness of training. Of the eight studies included in the review, we could use scores from seven studies; the eighth study<sup>47</sup> could not be included in the figure as the measure of test scores was not described. All the studies showed increase in the knowledge mean scores among CHWs pre- and post-training ranging from 3%<sup>48</sup> to 40%,<sup>51</sup> with six of the studies reporting statistically significant difference between the base knowledge level and post-training knowledge level of the CHWs.<sup>47,49,50,52-54</sup> In the two studies (including five sites) which assessed the knowledge post-intervention, the knowledge level of CHWs in Bangladesh did not change, the CHWs in Guatemala<sup>51</sup> showed an average increase of 11%, and the scores of CHWs in Mexico, South Africa<sup>51</sup> and Thailand<sup>52</sup> decreased over time. Figure 2 provides details regarding the change of the test scores and reported statistical significance of the pre-post training knowledge scores.

**Figure 2. Change in knowledge scores among CHWs**



\* Reported statistical significant change in pre-post knowledge scores

One study assessed the counselling skills of the participant CHWs at base-line, one month and two-months post-training through field visits.<sup>49</sup> In addition, two projects used qualitative methods to assess the potential challenges and enablers of CHW training programs, through observation, interviews, and focus group discussions.<sup>51,56,57</sup>

CHWs preferred a minimum 2-week training program with interactive classes. Since this was the first time many CHWs were offered training in such a setting, it wasn't clear to them what to expect from the training session or workshops. Language barrier was another challenge, as the training manual was written in the local language, while the medium of instruction was in English, this made it difficult for the CHWs to link the manual with the verbal instructions provided. Barriers experienced while working in the field included gender issues such as taking anthropometric measurements of the opposite sex, lack of trust among community to share their health concerns with CHWs, safety and other cultural issues.<sup>51,58,59</sup> In addition, heavy workload, underestimation of the time required to carry out the work and low remuneration provided were other barriers raised by CHWs. In terms of frequency of access to learning materials and satisfaction with the training program (including length, methods, and usefulness of the program, computer skills and using electronic and paper-based materials), CHWs seemed satisfied with the content of training program, and the assignments. However, about 46% (n=32) did not feel that computer skills were easy to learn.<sup>57</sup>

### **Study quality**

One out of the eight studies was a randomised controlled trial,<sup>52</sup> while the others were pre- and post- observational studies. The CHW retention rates varied across the studies from 77%<sup>51</sup> to 88%<sup>53</sup> with two studies retaining 100% of CHWs,<sup>48,52</sup> and one

study not reporting CHW turnover during the study period.<sup>47</sup> Detailed information about CHWs,<sup>54</sup> trainers,<sup>47,52</sup> development of the training program<sup>48,54</sup> and process of knowledge evaluation<sup>54</sup> was not reported in some studies. The quality of all included studies was assessed using Effective Public Health Practice Project's (EPHPP) Quality Assessment Tool.<sup>46</sup> Evaluated across six quality domains, each study was assessed with the potential of an overall rating of weak, moderate or strong. The quality of two studies were rated moderate.<sup>50,52</sup> The others were rated weak. Please see Table 4 for details of the quality assessment for each of the six quality domains.

**Table 4: Assessment of the quality of included studies using the EPHPP tool<sup>46</sup>**

Study	Selection bias <sup>*1</sup>	Study Design <sup>*2</sup>	Confounders <sup>*3</sup>	Blinding <sup>*4</sup>	Data Collection Methods <sup>*5</sup>	Withdrawals and Drop-outs <sup>*6</sup>	Overall Rating
Abrahams-Gessel S et al, 2015 <sup>51</sup>	Weak	Moderate	Weak	Weak	Moderate	Weak	<b>Weak</b>
Da Silva SSB E et al, 2010 <sup>48</sup>	Moderate	Moderate	Moderate	Weak	Weak	Moderate	<b>Weak</b>
Fatmah F, 2014 <sup>49</sup>	Moderate	Weak	Weak	Weak	Moderate	Weak	<b>Weak</b>
Ku GM V et al, 2014 <sup>53</sup>	Weak	Moderate	Not reported (weak)	Weak	Weak	Strong	<b>Weak</b>
Nishtar S et al, 2007 <sup>54</sup>	Weak	Moderate	Not reported (weak)	Weak	Weak	Weak	<b>Weak</b>
Sangprasert P, 2011 <sup>47</sup>	Moderate	Moderate	Moderate	Weak	Moderate	Weak	<b>Weak</b>
Seyed Emami R et al, 2011 <sup>50</sup>	Strong	Weak	Strong	Weak	Strong	Moderate	<b>Moderate</b>
Sranacharoenpong K et al, 2012 <sup>52</sup>	Strong	Strong	Moderate	Weak	Strong	Strong	<b>Moderate</b>

1. Likelihood of the participants to be representing the target population.
2. The likelihood of bias due to allocation process in the study design.
3. Effect of variables associated with the intervention and causally related to the outcome of interest.
4. Likelihood of protection against reporting bias.
5. Reliability and validity of outcome measures.
6. Assessment of the description of numbers and reasons for withdrawals and drop-outs.

## DISCUSSION

In this review, we assessed the effectiveness of training CHWs for the prevention and management of CVD and its risk factors. We reviewed eight studies, which focussed on CVD, hypertension, diabetes or physical activity. The limited evidence available from this review demonstrates that CHWs with low-levels of formal education can be trained effectively for CVD and risk factor prevention and management. The results of this review need to be assessed in light of the study quality which was rated as weak to moderate using the EPHPP tool. The knowledge and skill-set of CHWs improved in the immediate post training period for all studies and varied in performance in the 6-8 months after the initiation of the intervention. The limited qualitative data from two studies<sup>51,56,57</sup> indicates that interactive training, hands-on workshops and case scenarios were preferred over traditional didactic training. Training sessions adapted to local culture and delivered in the local language were found to be easier for the CHWs to understand and retain. Since measurement of cardiovascular risk factors involves taking blood pressure, height, weight and waist measurements in both men and women, understanding the cultural norms was an essential component to deliver the training to CHWs who were women in most studies.

Regardless of the baseline knowledge scores of the trained CHWs, most of the post-training knowledge scores ranged between 70 and 80%. The two studies <sup>51,52</sup> that measured knowledge at 6-8 months post-training showed that the CHWs maintained their knowledge (Bangladesh 86.5% to 86.8, Guatemala 69.6% to 80.4%) or had a small decline in their scores (Mexico 75.6% to 73.7%, Thailand 75.5% to 71.3%) see figure 2; demonstrating their retention of knowledge to certain degree over a period of six to eight months. A review of CHW training for maternal and child health related conditions<sup>60</sup> and mental health<sup>61</sup> found that without re-training, acquired skills and

knowledge are lost over time. Different time intervals of refresher training were found to be effective to retain the capability and performance of CHWs. Various studies conducted in different countries had diverse experiences using monthly, quarterly and yearly refresher trainings to help CHWs maintain consistent performance<sup>60</sup>. Further research is needed to assess the ideal interval for re-training to ensure long term improvement in knowledge and consequent improvement in health outcomes for the community. While training is an important determinant of performance, other factors related to training include recognition of competence in skills to perform related tasks. This allows CHWs to effectively interact with the community and enable them to integrate what they have learnt into their daily tasks to better support the community. Hence, contemporary CHW training programs now include competency based training rather than the traditional knowledge based training. Recent reviews on task-shifting from physicians to non-physicians for management of CVD and other NCDs in LMIC have found that training, close supervision and feedback are essential for the success of task-shifting interventions.<sup>25,62</sup> Training of CHWs occurs through formal schooling, in-service training and on-the-job experience; and these, coupled with the working environment, supervision, motivation, career progression, and incentives determine the long term effectiveness and performance of CHWs,<sup>63</sup> which ultimately impacts the health of individuals in the community.

While the focus of this paper was knowledge change, results from some of these studies have demonstrated the effectiveness of CHW training on health outcomes. For instance, trained CHWs in Bangladesh, Guatemala, Mexico and South Africa could correctly identify individuals at high risk of CVD <sup>51</sup>, and CHW screening had high concordance with health professionals. In Indonesia, the Posbindu health workers were successful in motivating the elderly to actively engage with the health care



providers and have better access to health care. <sup>49</sup> In the Philippines, Barangay health workers trained in diabetes care, were instrumental in improving Glycaemic control among diabetics. <sup>53</sup> In Pakistan, trained CHWs were successful in educating communities in cardiovascular risk factors. <sup>54</sup>

Over the last ten years, there have been several studies involving CHWs for the prevention and management of CVD risk factors via complex multifaceted interventions in LMICs. This involved training CHWs for six month to follow-up post-acute coronary syndrome patients for twelve months,<sup>64,65</sup> While most studies that involve CHWs include a component of training, none of them report the content, length or effectiveness of training on CHWs. Studies from South Africa,<sup>66,67</sup> Pakistan,<sup>68</sup> India,<sup>69-71</sup> China,<sup>72</sup> Dominic Republic,<sup>73</sup> Guatemala,<sup>74</sup> Thailand,<sup>75</sup> Mexico<sup>76</sup> and the Mexican-US border<sup>77</sup> have shown innovative ways of involving CHWs for the prevention and control of CVD and its risk factors. These innovations include using paper based algorithms<sup>71</sup> and mobile phone technologies<sup>66</sup> to screen the community for risk factors of CVD. However, these studies did not measure the impact of training on CHW knowledge and skill set.

Testing knowledge and skills via pre- and post-training tests does not necessarily reflect the trainee's competence and successful demonstration of behaviour change or change in capability. Standardized measures need to be considered for quality and efficacy assessment of CHW training programs. Few standardized tools and methods for training evaluation and effectiveness assessment are available<sup>78-81</sup> which focus on the short-term and long-term outcomes of the training. Kirkpatrick's Four-Level Training Evaluation Model<sup>81</sup> is one such method which is based on evaluating the trainees' reaction to the training program, improvement in knowledge, the degree to

which they apply the knowledge, and the long-term outcomes. Kaufman's 5 Levels of Evaluation<sup>80</sup> is another standard for evaluating the effectiveness of training which evaluates the training design, materials and resources used and the final outcome on the whole community and the trainee. Using standardized methods of evaluation allows better comparison and interpretation of the data. Researchers should consider making the tool kits and resources for CVD management publicly available to other researchers and governments.

This review was not able to explain the difference in the knowledge gained by CHWs within and across knowledge, and the variability of the training duration and contextual factors. For instance, the knowledge score of the CHWs in South Africa, Guatemala and Bangladesh were higher than the scores of CHWs in Mexico, even though all four sites were part of the same trial with the same training protocol.<sup>51</sup> Hence, research is needed to understand the training needs of the CHWs; and community requirements for the successful roll out of CHW focused interventions on CVD prevention and control. Randomised controlled trials involving CHWs should provide details about the CHW characteristics, curriculum development, training provided and impact of the training, and these should ideally be costed. Mixed methods studies would give a better understanding of the challenges involved with implementing training programs for CHWs and provide evidence for best practice. Training design should consider the background education and prior training received, current roles of the CHWs and how the new skills should complement this role. Training should include demonstration, simulation and on the job supervision to improve confidence of CHWs with their newly learned skills. Communication skills training should focus on changing social norms and behaviours and encouraging the community to work on local fears and myths. CHW attitudes, expression of respect, responsibility and concern should be addressed

in training design to assure development of appropriate relationship between the CHWs and the patients and rest of the community.<sup>82</sup> With the available mobile conferencing platforms, follow-up training can be provided to many trainees at a time, remotely as well. Training should be provided onsite where CHWs perform their roles, evidence suggest that onsite training tends to cost less and cause less disruption of the routine functioning of health services, compared to offsite training.<sup>83</sup> Better training programs alone will not solve the problems related to opportunities for career growth and professional development via continuing education; the chance to move to the next level within the health system would help motivate CHWs to stay in the workforce.<sup>60</sup> Career opportunities need to be created for the CHWs, these cannot be standardised across different programs or countries but rather contextualised and designed to fit into the local healthcare structure. Attention needs to be paid to CHW remuneration and career development as these are noted challenges affecting the retention of trained CHWs in the workforce. Governments should adopt innovative national planning and provide suitable financial and legal support to ensure the sustainability of implemented programs.<sup>84-87</sup>

Even though our search included all the CHW terminologies used by the WHO and recent reviews on CHWs,<sup>44</sup> we may have missed some studies. After expanding the search to include all languages and extending the time limit to the end of 2016, our search identified only eight studies. The insufficient reporting of study details such as CHWs characteristics, training site, and trainer's profiles led to limited understanding of the contextual factors that influenced the training. Most of the studies were not controlled trials, which made it difficult to investigate the effect of potential confounders. This review included CHWs who were part of the health system and those that volunteered their services. We acknowledge that there is a difference between health

volunteers and CHWs,<sup>88</sup> but since the overall aim of the paper was to evaluate the effectiveness of training programs, remuneration would have little impact on the change in knowledge and skill set. Despite these limitations, our review indicates that training CHWs about CVD and its risk factors is plausible in LMICs.

## **CONCLUSION**

This review demonstrates that there is not much information about CHW training for CVD prevention and control in LMICs. While the results of the eight included studies suggest CHWs can be trained effectively for CVD prevention and management, this finding would likely vary depending on context, given the numerous differences between studies (e.g., populations, settings and programs), and the weak quality of six of the eight studies. Well conducted mixed methods studies are needed to provide reliable evidence about the effectiveness and cost-effectiveness of training programs for CVD prevention and management. Furthermore, combined qualitative and quantitative research allows us to understand the perspectives of the stakeholders thereby drawing attention to the contextual challenges and potential supportive mechanisms that can render the CHW programs more effective and sustainable.

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# **CHAPTER THREE: Evaluation of a training program of hypertension for Accredited Social Health Activists (ASHA) in rural India**

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## **CHAPTER OVERVIEW**

This chapter evaluates a training program aimed at Accredited Social Health Activists (ASHAs) for the management of hypertension in three rural Indian districts. The chapter consists of a single manuscript titled: 'Evaluation of a training program of hypertension for ASHA in rural India.'

Hypertension is a major risk factor for cardiovascular disease, a leading cause of premature death and disability in India. Since access to health services is poor in rural India, a potential solution for improving hypertension control is by utilising this available workforce. Accredited Social Health Activists (ASHAs) are community health workers who are available for every 1000 population in rural India, while their main activities involve services for maternal and child health and infectious diseases, previous studies have shown that they can be trained for CVD prevention and control. The chapter presents an evaluation of a training program for ASHAs to identify and control hypertension in the community using the Kirkpatrick Evaluation Model. Pre-, post-training and post-intervention knowledge tests showed that ASHAs' knowledge of

hypertension improved after the 3-month intervention. Research officers, who observed the community meetings, reported that ASHAs delivered the self-management content effectively without additional assistance. The culturally adapted training materials were easy to understand and useful in educating community members. The available evidence shows that ASHAs can be trained to lead community-based group educational discussions and support individuals for the management of high blood pressure.

### **AUTHOR CONTRIBUTIONS**

MA, RJ, AGT and MR drafted this article and revised the manuscript. With input from RJ, MA analysed the results and interpreted the data. The overall project design was developed by AGT; and implemented by MR, AR, KT, BO, CKC, RGE, RJ, RG, PKM, GKM, NT, KK1, KK2, OS and AM. All authors read and approved the final manuscript for journal submission. MA and RJ helped draft the responses to the reviewers' comments. MA prepared the final draft of the manuscript for publication.

### **PUBLICATION DETAILS**

Abdel-All M, Thrift AG, Riddell M, Thankappan KR, Mini GK, Chow CK, Maulik PK, Mahal A, Guggilla R, Kalyanram K, Kartik K, Suresh O, Evans RG, Oldenburg B, Thomas N, Joshi R. Evaluation of a training program of hypertension for Accredited Social Health Activists (ASHA) in rural India. *BMC Health Services Research*. 2018 Dec;18(1):320.

## BACKGROUND

Cardiovascular disease (CVD) is the leading cause of premature death and disability in India, predicted to reach up to 2.6 million deaths by 2020.<sup>1</sup> Hypertension, a major risk factor for CVD, is responsible for 57% of all deaths from stroke and 24% of all deaths from coronary heart disease in India.<sup>2</sup> About 33% of urban and 25% of rural Indians have hypertension but less than a third are aware of their status and have their blood pressure under control.<sup>3</sup> Populations residing in rural regions of India face several challenges in accessing care for CVD. These include poor knowledge of risk factors, lack of physicians and nurses, and unavailability of affordable medicines.<sup>4</sup> Prevention and control of hypertension can be enhanced at the individual level by improving knowledge of hypertension and risk factors, adoption of a healthy lifestyle, and adherence to medications.<sup>5,6</sup> At the health system level, hypertension can be controlled by having adequate number of healthcare providers, provision of evidence-based management guidelines or decision support tools, improving the availability of medicines and access to health centres. When physicians and nurses are in short supply, tasks such as screening, education, referral and follow-up of individuals in the community can be shifted to non-physicians<sup>7</sup> such as community health workers (CHWs).<sup>8,9</sup> CHWs enhance coverage of essential healthcare services and are usually well accepted by their communities.<sup>10</sup> Furthermore, CHWs can deliver health interventions in a cost-effective manner with 35% lower cost than when CHWs are not in service.<sup>11</sup> The Indian government launched the National Rural Health Mission (NRHM) in 2005 and created a new cadre of non-physicians called Accredited Social Health Workers (ASHAs).<sup>12</sup> ASHAs are India's CHWs who act as an interface between the community and the public health system to improve access to health services, help raise community awareness about health and its social determinants and support the

primary healthcare system in facilitating care specifically for maternal and child health.<sup>13</sup> They are female residents of the villages<sup>14</sup> who are paid a fee-for service for certain primary health care activities.<sup>15</sup> Previous evaluation studies of ASHAs have mostly focused on maternal and child care.<sup>16,17</sup> Since the inauguration of the National Program for the Prevention and Control of Cardiovascular Diseases, Diabetes, Cancer and Stroke (NPCDCS) in 2010, ASHAs from 100 pilot districts across 21 States have been trained by the public health system to prevent and manage chronic diseases like hypertension, diabetes and their risk factors. The current study of control of hypertension in rural India was conducted at three sites, one of which was a pilot NPCDCS site. The objectives were to (i) develop training materials for an intervention to improve identification and control of hypertension; to be used across the three selected sites despite their difference in governmental training availability for chronic diseases management (ii) document the processes of training ASHAs, and (iii) evaluate the effectiveness of the training program in terms of the knowledge, skills and perception of ASHAs using the Kirkpatrick Evaluation Model.<sup>18</sup>

## **METHODS**

### **Area settings and recruitment**

This study was part of a trial aimed at improving self-management and control of hypertension in rural India (Cluster randomised feasibility trial to improve the Control of Hypertension In Rural India “CHIRI”).<sup>19</sup> The main study was conducted to investigate whether populations at various stages of economic transition, with different levels of knowledge and awareness of hypertension, and with differing barriers to diagnosis and treatment of hypertension, could have their hypertension managed using a community-based education program. The late transition populations are

characterized by rapid urbanization accompanied by declined physical activity levels. They will have higher prevalence of cardiovascular disease and its risk factors like hypertension and diabetes.<sup>20</sup> They also have relatively better access to health services and greater health awareness. On the contrary, early transition populations are economically disadvantaged with poor access to health services and have a lower socio-economic status. The study was conducted in three regions in South India, Trivandrum-Kerala (late transition), West Godavari-Andhra Pradesh (medium transition) and Rishi Valley-Andhra Pradesh (early transition).<sup>19</sup> The outcome of the feasibility trial will be reported in due course.

During the first phase of the study, a cross-sectional survey was conducted amongst local community members to determine the knowledge, awareness, treatment and control of hypertension in these regions. This was supplemented by an audit of the health system and a qualitative study to understand the major barriers in the management of hypertension.<sup>19</sup> Based on the information gathered during this first phase, a community-based group intervention was developed and its feasibility was tested at the three sites. The intervention study comprised group-based education and support for self-management of blood pressure in individuals with hypertension. Individuals with hypertension could also invite their family members to attend, if they wished. At the community level, the intervention was led by ASHAs.

### **Curriculum Development and Training**

Content of the training materials (Table 1) was created by the research team based on available literature, experience from relevant projects such as the Australasian Peers for Progress Diabetes Project, Kerala Diabetes Prevention Program (K-DPP),<sup>21</sup> the Andhra Pradesh Rural Health Initiative,<sup>22</sup> and the available ASHA Training

Modules,<sup>23</sup> Training materials were translated into the local languages (Telugu and Malayalam versions will be provided online) and a team of local research staff and clinicians reviewed the training materials to ensure it was culturally adapted to the local context. Content validity of the training materials was assessed by piloting it with four ASHAs from a non-study village that led to further modification and refinement of the resources.

Training was designed to provide ASHAs with knowledge regarding hypertension and its risk factors, strategies to manage hypertension via knowledge about healthy lifestyle and adherence to medications, and skills in facilitation of group meetings. ASHAs were also taught to deliver community group-based education, and provide support for individuals with hypertension.

Based on previous experience and available literature, five main themes were addressed during the training sessions. These included:

1. Hypertension, its risk factors, complications, management and clinical targets.
2. Healthy lifestyles and how to support the community to adopt a healthier lifestyle.
3. Goal-setting strategies and how to assist group members to set and achieve simple specific, measurable, achievable, realistic/relevant and time bound (SMART) goals to improve health outcomes.
4. Skills needed for taking clinical and anthropometric measures such as weight and blood pressure.
5. Group facilitation skills to conduct group meetings and skills in recording meeting progress, attendance, participant measurements and problems or issues faced by participants.



The ASHAs residing in the villages randomised to the intervention, received training in 15 sessions over five days (Table 1). Training was provided by members of the research team. The instructional strategies used to deliver the training content included lectures, interactive and problem-based learning such as group discussions, role-play and case studies. Training was delivered using electronic slide presentations and flip charts. The flipcharts for participants are pictorially based, and there is one for each of the six meetings. ASHAs flipcharts have the same pictures as for participants, but every second sheet (on the back of the flipchart) includes text that the ASHA could use to educate participants (Figshare: <https://figshare.com/s/7bbfcc22e0c9c91a5ca0>). Video feedback was also used to demonstrate correct, and incorrect, measurement techniques. The classroom based training sessions took place close to the community at each of the three sites. ASHAs were compensated for the time they spent during the training, including travel expenses.

**Table 1. Training agenda for ASHAs for the Control of Hypertension in Rural India Feasibility Study**

<b>Session</b>	<b>Title</b>	<b>Topics discussed</b>
<b>Day 1</b>	Introduction	Roles and responsibilities of ASHA Aims of CHIRI project Expectations of research
	Pre-training test	Assessment of knowledge and skills
	Working with research group / research project	Expectation of data collection Need for consistency and accuracy
	Measurement training	Anthropometric measurement
	Prevention and control of Non-Communicable diseases (NCDs)	Modified from Ministry of Health and Family Welfare NCD ASHA training module number eight for prevention of NCDs
<b>Day 2</b>	Measurement training	Measuring blood pressure and weight
	Goal setting	SMART Goals explanation and practice
	Hypertension knowledge	<u>Community Meeting 1</u> Knowledge about high blood pressure, risk factors and complications
	Measurements	Measuring blood pressure and weight
<b>Day 3</b>	Review Goals & Problem-Solving	Review goals set previous day and problem solve if goals not achieved
	Self-care / management of hypertension	<u>Community Meeting 2</u> Recommendations for self-management, medication adherence, diet, physical activity, tobacco alcohol Referral to clinical care, monitoring etc.
	Physical Activity	<u>Community Meeting 3</u> Physical activity, recommended quantity, intensity and some practical and easy activities to practice
	Measurements	Measuring blood pressure and weight
	Goal Setting	Set another goal and complete action plan
<b>Day 4</b>	Review Goals & Problem Solving	Review goals set previous day and problem solve if goals not achieved
	Diet / Tobacco and Alcohol	<u>Community Meeting 4</u> Dietary approaches to prevent hypertension, tobacco control and alcohol cessation recommendations
	Practical self-management	<u>Community Meeting 5</u> Practical advice and support for self-management
	Measurements	Measuring blood pressure and weight
	Goal Setting	Goal setting and action plan
<b>Day 5</b>	Review Goals & Problem Solving	Review goals set previous day and problem solve if goals not achieved
	Putting it all together	<u>Community Meeting 6</u> Review key messages from the program
	Preparation	Preparing for monthly meetings Dealing with informational needs Expectation of the group
	Measurements	Measuring blood pressure and weight
	Review Goals & Problem Solving	Review goals set previous day and problem solve if goals not achieved
	Conclusion and final wrap up	Practicalities, (payment, who to contact, etc.), logistics
	Post-training test	Assessment of knowledge and skills

Following the training, the intervention (community-based education support groups) was implemented among community members who were identified as having hypertension during the baseline survey.<sup>19</sup> The main tasks for the ASHA in the intervention group was to encourage community members to attend, and lead the community meetings. For the research study, the project manager at each site supervised ASHAs and a research fellow observed meetings. Community meetings were held every two weeks over a three- month period by ASHAs who were paid an incentive to facilitate the meetings, on par with the Government of India standards. ASHAs measured blood pressure and weight of the attendees at the start of each session; led group-based learning about hypertension and its management; and assisted in promoting adoption of healthier lifestyles and setting SMART goals. All the ASHAs invited to participate in the study agreed and gave written informed consent in the local language; there was no penalty for refusal to participate.

Approval for the overall study was obtained from The Centre for Chronic Disease Control, India; Christian Medical College, Vellore, India; Sree Chitra Tirunal Institute for Medical Sciences and Technology, India; Health Ministry Screening Council, Ministry of Health and Family Welfare, India; Rishi Valley Ethics Committee, Rishi Valley School, Madanapalle, India; Monash University, Australia and Indian Council of Medical Research, Delhi, India.

## Evaluation

There were four components to the evaluation of the training program (please see Supplemental Table 2),

1. A knowledge and skills test was developed to assess the ASHAs level of knowledge and skills at baseline and after training (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>). The test consisted of multiple choice and true/false type questions about hypertension, its risk factors, complications and healthy lifestyle and were based on previous research conducted by the team and existing literature <sup>24, 25</sup>. ASHAs at Rishi Valley and West Godavari had the same pre- and post-training test, while ASHAs at the Trivandrum site used a modified version of the test (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>). The modification was required, as ASHAs from Trivandrum had received initial training for NCDs from the public health system.
2. A research officer from the study, who participated in the baseline survey, attended the meetings and assessed the performance of ASHAs using a monitoring and evaluation reporting sheets. The monitoring sheet comprised of a checklist of the tasks delivered, use of resources, time management and problem solving skills that ASHAs were trained for earlier. The evaluation forms are available online (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>).
3. In addition to the written assessment, ASHAs were interviewed for 40-45 minutes in the local language to understand the major enablers and barriers in the implementation of the intervention. An external consultant, not involved in

the training or the intervention implementation in all the sites, interviewed ASHAs. The interviewers used an interview guide to explore the perspectives of ASHAs about the training received. All the interviews were recorded, translated and transcribed into English. The interview guide is available online (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>).

4. ASHAs were re-assessed for their knowledge and skills post-intervention using the same questionnaire at all three sites. (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>).

**Table 2. Demographics of ASHAs participating in the training program**

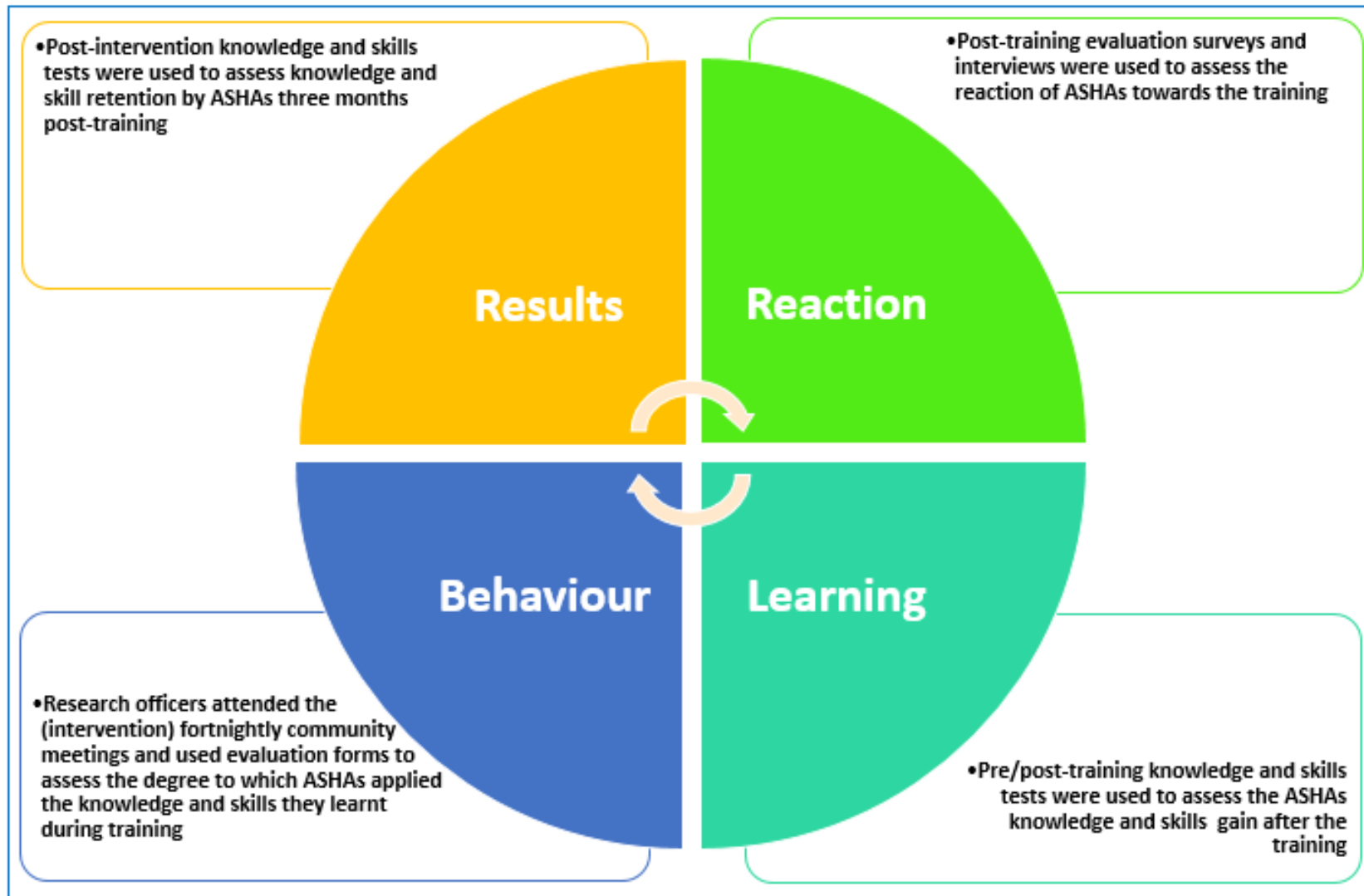
	Rishi Valley	West Godavari	Trivandrum	Combined
<b>Age (years)</b>				
< 20	-	1 (13.0 %)	-	1 (7.0 %)
20 - 30	2 (50.0 %)	2 (29.0 %)	-	4 (27.0 %)
30 - 40	2 (50.0 %)	2 (29.0 %)	2 (50.0 %)	6 (40.0 %)
>40 - 50	-	2 (29.0 %)	2 (50.0 %)	4 (27.0 %)
Median age	29	38	40	36
<b>Education</b>				
Class 10 and 11	4 (100%)	5 (71.0 %)	1 (25%)	10(67.0 %)
Class 12	-	2 (29.0 %)	3 (75%)	5 (33.0 %)
<b>Knowledge of English</b>				
Communicate well by reading and writing	1 (25.0 %)	4 (56.5%)	3 (75.0 %)	8 (53.0 %)
Only read	2 (50.0 %)	2 (29.0 %)	-	4 (27.0 %)
Do not communicate in English	1 (25.0 %)	1 (14.5 %)	1 (25.0 %)	3 (20.0 %)
<b>Median age starting work as an ASHA (years)</b>	21.5	21	31.5	23
<b>Proportion of ASHAs having other paid duties*</b>	1 (25.0%)	3 (43.0%)	-	4 (27.0%)
<b>ASHA work experience (years)</b>				
≤ 2	2 (50.0 %)	2 (29.0 %)	-	4 (27.0 %)
3– 6	1 (25.0 %)	1 (14.5 %)	-	2 (13.0 %)
> 6	1 (25.0 %)	4 (56.5 %)	4 (100 %)	9 (60.0 %)
Mean work experience	7	12	7	9.5
<b>ASHA usual working hours*</b>				
< 2	2 (50.0 %)	2 (29.0 %)	-	4 (27.0 %)
2 - 4	1 (25.0 %)	1 (14.5 %)	-	2 (13.0 %)
4 - 6	-	3 (42.0 %)	4 (100 %)	7 (47.0 %)
> 6	1 (25.0 %)	1 (14.5 %)	-	2 (13.0 %)
<b>Regular use of mobile phones</b>	4 (100%)	7 (100%)	4 (100%)	15 (100%)
<b>Proportion who share a phone with family members</b>	2 (50.0%)	5 (71.0%)	-	7 (47.0%)
<b>Ability to operate a smart phone</b>	1 (25.0 %)	1 (14.5%)	3 (75.0 %)	5 (33.0 %)

\*Excludes unpaid household duties.

The effectiveness of training was based on Kirkpatrick's four level evaluation model (Figure 1).<sup>18</sup>

- Learning: knowledge and skills achieved by trainees during training was assessed using the pre- (day 1) and post-training (day 5) tests;
- Result: the long-term outcomes of the training, i.e. the degree to which ASHAs could retain the knowledge and skills gained during training and apply it to the community, was evaluated using the post-intervention tests (3-month post-training);
- Behaviour: the degree to which trainees applied the gained knowledge and skills during the intervention was assessed using forms, completed by research officers during the community education meetings, designed to monitor and evaluate the competence and performance of ASHAs; and
- Reaction: trainee's perception and reactions toward the training was assessed in two ways. First, satisfaction of ASHAs with the training program was assessed at the end of training using evaluation forms that comprised both Likert-scale questions and open-ended questions. Secondly, at the end of the implementation period ASHAs were interviewed by external consultants about their experience of the training program and the implementation period. Training evaluation forms and interview guides are available online (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>)

**Figure 1. The Kirkpatrick's evaluation of the ASHAs training**





## **Data Analysis**

Demographic characteristics of ASHAs were summarised using medians and ranges. Quantitative data on knowledge and skills was assessed using two-tailed paired t-tests for comparing scores within groups (SPSS version 23 for Windows). Qualitative data were obtained from training evaluation forms and research officers' monitoring sheets. The forms comprised of structured and open-ended questions MA and RJ reviewed the evaluation forms and interview transcripts. The transcripts were manually coded and thematic analysis was conducted to determine ASHAs' perceptions of the training, their community experience, challenges faced during the intervention and recommendations for the future. MA and RJ met to note any discrepancies and agree on the final data coding and emerging themes.

## **RESULTS**

### **ASHA participation**

Eleven of the 15 ASHAs from the CHIRI intervention sites were appointed by the panchayat (local government), while four were recruited for the purposes of the study, due to vacant positions in the villages. Seven of these ASHAs, were recruited from West Godavari, and four each in Rishi Valley and Trivandrum. All the ASHAs attended all the training sessions and participated in the intervention.

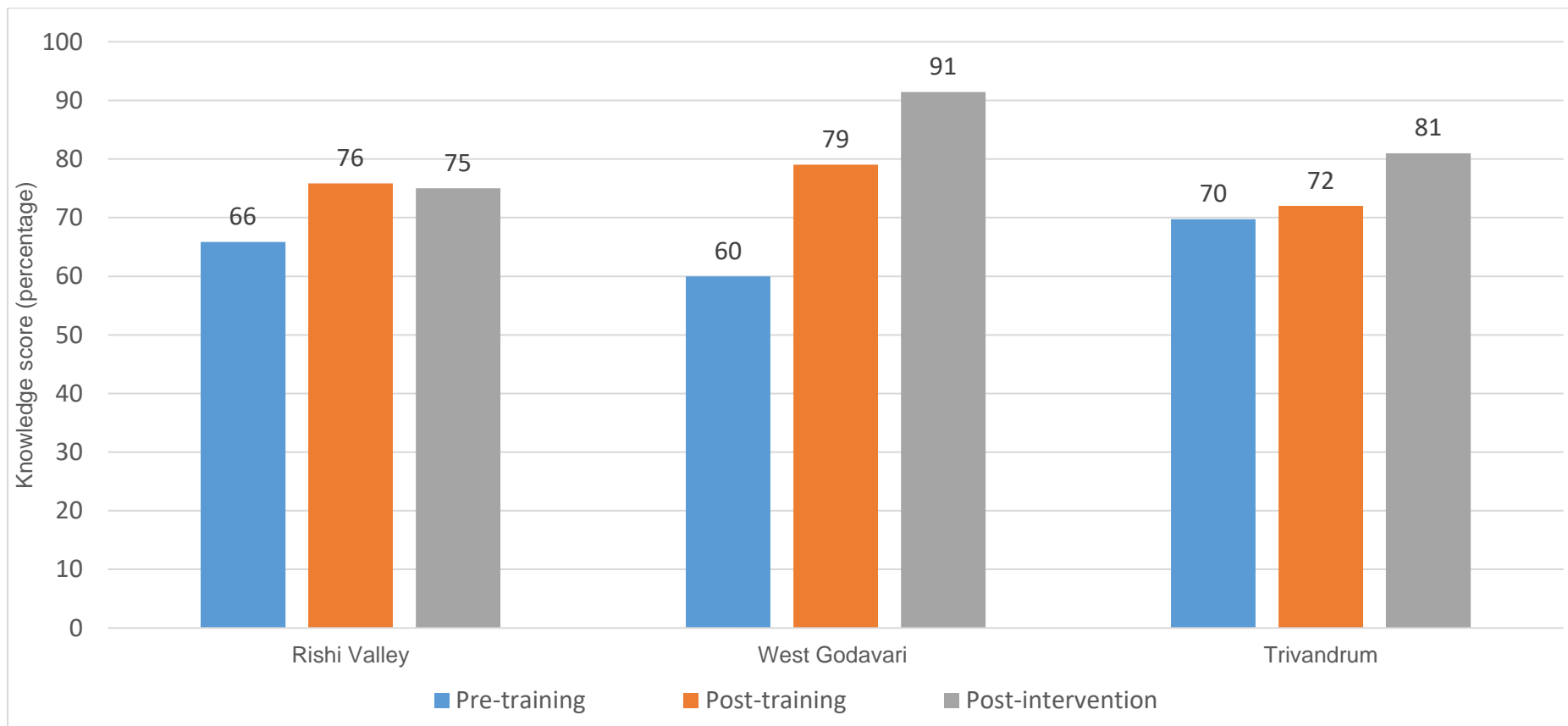
The majority of the ASHAs were married (87%) and had completed at least 10 years of education as per government requirement with (33%; Table 2) completing 12 years of education. Their ages ranged from 19 to 50 years. The overall median age was 36 years but differed between sites, being least in Rishi Valley (29 years) and oldest in Trivandrum (40 years). Two thirds (60%) of the ASHAs had more than 6 years'

experience working in their communities, and worked between 2 and 6 hours per day. In West Godavari, the mean work experience was 12 years, while that of the two other sites was 7 years. Furthermore, 73% had no other paid job other than their role as an ASHA. Eighty percent of the ASHAs had previously attended at least one training session provided by the NHRM, the public health training that was provided by the government, while almost half had attended all seven of these government training modules.<sup>23</sup> Fifty three percent of the ASHAs could communicate well in English. While all of them used cell phones, 47% of them shared the phone with their families (Table 2). Previous training received and other demographic variables did not seem to have an impact on the baseline knowledge of ASHAs, as all three sites had mean basic knowledge scores between 60 and 70%.

### **Learning outcomes**

The mean knowledge score of all ASHAs at baseline was 64%, ranging from 60% in West Godavari to 70% in Trivandrum (Figure 2). The mean overall knowledge score increased to 76% ( $t_{14} = 4.04$ ,  $p \leq 0.001$ ) at the post-training assessment. Test scores and mean increase in knowledge score varied between the three sites. Only West Godavari showed a statistically significant increase of 19% ( $p \leq 0.001$ ) in the post-training test compared to the pre-training test.

**Figure 2. Pre-, Post-training and Post-intervention knowledge level change for ASHAs as part of the feasibility study of the CHIRI project**



## **Changes in knowledge post-intervention**

The post-intervention mean knowledge scores ranged from 75% in Rishi Valley to 91% in West Godavari (Figure 2). The mean overall knowledge score was 84% ( $t_{14} = 4.65$ ,  $p \leq 0.001$ ), demonstrating an increase of 20% from baseline and an 8% increase from post-training knowledge scores. Only West Godavari showed a statistically significant post-intervention increase of 12% ( $p = 0.02$ ) compared to the post-training test scores.

## **Behaviour**

Using records documented by Research Officers during the community meetings we found that ASHAs led and facilitated the community meetings; they measured blood pressure and weighed the participants, and demonstrated and explained handouts and (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>) as trained. They also helped the participants to set SMART goals and reviewed their action plan.

## **Reaction**

Interviews with ASHAs indicated that they had developed a better understanding about hypertension and had improved their skills in clinical anthropometric measurement (Table 3). They further conveyed that the training content was easy to understand and captured a wide range of relevant topics important for their job, including developing confidence in discussing hypertension within the community. The ASHAs appreciated the interactive training activities, which they reported had equipped them to understand real life scenarios and enabled them to overcome some of the challenges related to their new roles. For several ASHAs, the CHIRI training was the first time they were trained in measurement of blood pressure and weight, and they appreciated the opportunity to learn new skills. The ASHAs stated that the trainers were supportive

and helped them understand their role as “Group supporters”. They reported that the flip charts and the pictures were useful in educating community members about risk factors for cardiovascular disease and adopting a healthy lifestyle. Most of the ASHAs used the knowledge gained to educate their families, neighbours and friends.

**Table 3. Views and recommendations of ASHAs about the training**

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**Training outcomes**

“Before I felt shy to talk, but now I’m more confident ...”

“It brought more interest to work”

“Now it’s easy to motivate people”

“I didn’t know much before training, after training I learnt lot of things ... now I can give advice and help others”

“It helped a lot; we learnt something new about health .... I learnt about blood pressure and how to control it”

“The community members respect us because we are taking care of their health”

“Our trainers taught us how to explain to people in understandable way and how to take decisions”

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**Training material**

“Even though we explain things to them, it’s hard to get them to understand .... by seeing flip charts and images they can understand easily”

“I went home and taught my family members”

“It helped a lot, now I can check all the blood pressure of my family members, I’m more experienced and advise them to eat good food and exercise daily”

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**Community experience and recommendations**

“People smile when they see us and keep telling us that they learnt a lot of things from us and they are taking good care of themselves now and doing more exercise. When we hear these words, we know they are interested to listen to us.... we get satisfied”

“We should conduct meetings for young people so that they learn to take care of their health”

“They usually follow our advice, but soon they will forget. It’s better if we can set up scheduled visits to keep reminding them”

“It will be good if you increase training period and should do more training on other health issues”

“It is a very good program; it would be better to continue for 3 months we can learn more things”

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**Challenges and difficulties**

“I have been working as an ASHA for 10 years, but my family is not happy with my job due to insufficient pay, they want me to quit”

“Sometimes it takes us up to 5 months to receive our pay”

“Some ASHAs went on strike but were told by our supervisors, that you will never get a fixed salary only incentives”

“Housewives and farmers are busy, they don’t have time to come to the meetings”

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## **Challenges and recommendations**

Some of the challenges that were mentioned by the ASHAs in the interviews included a low response from community members, especially housewives and farmers who they perceived did not have sufficient time to attend group meetings. There was also concern about a lack of facilities for transportation to the meeting venue and failure to supply medicines during the community meetings. The topic of insufficient remuneration was raised by several ASHAs who reported that the incentives provided by the National Rural Health Mission were usually delayed. They reported a preference to be part of the health system and receive a regular salary. Some ASHAs also complained about the lack of supportive supervision and assistance from their line managers within the public health system.

ASHAs suggested the need for regular refresher training sessions. They also wanted to be trained on other chronic conditions such as diabetes mellitus. Some ASHAs suggested inviting young adults to their meetings so that they might be encouraged to adopt a healthy life style to prevent chronic diseases. Others suggested making monthly home visits for patients, to monitor hypertension and provide support in adhering to medications.

## DISCUSSION

We have demonstrated that ASHAs can be trained to lead community-based group educational discussions, and support community members in the management of high blood pressure. We also showed that the methods and materials were amenable to each site, resulting in similar increases in knowledge of hypertension from baseline. The training program and training materials were appropriate for the different sites and no tailoring, except for the pre-and post-test questionnaire, was needed. The ASHAs were motivated and wanted to enhance their knowledge on other chronic diseases. The interviews suggested that the incentivisation (within government recommended salary structures) along with the aspiration to learn new skills and gain knowledge helped improve motivation levels, and practicing the skills each fortnight helped with the retention of knowledge over time.

Previous studies on the effectiveness of training CHWs for prevention and management of CVD and its risk factors, in low and middle-income countries (LMICs), demonstrate immediate improvement post-training in knowledge among CHWs as well as practical skills.<sup>26-30</sup> Baseline scores improved between 3% and 40% after training and up to 35% after delivering the intervention. In two of these studies<sup>28,29</sup> knowledge was retained for up to six<sup>28</sup> and eight months.<sup>29</sup> Evaluation of the effectiveness of training was mostly done using pre-post training scores but two of the studies<sup>28,29</sup> incorporated interviews and focus group discussions to capture the CHWs' experiences of the training program. These are useful additions to the evaluation of the effectiveness of training using pre- and post-training tests as they enable assessment of both the motivation of trainees and their ability to implement the knowledge and skills gained in the work environment. Recent studies have provided



evidence that behaviour change is necessary in implementation of evidence-based practice<sup>31-33</sup> which is usually the main aim of such training programs.

ASHAs were first engaged by the NRHM to be the primary interface between the community and public health system.<sup>15</sup> Their main role was to assist the Auxiliary nurse midwife (ANM) in providing maternal and child health related activities such as antenatal care and immunisation. In some regions where the prevalence of NCDs is high, such as in the state of Kerala. ASHAs have been trained in prevention of NCDs and to provide support to the ANM in community-based preventive activities.<sup>34</sup> Irrespective of previous training received, the knowledge of ASHAs in the three sites was similar. This could be due to several reasons, first, the training may not have been adequate, second, they may not have used their knowledge in the field, or third, they may not have retained the knowledge and required re-training. One of the challenges faced by ASHAs is that they are not employees of the health system and receive insufficient and sometimes delayed incentives for their work, which often translates, to poor motivation levels. ASHAs also reported feeling disadvantaged due to the lack of opportunities for advancement of their career. Similar findings were reported in another study where the lack of incentive and inappropriate career growth opportunities led to high turn-over rates and poor performance of CHWs.<sup>35</sup>

In recent years, there have been several studies that have involved the training of CHWs to prevent and manage CVDs and risk factors in LMICs, while the authors are aware that a number of others are in progress<sup>36,37</sup>. None of these studies has provided details about the effectiveness of the training or has published their training materials. With the expanding role of CHWs, which now also includes the prevention and management of NCDs, there is a need for effective training materials and methods to train them appropriately. At a health system level, it is important that CHWs have a

defined job description, good supervision and appropriate remuneration. They should also have regular training and retraining which is evaluated and supported by appropriate supervision.

### Strengths and limitations

The primary strength of this study is the use of the Kirkpatrick's four level evaluation model<sup>18</sup> to assess not only the effectiveness of the training program in changing knowledge scores, but also in the assessment of behaviour change, motivation and reaction to the training. Like most feasibility studies, our main limitation is the relatively small number of ASHAs included and the relatively short duration of the intervention. A reflection of this is seen in the variable knowledge results in the post-intervention test e.g. one-percent decrease in knowledge level among ASHAs in Rishi Valley and nine-percent increase in knowledge level among ASHAs in Trivandrum which was not statistically significant. A statistically significant improvement was detected in West Godavari (seven ASHAs) only, this could be due to more experience of the ASHAs compared to the other two sites. There were trends for improvement in the other two sites, so given the small sample sizes; the absence of a detectable effect could reflect type II error. Moreover, the relatively poor baseline levels of knowledge in West Godavari may have resulted in a larger effect size. We did not assess the knowledge level of ASHAs in the control group, and so are unable to exclude other factors that may have influenced knowledge. Nevertheless, we developed a culturally adapted CVD training program for ASHAs, and have made these materials publicly available for others to use (at Figshare). Most LMICs have a health workforce similar to ASHAs, such as Barangay health workers in Philippines, Lady health workers in Pakistan, and Shastho Shebikas in Bangladesh. These countries face similar challenges in terms of disease burden and access to healthcare<sup>38</sup> and hence, could potentially use culturally

adapted training strategies and the available workforce to increase health-care access for managing hypertension.

## **CONCLUSIONS**

In summary, we demonstrate that training ASHAs for management of hypertension is feasible and leads to change in knowledge, skills and motivation. Our findings emphasise the need for culturally appropriate training materials for NCDs and their risk factors, which can be delivered using interactive and innovative methods. To get a better picture of the effectiveness of training, using frameworks such as the Kirkpatrick model<sup>18</sup> is important; since these models do not focus on a single outcome measure and emphasise the importance of using multiple measures for the evaluation of training, thereby allowing more comprehensive comparison and interpretation of training outcomes. Use of these models also draws attention to the learning transfer process and the behavioural change of the trainee to achieve the desired outcome of the training.<sup>39</sup> Future studies might be best focussed on assessment of the appropriate time and methods for re-training. In the era of technology, where most of the ASHAs had access to mobile phones, technology could also potentially be used for re-training or sending reminders. Use of these devices could also reduce the cost and time of training<sup>40</sup> and improve the overall performance and quality of care provided.<sup>41</sup> Changes in the health system, such as career opportunities for ASHAs, performance based incentives delivered on time, and innovative training techniques would help improve the morale of this rural community based health workforce.

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**PART THREE: Factors influencing the  
motivation and retention of the ASHAs in the  
workforce**

# **CHAPTER FOUR: The development of an Android platform to undertake a discrete choice experiment in a low resource setting**

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## **CHAPTER OVERVIEW**

This chapter presents the development of an Android-based platform to conduct a discrete choice experiment (DCE) among community health workers (CHWs) in rural India. The chapter consists of a single manuscript titled: 'The development of an Android platform to undertake a discrete choice experiment in a low resource setting.'

DCE is a quantitative technique that helps determine preferences from a definite set of choices. DCEs have been widely used to inform health services in high-income country settings and are increasingly being used in low and middle-income countries (LMICs). There are contextual, cultural and language related challenges in deploying this method in LMIC settings. This chapter describes the development of a DCE for CHWs with 10 years of education, in a low-resourced setting using an Android platform. We illustrate the process of identifying realistic and locally relevant attributes, finalising the tool and cognitively testing it among respondents with an average of 10 years of education using 'think aloud' and 'verbal probing' techniques. The evidence from this study demonstrates that administration of DCE on Android computer tablets to CHWs with basic education is feasible, efficient, and time-saving.

## **AUTHOR CONTRIBUTIONS**

MA, BA, SJ and RJ led the design of the trial. DP provided input into the design and direction of the trial. MA wrote the initial draft of manuscript. RJ provided input the manuscript. All authors read and approved the final manuscript for journal submission. MA and RJ helped draft the responses to the reviewers' comments. MA prepared the final draft of the manuscript for publication.

## **PUBLICATION DETAILS**

Abdel-All M, Angell B, Jan S, Praveen D, Joshi R: **The development of an Android platform to undertake a discrete choice experiment in a low resource setting.**  
*Archives of Public Health* 2019, **77**(1):20

## BACKGROUND

Discrete choice experiment (DCE) is a quantitative research method used to assess the preferences and priorities of individuals. DCEs analyse the trade-offs individuals make when choosing between sets of hypothetical choices with different attributes. It is regarded as a more useful tool than ranking techniques in policy analysis and planning as respondents are forced to explicitly make trade-offs between the attributes of differing policy alternatives.<sup>1</sup> DCEs have been extensively used in fields such as marketing research and transport economics. More recently, DCEs are being used in health economics to determine consumer choices. For instance, DCEs are used to understand patient or provider preferences to guide decision-making in providing customized care and to navigate policy decisions on different implementation strategies. DCEs engage a variety of stakeholders including patients, healthcare providers and administrators to identify their personal preferences. This is critical for successful design and implementation of interventions; and to minimise the gap between policy and evidence-based practices.<sup>2</sup>

The World Health Organization and The World Bank have developed DCE guidelines to encourage policy makers in resource poor settings in order to identify health workforce retention strategies.<sup>3</sup> Furthermore, DCEs are also used to inform policies to reduce health disparities in resource poor settings.<sup>4</sup> Research indicates that DCEs may be cognitively challenging for individuals with low literacy levels, and have recommended pre-testing the tool during the development stage to ensure that the DCE captures the true preferences of respondents.<sup>5</sup>

Electronic data collection has been proposed as a means to present the data in a user friendly way to make the choice sets less confusing for the respondents with low

literacy levels.<sup>6,7</sup> The median response time for electronic data collection is shorter compared to paper-based data collection and more cost-effective, apart from the initial cost of application development.<sup>8</sup> However, there is limited information on the role that electronic data collection processes can play in carrying out DCEs among participants with low educational level.

In India, a cadre of CHWs, the Accredited Social Health Activist (ASHA) are remunerated according to a performance-based incentive system. Similar to other CHW based programs, inadequate remuneration and the complex nature of tasks leads to high attrition rates of the CHWs.<sup>9</sup> We sought to understand the set of attributes and choices acceptable to CHWs, which would promote their retention and motivate them to stay in the health systems. In this study, we describe the development of an Android platform for the administration of a DCE among CHWs in rural India.

### **Ethics approval and consent to participate**

Approval for the overall study was obtained from The George Institute Ethics Committee of The George Institute for Global Health, India. A participant information sheet and consent form were used to gain consent of participating ASHAs. All participants gave written informed consent in the local language.

### **METHODOLOGICAL DEVELOPMENTS**

We developed an Android-based application to display a DCE in order to quantify the relative importance of different factors, which improve job-satisfaction and motivate ASHAs in a state in rural India. The DCE development process is described below:

## **Step 1: Identification of attributes and levels**

Literature and policy documents review along with qualitative research were essential to understand the contextual factors and challenges that the ASHAs face in delivering healthcare; and to guide the development of a list of key attributes relating to the ASHA's job conditions. Expert consultation allowed the editing of the terms used for different levels to be more comprehensible and relevant to the ASHAs. The software "Ngene" (version 1.2.0, Choice Metrics Pty Ltd, Sydney, NSW, Australia)<sup>10</sup> was used to generate the DCE experimental design based on the final sets of attributes. All the documents and tools were translated into the local language (Telugu).

## **Step 2: Cognitive testing**

A team of three field staff who were independent of the local health system conducted the cognitive testing. The team was trained on the study protocol, ethics and administration of DCE. All the surveys were administered in the local primary health centre. All the invited ASHAs agreed to participate in the DCE and provided written informed consent. The pre-test was used to assess the understanding of the DCE choice sets and concepts by the ASHAs. The cognitive testing involved administering the DCE in a paper-based form to 20 ASHAs. We used 'think aloud' and 'verbal probing' techniques to assess the ASHA's comprehension (ability to understand the question as intended), retrieval of information (thinking about the question and drawing conclusions), judgement and selection of response to the question. The first 10 surveys were conducted on the first day as one-to-one survey administration. The second day, a different approach was used where a group of ASHAs were seated in a classroom setting and each responded to the DCE on her own. At the beginning of the sessions, the DCE procedure and job-sets were explained after which the ASHAs



completed the survey without further assistance. The team ensured that the choices were made individually and group discussion was discouraged. At the end of each data collection day, the team discussed the survey with the ASHAs to understand the strategies used to make the choices.

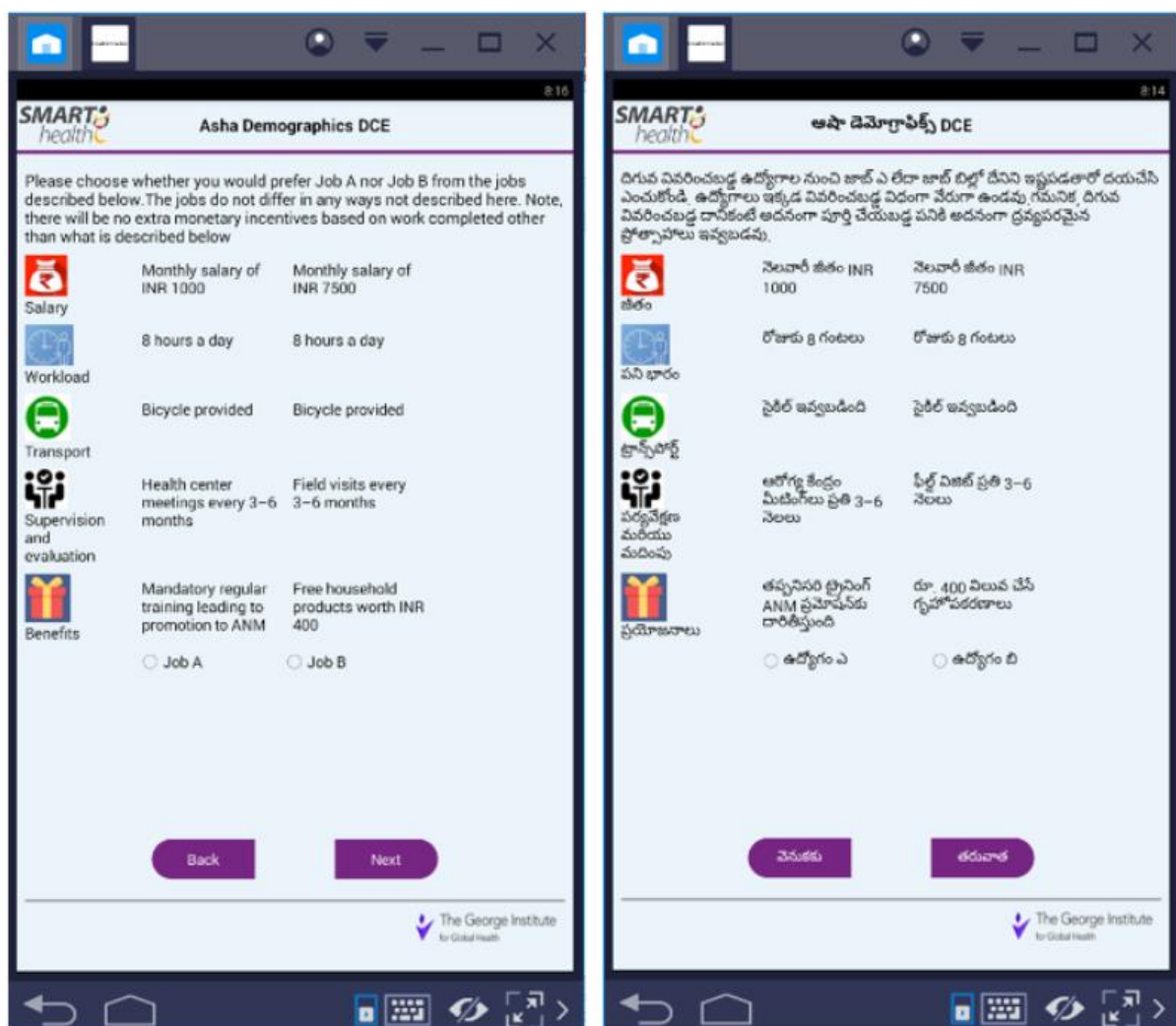
The field staff were asked to complete a debriefing report summarising their observations and reflections of the survey and their discussions with the ASHAs. We used this report to identify cognitive challenges faced by the ASHAs in completing the survey and their overall satisfaction of the survey experience. Since there were no changes in the choice sets or attributes, the paper based DCE was then converted to an Android application.

### **Step 3: Development of the Android application**

A detailed Microsoft Excel spreadsheet with all the demographic items and DCE choice sets was prepared. This spreadsheet imitated the expected data output required for analysis of the DCE results. All the variables were provided to the George Institute India Information Technology (IT) team to develop an offline Android-based application using Java programming with Android studio as an integrated development environment (IDE). Android custom layouts were used for designing the user interface and Android emulators were used as virtual device for testing the application. Data was stored locally in the internal storage of the device using SQLite database. The application was first developed in English and then into the local language (Telugu). A screenshot of both versions of the DCE is presented in Figure 1. Samsung Tab 4 with Android version 4.2 was used to collect the information. First demographics were collected, presented in the form of dropdown choices. Next, DCE choice sets were presented with pictures and graphics to engage the respondents. The DCE choice

sets required the respondents to tick their preferred job, which took them to a pop-up screen with their chosen job choice to confirm their acceptance to take the job, if offered to them. Forced response functionality, which forces the respondent to answer each question in order to proceed to the next section, was used to prevent missing data. The collected data was securely saved on the computer tablets, and later sent to the developer team to be extracted into the desired output for analysis.

**Figure. 1 Screenshot of the English and Telugu versions of the DCE application**



## **Testing of the Android Application**

The research team conducted the first round of user testing of the Android application on mobile tablets to check for any errors in the sequence or display of questions. Then a second round involved user testing of the application among ASHAs to assess if they could use the mobile tablets with ease.

## **RESULTS**

The average age of participated ASHAs (n=20) was 31 years and 60% of them had completed secondary education. The research team conducting the survey reported that the DCE was well received by the ASHAs and that they did not find it difficult to understand the choice sets presented to them. The introductory statement with the choice set example helped to explain the hypothetical nature of the DCE and confirmed the cognitive understanding of the ASHAs of the DCE.

Data collection using the paper based format occurred over two days during February 2018. Once we had clarified the cognitive understanding of the choice sets, we piloted the DCE data collection using the android application with ASHAs. This step was essential to ensure that the ASHAs could use the tablets with ease. Twenty ASHAs were invited for the pilot session, the DCE procedure and job-sets were explained to them and they were allowed to complete the DCE individually without any group discussions. The research team who observed the Android-based data collection, reported that the ASHAs did not take much time to familiarize themselves with the computer tablets. The observers noticed that the younger ASHAs used the tablets with more ease compared to the older ASHAs. Most ASHAs had never used a computer tablet prior to the study, but almost all of them had access to a smart mobile phone.

The Android-based answers were in line with the paper-based tool answers. Data collection time was notably shorter using the computer tablets, (10 to 15 minutes) compared to (20 to 25 minutes) for completing the paper based DCE. In addition, no additional data entry or data cleaning was required.

## **DISCUSSION**

This methods paper describes the approach used to develop an Android-based DCE for CHWs with basic education in a rural region of India. The user testing of the DCE on the Android tablets showed that the ASHAs had no difficulty using the tablets especially those who had access to a smart phone. Apart from the initial cost of developing the Android application, the application required minimum user interaction with the device and allowed no skipping of questions by respondents. Data collected using the computer tablets is easily transferred to the main server to allow for real time analysis. In addition, the electronic administration of the DCE allows a better design to display the choice sets by incorporating graphics and pictures. Presenting different options using graphics is advantageous, especially when dealing with respondents with basic education.

While all studies use similar steps to develop DCEs, there are particular challenges in implementing DCEs in LMICs where the culture, context, literacy levels and language need to be considered during the design stage. Cognitive testing of the DCE is necessary to assess the respondent's comprehension of the choice sets. In addition to literature reviews, we found qualitative research and expert consultation to be particularly helpful in identifying realistic attributes that were relevant to the local context. Mobile technology is increasingly being used in LMICs in improving public health services especially by frontline health workers.<sup>11</sup> Although LMICs can greatly

benefit from the increasing use of the mobile phones, they can be limited by the service cost. In order to support researchers in LMICs, the United States Agency for International Development (USAID) has developed a rapid DCE tool for LMICs to simplify the design and implementation of evidence-based recruitment and retention strategies which eliminate the need of expertise.<sup>12</sup>

It was important that the data collectors were independent of the health system, and the data collected was de-identified and confidential. This ensured that the ASHAs could trust the research team and answer the questions honestly. The two approaches used to test cognition of the questionnaire were 'think aloud approach' and 'verbal probing'. The think-aloud approach is where respondents verbalize their thoughts as they try to answer the questions.<sup>13</sup> This helped us understand the main concerns of the ASHAs while answering the DCE. In the 'verbal probing' approach the interviewer asks a series of questions designed to elicit information beyond that normally provided by the respondent.<sup>14</sup> These two approaches helped us assess the respondent's understanding of the options. It also explained the ASHA's thought process and the factors used to guide their decisions regarding the jobs offered. Most of the ASHAs used smartphones in their daily routine, while using a tablet was novel to display the DCE, it was not challenging for them.

Although, one of the main advantages of using technology is connecting with remote people using network connections, this study did not investigate the capability of the low-literate community health workers to handle the complete DCE experiment without the research team guidance to explain the nature of the experiment. Our study only needed minimal interaction with the computer tablets, hence, further research need to

be conducted to investigate the capabilities of community health workers to use the computer tablets on their own.

## **CONCLUSION**

This paper illustrates the steps needed to develop an Android-based application used to conduct a DCE among CHWs in rural India. The CHWs with basic education found it easy to use Android computer tablets to complete the DCEs. Data collection using an Android platform was time-saving, and more efficient compared to the paper based tools as it had inbuilt checks, eliminated data entry, and produced a data set which was clean and ready for analysis. India is one of the largest smartphone markets in the world and has extensive phone networks; this in turn can facilitate the administration of the DCEs to a wider population. In conclusion, it is feasible to use digital technology to develop and implement a DCE for CHWs with low literacy levels in a low-income setting.

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# **CHAPTER FIVE: What do India's Accredited Social Health Activists want – findings from a discrete choice experiment**

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## **CHAPTER OVERVIEW**

This chapter builds on chapter four, and presents the findings of a discrete choice experiment (DCE) developed to examine the preferences of the Accredited Social Health Activists (ASHAs) to remain in service. The chapter consists of a single manuscript titled: 'What do community health workers want? Findings of a discrete choice experiment among Accredited Social Health Activists (ASHAs) in India.'

One of the major challenges faced by the Indian health system is keeping Accredited Social Health Activists motivated, and retaining them in service. Several factors including individual, social, economic and work-related factors impact the motivation and retention of the ASHAs. This chapter investigates the key motivational factors (and their relative importance) that may help retain ASHAs in service. Career progression was found to be the main influencing factor for ASHAs choosing between job options in addition to fixed salary and other non-financial factors such as priority free family health-check and reduced workload. However, there is a heterogeneity in the preference profile of ASHAs depending on their sociodemographic factors. The

chapter provide evidence that non-financial and financial incentives should be combined to improve health workers satisfaction and performance. Policy recommendations should consider the preferences of health workers and target features most valued by ASHAs.

The questionnaire used in this study is available in appendix 1.

## **AUTHOR CONTRIBUTIONS**

MA and RJ and SJ conceived the idea of this study. BA and MA designed the experiment and analysed the data under the supervision of MH and KH. MA and RJ drafted this article and all authors revised the manuscript and provided advice and input to prepare the manuscript for journal submission. MA, BA, MH, KH and RJ helped draft the responses to the reviewers' comments. MA prepared the final draft of the manuscript for publication.

## **PUBLICATION DETAILS**

Abdel-All M, Angell B, Jan S, Howell M, Howard K, Abimbola S, Joshi R: What do community health workers want? Findings of a discrete choice experiment among Accredited Social Health Activists (ASHAs) in India. *BMJ Global Health* 2019, 4(3):e001509.

## BACKGROUND

The shortage of health workforce in low-income and middle-income countries is a major challenge to achieve the United Nation's Sustainable Development Goals (SDGs). Projections by the World Health Organization indicate that in order to achieve the SDGs by 2030, there is a worldwide shortfall of 18-million health workers, of which 6.9 million will be in Southeast Asia.<sup>1</sup> One promising approach to overcome workforce shortages has been the formal incorporation of community health workers (CHWs) in the health systems as front-line care providers and form a link between the community and the health system.<sup>2</sup> CHWs are health workers who do not hold formal professional certification but receive job-related pre-service training, and usually reside in the community where they work.<sup>3</sup> CHWs have been a cornerstone of health systems in several countries.<sup>4</sup> Over 26 different CHW programs have been identified in the literature across more than 24 low-income and middle-income countries; with remarkable diversity in their remuneration, training and job description.<sup>5</sup>

One of the major challenges faced by health systems is keeping CHWs motivated and retaining them in service. Attrition rates for CHWs are variable and are reported to be between 3% in the Solomon Islands and 77% in other low and middle income countries.<sup>6</sup> High attrition rates impact on service delivery as the continuous replacement of CHWs results in increased recruitment and training costs,<sup>7</sup> lost chances to build on experience and trust built between the community and the CHW. A number of factors contribute to the performance and motivation of CHWs including financial and non-financial incentives.<sup>6</sup> Despite a large literature describing the CHW motivation and retention in the local health settings,<sup>8-11</sup> there is limited empirical

evidence on the importance of the different factors and the trade-offs that CHW may be willing to make between them.

In India, the National Rural Health Mission introduced a cadre of CHWs, the 'Accredited Social Health Activist' (ASHA) in 2005. ASHAs reside in the rural communities where they work and their main task is to link the community to the public health system. They are female volunteers who are remunerated according to a performance-based incentive system, where they receive money conditional on delivering services or attaining targets such as tracking and ensuring full childhood immunisation. They are often confronted by challenges such as lack of support by supervisors, and insufficient and/or delayed remuneration which impacts their motivation<sup>12</sup> and often leads to attrition. While some studies have explored factors which motivate ASHAs (e.g. adequate compensation and community recognition),<sup>13</sup> <sup>14</sup> there is no empirical evidence about the relative importance of the different incentives that may help to retain ASHAs in service.

Understanding the preferences of ASHAs is essential to the development of interventions aimed at reducing attrition rates across the health system. This is particularly important in settings where the resources available to fund health services are constrained. Discrete choice experiments (DCEs) have been widely used to elicit the preferences of health care workers across a variety of settings. A DCE is a quantitative research method that is regarded as a more useful tool than ranking techniques in policy analysis and planning. DCEs can be designed to provide insight into the relative value of specific components (attributes) of interventions, the trade-offs respondents may be willing to make between the attributes and the overall value attached to a program.<sup>15,16</sup>

This chapter aims to elicit the preferences of ASHAs in Guntur, a district in Andhra Pradesh, southern India, for attributes of their work that may increase motivation and reduce the rates of attrition, quantify the relative importance of the different attributes and the impact of demographic factors on preferences.

## **METHODS**

The study was registered with “Clinical Trials Registry – India” <http://ctri.nic.in> (identifier\_CTRI/2018/03/012425). Ethics approval was obtained from The Institute Ethics Committee of The George Institute for Global Health, India. A participant information sheet and consent form were used to gain consent of participating ASHAs. All participants gave written informed consent in the local language (Telugu).

### **Patient and Public Involvement**

This research was done without patient involvement. It was not appropriate or possible to involve patients or the public in this work

### **Development of Discrete Choice Experiment for ASHAs**

#### **Identification of the attributes and levels**

Contextual factors and challenges that CHWs face in undertaking their daily tasks were identified through a literature review of peer reviewed articles and grey literature of the CHWs perspectives and experiences and a review of policy documents relating to the recruitment, training, job description, remuneration, supervision and career progression of ASHAs.<sup>17</sup> In addition, synthesis of focus group discussions and in-depth interviews of ASHAs from a related study in the same region of India<sup>18</sup> helped us understand the enablers and barriers faced by ASHAs while performing their duties

in the community. The emerging themes guided the development of a list of key attributes relating to the ASHA's job conditions, satisfaction, expectations, and motivating factors. Once the attributes were finalised, the research team assigned levels to each attribute to reflect the realistic options that ASHAs experience in their work.

### **Expert consultation and construction of job sets**

Attributes and levels were finalised after consulting researchers and program managers familiar with the Indian health system. They were asked to review the attributes and provide insight regarding whether the attributes and levels depicted realistic options. In addition, the wording of the different levels were edited to ensure they were comprehensible and relevant to the ASHAs. From this process, the included attributes in the DCE were: fixed salary, workload, travel allowance, supervision, job benefits incorporating training leading to promotion to the next level of auxiliary nurse midwife (ANM), free family health-check and free household products. A list of the attributes and levels in the DCE is presented in Table 1.

**Table 1. Attributes and levels used in the Discrete Choice Experiment**

<b>Attributes</b>	<b>Levels</b>
Salary (Monthly pay of)	7500 INR 5000 INR 2500 INR 1000 INR
Workload	4 hours a day 8 hours a day
Transport	Travel allowance Bicycle
Supervision	Health centres meetings Field visits
Benefits	Mandatory regular training leading to promotion to next level auxiliary nurse midwife (ANM) Free household products worth 400 INR Priority free family health-check No benefit provided

### **DCE design**

The DCE was designed following standard practices<sup>19</sup> using the software Ngene (version 1.2.0, ChoiceMetrics Pty Ltd, Sydney, NSW, Australia).<sup>20</sup> We used a d-efficient fractional factorial design with two blocks of eight questions using a multinomial logit model with no interaction terms specified in the design. The ASHA's educational level was taken into consideration when determining the number of attributes in each choice set to minimise cognitive burden.<sup>21</sup> The final design was translated into the local language (Telugu). Participants were asked to respond to eight choice sets each containing two unlabelled job profiles. The respondents were required to choose their preferred alternative from the two options. After choosing the preferred job profile, they were asked if they would accept that job if it was offered, thereby providing an indication of preference relative to their current job. The DCE was piloted with 20 ASHAs to confirm cognitive understanding and ensure appropriateness

of the wording of the questions, attributes and levels to the ASHAs. The data from the pilot was analysed and the estimated coefficients were used as prior estimates to maximise the statistical efficiency of the design of the DCE. The final design was split into two blocks (each answered by approximately half of the cohort). The DCE and collection of sociodemographic information (age, education, years of service, working hours, location of work, other paid job and main household earning status) were administered on computer tablets using an offline Android-based application developed by the research team.<sup>22</sup>

### **Data collection**

The study was conducted in Guntur, the second most populous district of Andhra Pradesh, a southern state of India. Guntur was selected because of its rural status with more than 66% of its population living in the rural areas. Data collection occurred from April to June 2018 with primary health centres (PHCs) as the sampling unit of the study. We randomly selected 53 PHCs out of a total of 84 PHCs in Guntur, representing all the rural and remote regions of the district. Six ASHAs from each of the selected PHCs were invited to participate in the study, the ASHA's supervisors facilitated the invitation of the ASHAs to the DCE sessions which took place within the PHCs premises. The DCE was self-administered on the tablets in the local language (Telugu). A member of the research team explained the nature of the study to the participants, went through the introductory statement with them and explained the job sets. They also ensured that the ASHAs responded individually by discouraging group discussions. The introductory statement is provided in supplementary material S1.



## Analysis

DCEs are theoretically based on random utility theory where independent rational actors act to maximise their individual utility.<sup>23</sup> We assume that participants will choose the job that maximise their individual benefit or utility which depends on the attributes such that:

$$U (A \text{ or } B) = \beta_1 \text{ Salary} + \beta_2 \text{ Training} + \beta_3 \text{ Health} + \beta_4 \text{ Supervision} + \beta_5 \text{ Travel} + \beta_6 \text{ Workload} + \varepsilon$$

Where:

Salary = Fixed monthly salary

Training = Mandatory regular training leading to promotion to the next level auxiliary nurse midwife (ANM)

Health = Priority free family health-check

Supervision = Field visits supervision

Travel = Travel allowance

Workload = Daily workload

At the end of the study, data from the computer tablets were extracted into an Excel spreadsheet and analysed using NLOGIT software (version 6, Sep 7, 2016. Copyright 1986-2016 Econometric Software, Inc.). The analysis of the DCE has followed the general approach outlined by the International Society of Pharmacoeconomics and Outcomes Research (ISPOR) and published guides to model specification.<sup>24,25</sup> The

multinomial logit model was used to estimate the relative utility of job attributes. Salary and workload hours were modelled as continuous variables, and the others were specified as categorical and effects coded. A willingness to 'sacrifice salary' analysis was carried out in order to estimate the strength of the ASHAs' preferences to a single standard – how much salary are the ASHAs willing to sacrifice in order to secure their 'desired job'.

A Latent Class (LC) model was used to explore preference heterogeneity by identifying the existence of latent classes with differing preference profiles. It is not possible to assign an individual participant to a specific latent class; however, inclusion of sociodemographic factors as covariates in the LC model provides an understanding of the distinguishing characteristics of the classes. The final LC model was specified with three latent classes based on log likelihood tests and comparison with models having 2 or 4 latent classes. The sociodemographic factors used to predict latent class membership included education, other paid job and main household earning status. The final model included covariates that were statistically significant predictors ( $p < 0.1$ ) of an individual being a member of a latent class.

## **RESULTS**

### **ASHA Characteristics**

A total of 318 ASHAs were invited to participate in the study from 53 PHCs across Guntur, of which 299 completed the DCE giving a response rate of 94%. The average age of participating ASHAs was 35 years, all were females and 60% of them had completed at least 12 years of education. All but four of the 299 ASHAs, resided in the villages they worked in. Most of the ASHAs (75%) had worked in the role for more than

six years, worked for at least six hours a day (65%) and had another paid job (68%).

The demographics of the ASHAs are presented in Table 2.

**Table 2. Demographics of the ASHAs participating in the Discrete Choice Experiment (n=299)**

	N (%)
<b>Age (years)</b>	
Mean age	35
Range	20 - 55
<b>Education</b>	
Primary	64 (21.4)
Secondary	188 (62.9)
Higher education	47 (15.7)
<b>ASHA years of service</b>	
≤ 6	73 (24.4)
> 6	226 (75.6)
<b>ASHA usual working hours</b>	
< 6	100 (33.4)
6	94 (31.4)
> 6	105 (35.1)
<b>Proportion of ASHAs residing in the villages they worked in</b>	295 (98.7)
<b>Proportion of ASHAs having other paid duties</b>	202 (67.6)
<b>Proportion of ASHAs being main household earners for their families</b>	89 (29.8)
<b>Proportion of ASHAs having an average household income of less than INR 5000 per month</b>	182 (60.9)

### **Multinomial Logit Model**

The multinomial logit model was a good fit to the data (pseudo  $R^2$  0.263); it showed that the main factor which influenced ASHAs' job choice was training leading to career progression to the cadre of ANM. This was followed by a fixed monthly salary and priority free family health-check at the local PHC. Provision of travel allowance, workload and supportive supervision did not have an influence on the ASHA's job

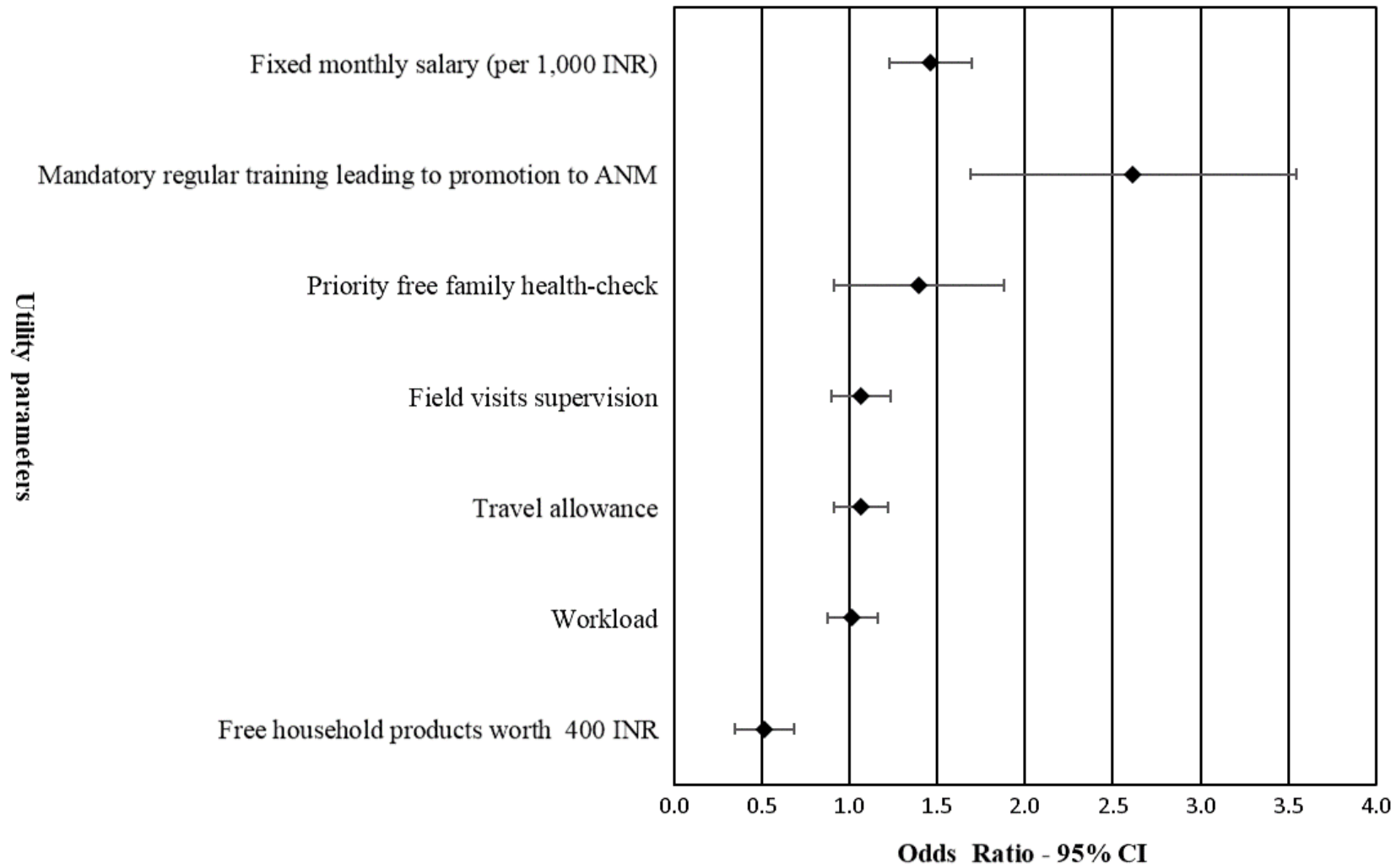
choice. The option of having free household products was inversely related to motivation.

The willingness to 'sacrifice salary' analysis showed that ASHAs were willing to sacrifice 2530 INR (35.45USD) of their monthly salary for a job that offers them training with an opportunity for promotion to the ANM position and 879 INR (12.32USD) for free priority family health-check at the local PHC. Multinomial logit model analysis results and willingness to 'sacrifice salary' analysis results are presented in Table 3 and Figure 1.

**Table 3. Multinomial Logit Model results (n=299, McFadden Pseudo R<sup>2</sup> = 0.263, log likelihood function= -1222.07, number of observations=2392)**

Utility parameters	$\beta$ Coefficient	p value	OR (95% CI)	Willingness to sacrifice salary (INR)
Constant	0.11	0.200	1.12 (0.94 – 1.33)	
Fixed monthly salary (per 1000 INR)	0.38	< 0.001	1.46 (1.35 – 1.58)	-
Mandatory regular training leading to promotion to ANM	0.96	< 0.001	2.62 (2.19 – 3.12)	2,530
Priority free family health-check	0.33	< 0.001	1.40 (1.18 – 1.66)	879
Field visits supervision	0.06	0.116	1.07 (0.98 – 1.16)	
Travel allowance	0.06	0.082	1.07 (0.99 – 1.15)	
Workload	0.02	0.644	1.02 (0.95 – 1.09)	
Free household products worth 400 INR	-0.66	< 0.001	0.52 (0.44 – 0.61)	-1,745

**Figure 1. Willingness to ‘sacrifice salary’ analysis (per 1,000 INR) after “Fixed monthly salary” (n=299, McFadden Pseudo R2 = 0.263)**



## Latent Class Model

The LC model was a good fit to the data (pseudo  $R^2$  of 0.279); it identified three distinct classes of ASHAs. Group 1 and 2 ASHAs were both strongly influenced by the presence of training leading to promotion to the ANM position, followed by salary. In addition, group 2 ASHAs were highly influenced by priority free family health-check at the local PHC. Interestingly, both groups were less likely to accept the job choice if it offered them free household products worth 400 INR. In contrast, group 3 ASHAs preferred less workload and no other factor had a statistically significant effect on their choices. Results of Latent Class Model analysis are presented in Table 4.

The probability of belonging to a particular respondent class varied based on education level, having another paid job and whether they were the main household earner. Compared to group 3, group 1 ASHAs were more likely to have a higher level of education (OR 4.03; 95% CI, 1.47-11.00) and less likely to be the main household earners for their families (OR 0.41; 95% CI, 0.16-2.07). Group 2 ASHAs were more likely to have a higher level of education (OR 7.09; 95% CI, 1.84-27.33), have another paid job (OR 3.64; 95% CI, 1.14-11.60) and less likely to be the main household earners for their families (OR 0.21; 95% CI, 0.07-0.70).

**Table 4. Latent Class Logit Model results (n=299, McFadden Pseudo R<sup>2</sup> = 0.279, log likelihood function= -1194.76, number of observations = 2392)**

<u>Utility parameters</u>	<u>Group 1</u>				<u>Group 2</u>				<u>Group 3</u>			
	$\beta$	p	OR (95% CI)	*WTS (INR)	$\beta$	p	OR (95% CI)	*WTS (INR)	$\beta$	p	OR (95% CI)	*WTS (INR)
Constant	0.16	0.403			-0.42	< 0.01			1.27	< 0.01		
Fixed monthly salary	0.52	< 0.01	1.68 (1.46 – 1.93)		0.15	< 0.01	1.16 (1.04 – 1.28)		140.7	0.845	1.15 (0.88 – 1.17)	
Mandatory regular training leading to promotion to next level auxiliary nurse midwife (ANM)	1.31	< 0.01	3.71 (2.55 – 5.39)	2,518.7	0.64	< 0.01	1.90 (1.49 – 2.44)	4,293.0	0.01	0.944	1.01 (0.71 – 1.43)	
Priority free family health-check	0.03	0.880	1.03 (0.73 – 1.44)		0.41	< 0.01	1.50 (1.14 – 1.97)	2,700.8	0.28	0.131	1.32 (0.92 – 1.89)	
Field visits supervision	0.14	0.135	1.15 (0.96 – 1.38)		0.11	0.206	1.11 (0.94 – 1.31)		-0.22	0.105	0.80 (0.58 – 1.05)	
Travel allowance	0.00	0.984	1.00 (0.87 – 1.15)		0.06	0.274	1.06 (0.96 – 1.18)		0.09	0.387	1.09 (0.90 – 1.33)	
Workload	0.06	0.254	1.06 (0.96 – 1.16)		-0.06	0.230	0.94 (0.86 – 1.04)		-0.21	0.012	0.81 (0.69 – 0.96)	
Free household products worth 400 INR	-0.73	< 0.01	0.48 (0.32 – 0.71)	-1,410.5	-0.49	< 0.01	0.61 (0.48 – 0.78)	-3,260.5	-0.14	0.517	0.87 (0.56 – 1.33)	
<b><u>Sociodemographic predictors</u></b>												
Education	1.39	< 0.01	4.03 (1.47 – 11.00)		1.96	< 0.01	7.09 (1.84 – 27.33)				ref-	
Other paid job	0.59	0.23	1.80 (0.70 – 4.62)		1.29	< 0.1	3.64 (1.14 – 11.60)				ref-	
Main household earner	-0.89	< 0.1	0.41 (0.16 – 2.07)		-1.54	< 0.1	0.21 (0.07 – 0.70)				ref-	
<b><u>Class probabilities</u></b>			<b>0.514</b>				<b>0.353</b>				<b>0.133</b>	

\*WTS (Willingness to 'sacrifice salary' analysis (per 1,000 INR) after "Fixed monthly salary")

## DISCUSSION

Our findings demonstrate that more than 85% of the participating ASHAs were influenced by the opportunity of promotion through training and were willing to sacrifice 2530 INR (35.45USD) out of their monthly salary for a job that offers them career progression. These data are in line with previous literature specifying the importance of career development for motivating community health workers in India.<sup>26</sup> Our results are also broadly consistent with previous human resource for health research utilising DCE, which indicate that career development and continuing education were the main influence shaping the preference profile for nurses in Malawi,<sup>27</sup> Lao<sup>28</sup> and community health officers in Ghana.<sup>29</sup> Although training with a promotion opportunity is not a direct financial incentive, it offers the CHWs an opportunity to progress to the next cadre with higher salary, more authority and recognition. Priority free family health-check and low workload were other driving factors that affected the ASHAs' choices. These findings support the growing evidence of the importance of the non-financial interventions in motivating community health workers in developing countries,<sup>15</sup> and the need for a bundle of combined non-financial and financial benefits.<sup>6</sup> The recent World Health Organization guidelines for optimising CHW programs<sup>30</sup> using systematic reviews and evidence from available literature recommended a fair financial incentive to be provided to the CHWs which should be proportionate to the workload they perform and could include career development pathway for the well performing members. This should be accompanied by a non-financial package that could be tailored to the local context. Both options are indispensable, where monetary incentives provide security and allows for personal development of the workers; non-monetary incentives provide satisfaction and can optimize the CHW's performance.



Our study showed a significant heterogeneity of ASHAs' preferences (Table 4), which varied depending on their education level, having another paid job or by being the main household earner. Age did not have a significant effect on the ASHA's decisions. For instance, the ASHAs in group 2 valued the priority free family health-check at the local Primary Health Centre, were more likely to have a second paid job and were less influenced by training opportunities compared to the ASHAs in group 1. This may be because ASHAs having larger families may need more health visits, and are more concerned that training might take them away from their families or cost them more days off their second job. This preference heterogeneity suggests that policy options are perceived differently by ASHAs depending on their individual circumstances. While policy decisions cannot be tailored to individual preferences, they need to be contextualized to the overall preferences of the ASHAs. Our study demonstrates that there are two broad groups of ASHAs, higher educated ones aiming for career progression with a better pay and recognition; and less educated ASHAs more interested in immediate high pay with no intention for further training to be promoted. These results could be used by policy makers to offer two or more packages for ASHAs. Since the educational requirement for ASHA's selection has recently increased to a minimum of ten years of education, the less educated ASHAs may receive a fixed salary and the higher educated ASHAs could compromise some of their pay to cover their training expenses for an opportunity to be promoted to the next cadre. This can be applied until the less educated ASHAs are progressively eliminated out of the program, allowing for a higher educated cadre with more capacity and tendency to advance.

The DCE is a useful method for human resources research and helps to investigate the impact of potential policy options on different subgroups within the study population. It is of value to low- and middle-income countries where the need to make the best use of the limited resources. However, DCE requires expertise and competence in design and analysis. The USAID has developed a rapid DCE tool<sup>31</sup> for low-income and middle income countries to design and implement evidence-based recruitment and retention strategies. The tool is a simplified and reliable version of the DCE, and does not require a high level of expertise. It has been used to identify attraction strategies for Lao's health workers to accept rural positions.<sup>32</sup>

Although DCE is a reliable tool, the results will always be dependent on the attributes used and the clarity by which these attributes were presented to the participants. This highlights the importance of initial qualitative work to obtain pragmatic policy options that are realistic and accord well with the experiences of health workers. One of the limitations of our study is that we did not perform any tests to ensure internal validity of the DCE among the participants and that they have a complete understanding of the study. Instead, we used 'think aloud' and 'verbal probing' techniques to cognitively test our DCE survey. While the results of our study can be generalised to the State of Andhra Pradesh due to similar remuneration policies, the findings may not be applicable to other states of India, due to the variation in the remuneration policies of ASHAs. All our participants were from the same Indian district and we did not compare them to other districts, where ASHAs might have a different preferences profile. Previously, human resource retention policies were exclusively decided by policy makers, this study provides a rigorous method for identifying the preferences of the local health workers to improve their motivation.

The Government of India has recently announced a revised pay scale for the ASHAs with a free social security cover.<sup>33</sup> These guidelines are supposed to come into effect immediately. Given that different States in India have the authority to implement the new recommendations,<sup>34</sup> the following years will see how this policy is rolled out in the different states and districts of India.

## **CONCLUSION**

Bundled incentives of both financial and non-financial packages are attractive to ASHAs. Policy decisions should be contextualized to local health worker's preferences to guarantee their satisfaction and better performance and improved quality of service. Our study demonstrates the potential value of using DCEs in other low- and middle-income countries similar to India to analyse local CHW preference profile and identify the most effective policy interventions that can vary from one setting to another and from one country to another.

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## SUPPLEMENTARY MATERIAL S2






### DCE Introductory Statement

Thank you for agreeing to take part in our survey. Today we want to understand which job conditions or characteristics you most prefer to be motivated and stay in service.

We will be presenting you with eight different hypothetical job choices and will ask you to tell us which job you will choose. You will notice that each job will have advantages and disadvantages and you will need to carefully choose between them and tell us which one you will prefer. (There is no right or wrong answers)

#### Example job choice 1:

- Please choose whether you would prefer Job A or Job B from the jobs described below. The jobs do not differ in any ways not described here.  
Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 Salary	Monthly salary of INR 1,000	Monthly salary of INR 5,000
 Workload	8 hours a day	4 hours a day
 Transport	Travel allowance provided	Bicycle provided
 Supervision and evaluation	Field visits every 3-6 months	Health centre meetings every 3-6 months
 Benefits	No additional benefits provided	Priority Free Family Health-check

- If this job was offered to you, would you accept it?

YES	NO
<input type="checkbox"/>	<input type="checkbox"/>

*Thank you*

**PART FOUR: Perspectives of the key stakeholders of the ASHA program**

# **CHAPTER SIX: What do ASHAs need to provide comprehensive care that incorporates non-communicable diseases? – Findings from a qualitative study in Andhra Pradesh, India**

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## **CHAPTER OVERVIEW**

This chapter presents the findings of a policy review and qualitative analysis investigating the current capacity and challenges for ASHAs to provide non-communicable disease (NCD) services. The chapter consists of a single manuscript titled: 'What do ASHAs need to provide comprehensive care that incorporates non-communicable diseases? Findings from a qualitative study in Andhra Pradesh, India'

The Indian National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke (NPCDCS) was introduced to provide NCD care through primary healthcare teams including ASHAs. Since ASHAs are being deployed to provide NCD care on top of their regular work for the first time, there is a need to understand the current capacity and challenges faced by them. The findings provide evidence that ASHAs play a key role in providing comprehensive and culturally appropriate care to communities. However, ASHAs are unrecognised as part of the formal NPCDCS service delivery team; they are overburdened, since they deliver several NPCDCS activities without receiving training or remuneration; and they aspire to be formally recognised as

employees of the health system. Understanding the needs and motivational factors for CHWs can help improve their performance and improve health outcomes

### **AUTHOR CONTRIBUTIONS**

MA and RJ conceived the idea of this study. MA analysed the data under the supervision of SA and RJ. MA, SA and RJ drafted this article and all authors revised the manuscript and provided advice and input to prepare the manuscript for journal submission. MA and RJ helped draft the responses to the reviewers' comments. MA prepared the final draft of the manuscript for publication.

### **PUBLICATION DETAILS**

Abdel-All, M., Abimbola, S., Praveen, D. Joshi, R. What do Accredited Social Health Activists need to provide comprehensive care that incorporates non-communicable diseases? Findings from a qualitative study in Andhra Pradesh, India. *Human Resources for Health* 17, 73 (2019) doi:10.1186/s12960-019-0418-9

## BACKGROUND

During the last decade, many low-income and middle-income countries (LMICs) have invested in community health worker (CHW) programs due to their distinctive capacity to reach under-served populations.<sup>1</sup> CHWs have improved access to healthcare and led to better outcomes for maternal and child health,<sup>2</sup> and for a range of programs to control infectious diseases like malaria, HIV and TB. In recent years there have been research studies evaluating the effectiveness of CHWs to address common non-communicable diseases (NCDs) like cardiovascular disease<sup>3,4</sup> and mental health.<sup>5,6</sup> Since most of the evidence is from research and small-scale national programs,<sup>7</sup> it is important to understand how these interventions are implemented and embedded in the routine work of CHWs. It is also essential to understand how the knowledge and skill-set of CHWs is expanded, and workflow streamlined from traditionally focusing on selective vertical programs to now working across horizontal programs with a life-course approach.

The female community health workers of India, known as Accredited Social Health Activists (ASHAs) form one of the largest community-based health workforce in the world, with almost one million ASHAs across India.<sup>8</sup> Each ASHA supports 1000 people for better access to public health services. In most states of India ASHAs are volunteers who receive financial compensation for attending training and performance-based incentives to provide specific tasks like immunisation, referral of pregnant women to health centres and accompanying them for institutional deliveries.<sup>9,10</sup> Other responsibilities include linking the community to the health system, community sensitization to new initiatives, health education, referral to health centres and supporting medication adherence for infectious diseases such as tuberculosis through the Directly Observed Treatment, Short Course (DOTs) program.<sup>11</sup> They

support the auxiliary nurse midwives (ANMs) in delivering maternal and child health related services.

India has been facing an escalating burden of non-communicable diseases (NCDs) which is responsible for almost six million deaths (60% of all-cause mortality) annually.<sup>12</sup> Cardiovascular disease, respiratory disease, cancer and diabetes account for most of the NCD related deaths, 26% of which occur prematurely between the age of 30 and 70 years.<sup>12</sup> In order to address this growing problem, the Government of India launched the National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke (NPCDCS) in 2010.<sup>13</sup> NPCDCS was designed to provide comprehensive primary healthcare to communities through the primary health centres (PHCs). The program aims to prevent and control common NCDs by increasing community awareness, facilitating early detection of undiagnosed cases, and linking the identified cases with the health system for follow-up and continuity of care. An important component of the program involves capacity building and training of the health workforce including the ASHAs to deliver these interventions.

In order to strengthen health services for NCD control at the community level, there is a need to understand the current capacity, working conditions and challenges faced by ASHAs – this study aims to achieve these objectives. Furthermore, this study aims to understand the role of the health system to support ASHAs to perform these duties.

## **METHODS**

This study involved two steps. First, a review of the current policies for NCDs management and the ASHA workforce. Second, a qualitative study including focus group discussions (FGDs) with ASHAs and community members, and semi-structured

in-depth interviews with ASHA's supervisors and senior medical officers at the district level.

### **Study setting**

This study was conducted in Guntur, the second most populous district of Andhra Pradesh, in south India, with a population of almost five million people. The study was conducted between April and June 2018 in close collaboration with policy makers and key stakeholders of the ASHA program. Guntur has 85 PHCs serving around 5 million population, with two-thirds classed as rural. Guntur was selected because its rural-urban distribution and health system is similar to most regions of India. Secondly, The George Institute has its field office and team in the region which enables collaboration with the local Government and facilitates data collection.

### **Study participants**

We purposively selected 41 PHCs for their geographic spread, encompassing all different serving population capacities and representing all the rural and remote regions of Guntur. We invited five ASHAs from each PHC to ensure that a broad range of perspectives are represented. In total, we conducted 13 FGDs with 180 ASHAs and five FGDs with 47 community members. We also interviewed 13 ANMs and seven medical officers. In addition, we interviewed two senior medical officers at the district level. Each FGD involved 9-14 participant and lasted approximately 75 min, and each interview lasted approximately 45 min.

### **Study instruments**

For the interviews and group discussions, we modified the Community Health Worker Assessment and Improvement Matrix (CHW AIM)<sup>14</sup> to include interventions for the



screening and management of cardiovascular diseases and diabetes mellitus based on the World Health Organization's Package of Essential Non-Communicable Diseases Interventions (WHO PEN)<sup>15</sup> and NPCDCS.<sup>13</sup> The modified version was used as a guide for the qualitative interviews and group discussions. Respondents were asked to reflect on four key areas:

- a) Current engagement and responsibilities of ASHAs in the NPCDCS
- b) Support strategies including training, supervision, reimbursement schemes
- c) Challenges and needs of ASHAs
- d) Expanding the role of ASHAs beyond maternal and child health

### **Data collection and management**

For the document review component of the study, we obtained online all publicly available policy and program documents relating to the NPCDCS, and ASHA recruitment, training, assessment, remuneration, career progression, supervision and job description. Data extraction from the policy documents included information on the expected engagement and responsibilities of ASHAs in the NPCDCS, program governance and inputs such as remuneration, training and evaluation schemes. We then identified the system components of the ASHA program that were most relevant to the knowledge and skills required for NCD prevention and control. These were also used to inform the interviews and group discussion guides.

All in-depth interviews and focus group discussions were conducted in Telugu, the local language, and run by experienced facilitators, who have previously worked on similar projects, and note takers who met the participants for the first time for the study. The facilitators and note takers are part of the research team at the George Institute India, who organised for all the interviews and focus group discussions to take place.

The ANMs facilitated the invitation of the ASHAs and community members for the FGDs which took place within the PHCs premises. At the beginning of each session, the study objectives were explained to the participants and confidentiality was assured. The facilitators were briefed regularly by two of the authors (MA and RJ) and discussion guide updated accordingly. The FGDs and interviews were audio recorded and transcribed verbatim and the data was translated to English.

### **Data analysis**

Iterative-inductive thematic analysis of the qualitative data was conducted. We identified the different emerging themes, which were then categorised into codes and sub-codes and compared across participant groups to inform the interpretation of the data. We sought to identify how intersections between the ASHA program and the NPCDCS influences the capacity and disposition of ASHAs to deliver NCD services from the point of view of both the health system and of ASHAs themselves.

### **Ethics**

Ethical approval was obtained from Ethics Committee of The George Institute for Global Health, India. All participants gave written informed consent in Telugu.

## **RESULTS**

Three themes emerged to characterise how the ASHA program intersects with the NPCDCS to influence the capacity and disposition of ASHAs towards delivering NCD services. First, while ASHAs are identified as part of the NPCDCS team at the policy level, they are not recognised as part of the formal NPCDCS service delivery team on the ground. Second, ASHAs are overburdened, since they deliver several NPCDCS activities as well as their routine primary care workload without receiving training or

remuneration for the NCDs activities. Third, they aspire to be formally recognised as employees of the health system. ASHAs are enthusiastic about their work including the NPCDCS responsibility, and remain an essential link between the health system and the community. See Figure 1 for further characterisation of contextual enablers and constraints, activities delivered by ASHAs for NCD care and the implications.

**Figure 1. Enablers and barriers in the delivery of the National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke services through the Accredited Social Health Activists**

Context	NCD related services provided by ASHAS	Implications and recommendations
<p style="text-align: center;"><b>Enablers</b></p> <ul style="list-style-type: none"> <li>• ASHAs are volunteers who receive performance based incentives for 38 health related tasks.</li> <li>• Community embeddedness of ASHAs</li> <li>• Trust and good relationships built with the community.</li> <li>• ANMs trust the ASHAs and their capacity to perform basic tasks</li> <li>• Opportunity to learn at monthly meetings with Doctors and ANMs</li> </ul> <p style="text-align: center;"><b>Constraints</b></p> <ul style="list-style-type: none"> <li>• ANMs have power to pressurise ASHAs to fulfil some of their own service targets</li> <li>• ASHAs are not part of the health system</li> <li>• There is no formal role for ASHAs in the delivery of NCD services</li> <li>• The performance based incentives are often delayed</li> <li>• Lack of support from the health system has led to low morale of ASHAs</li> </ul>	<ul style="list-style-type: none"> <li>• List all community members</li> <li>• Enlist all community members diagnosed with NCDs and provide this information to ANMs</li> <li>• Mobilise community members to attend the government operated NCD screening days</li> <li>• Refer patients to the PHC for follow-up</li> <li>• Refer complicated cases to ANMs</li> <li>• Refer and accompany patients to emergency or PHC as required</li> <li>• Mobilise the community to collect their medicines from the mobile pharmacy</li> <li>• Follow-up patients with NCDs by providing medication adherence support and lifestyle modification counselling</li> </ul>	<ul style="list-style-type: none"> <li>• Unrecognised part of the NCD program               <ul style="list-style-type: none"> <li>○ ASHAs should be recognised as formal CHWs of India who provide basic NCD related services</li> </ul> </li> <li>• Provision of NCD related services without formal training or remuneration               <ul style="list-style-type: none"> <li>○ ASHA focused training to provide basic services such as education and adherence support to improve the quality of care</li> <li>○ Allocation of performance based incentives for NCD related services</li> </ul> </li> <li>• Aspirational               <ul style="list-style-type: none"> <li>○ Opportunities for career progression</li> <li>○ Supportive supervision and a better working conditions</li> </ul> </li> </ul>

## **Unrecognised: ASHAs are not a formal member of the NPCDCS healthcare team**

The NPCDCS policy review identified detailed guidelines about the role of various team members at the PHC and sub-centre levels. According to the policy, ASHAs are to perform a broad range of program-related tasks. These entail screening for chronic diseases risk factors using "Community Based Assessment Checklist"; surveying the community for family history of NCDs; mobilising the community to attend screening days; improving community awareness of the importance of following healthy lifestyle, and following-up patients for medication adherence and continuity of care.

Our study found out that while ASHAs are not officially recognised as members of the NPCDCS services delivery team by the primary care team, they are involved in some NPCDCS activities. Community members discussed that ASHAs advised them about healthy eating and lifestyle to help them with their poorly controlled blood pressure and diabetes. ASHAs also remind the community members to attend the regular screening campaigns and to pick up their monthly medications when necessary. As part of NPCDCs, a NCDs training module has been prepared specifically to train ASHAs about NCDs, their risk factors, how to raise community awareness of NCDs, and promote healthy lifestyles.<sup>13</sup> However, ASHAs in this region have not been trained in this module. In addition, none of the activities described in the NPCDCS policy guidelines are incorporated in the performance-based incentive scheme for ASHAs.

Although ASHAs are recognised as part of the primary care service delivery team, they are not formal employees of the health system. The perception among some of the medical officers interviewed was that, ASHAs are not competent and do not have the knowledge and necessary skill-set to provide NCD services. In the words of one

of the medical officers, *“ASHAs are volunteers who can only perform tasks during their free time and their main role is to link the community to the health system”*. Another medical officer added *“ASHAs’ basic level of education would not allow them to learn as fast as other technical members of the healthcare team”*. This has caused ASHAs to experience some harassment and disrespect by members of the primary healthcare team. One of the ASHAs explained *“when we take a patient to the hospital, they would tell us “you are an ASHA, stay outside”*. Patients would react by saying *“there is no point for you to accompany us to the hospital”* and consequently *“they lose their trust in ASHAs”*. But despite this, one of the senior medical officers highlighted that ASHAs are always considered a part of the health system – in his words: *“any new program launched by the government with ASHAs will have their names listed on the program portal along with other healthcare providers”*.

### **Overburdened: ASHAs are the ones on the ground delivering NPCDCS services**

The main role of ASHAs is to mobilise their communities to increase health services utilisation. Apart from participating in a wide range of primary healthcare programs, they are required to carry out regular household surveys to update the demographic profile of the communities they serve. This role has helped the ASHAs understand their community’s needs, identify individuals requiring different health services and build trust with the community members. A medical officer described ASHAs as *“the first person to know community member’s symptoms”*, and one of the senior medical officers added that *“community members feel [the] ASHA as their own person...[the] first thought which comes to their mind when they are sick is ASHA”*. Counting on this unique status, ANMs have relied on ASHAs to fulfil some of their own NPCDCS targets.

These include reporting previously diagnosed cases of NCDs to ANMs; inviting community members aged 30 years and above for screening days and ensuring that patients have collected their monthly medication supply. Most ASHAs reported that they did not receive a job description defining their expected role.

Without formal training on NCDs, ASHAs often need to provide health education regarding nutrition and physical activity for individuals diagnosed with NCDs such as diabetes or high blood pressure. An ASHA noted *“we visit the patients at home and check if they are using their medicines and advise them to go for check-ups regularly. Sometime, we give them our phone number and tell them to call us in case of any emergency to help refer them to a nearby hospital”*. When asked how they get to know about patient counselling, they mentioned that they often ask ANMs for specific counselling to respond to community enquiries. Others mentioned that these topics were discussed during the monthly meetings at the PHC. One medical officer explained that ASHAs and ANMs are invited for monthly refresher training meetings at the PHC, where different topics are discussed such as cardiovascular disease risk factors and healthy lifestyle promotion. Although these topics are not targeted for ASHAs they acquired knowledge through these meetings.

Even though ASHAs are volunteers who are expected to work for a couple of hours per day, and receive performance based incentives, they are overburdened by the additional workload and end up working long hours without receiving any incentives to perform many of these tasks (e.g. medicine adherence support). Several ASHAs have a second job to supplement their income. One ASHA said: *“We get pressurised to finish more tasks and put aside our family needs... We end up getting blamed by our families, or even losing the second job we have”*. The community members as well

expressed their gratitude for the efforts of the ASHAs. One community member said: *“ASHAs put in a lot of effort under hard conditions like rainy and hot days .... They provide us with lots of services”*.

### **Aspirational: expectations for the expansion of the role of ASHAs**

Stakeholders felt that ASHAs are well placed to help address the growing burden of NCDs at the village level, and that ASHAs are enthusiastic about helping people in their communities. The stakeholders acknowledged that ASHAs are interested to be trained and up-skilled so that they can support the communities they serve. They also aspire for their role to be recognised by the health system. In the words of one of the senior medical officers: *“some ASHAs have completed the ANM training themselves... They want to progress their career”*. He also noted that the government has shown interest in these more ambitious ASHAs; and there are discussions about career advancement opportunities for ASHAs. Stakeholders emphasised the crucial need for ASHAs to be trained for NCDs. One medical officer said: *“it will be very good to train ASHAs for NCDs .... They need to have some knowledge about the different diseases the population is suffering from like diabetes and hypertension which prevents further complications... We can make a better community”*. One of the senior medical officers also highlighted the importance of the prerequisite of basic education for recruitment of ASHAs to ensure that they can acquire further skills and knowledge. He said: *“there are ASHA workers who have a higher level of education now...If we can train those for screening and follow-up, it will be good and the community will definitely accept them”*. Community members welcomed the idea of ASHAs providing basic NCDs services, as they would get better access to health services and save on transportation expenses to the PHCs for problems that can be resolved by the ASHA. One



community member said: *“everyone from our village will come to her rather than going very far for check-up ... It will be convenient if they do it at home”*.

Remuneration for ASHAs was extensively discussed as a factor limiting their job satisfaction. All the stakeholders agreed that ASHAs were not being remunerated in accordance to the services they perform. One of the ANMs explained: *“ASHAs have been helping us in multiple programs; they do not get paid for many of the tasks .... They are not getting paid enough in overall, we have been asking for a pay rise for them”*. And community members expressed their concern regarding the poor income of ASHAs and how it is insufficient to cover their family needs. One community member said: *“ASHAs care a lot about us ...they come to visit us at home and tell us about the available health services .... Hopefully they get paid enough to support themselves”*. One of the senior medical officers explained that ‘the remuneration scheme has been increasingly discussed in the governance meetings, and they are considering a suitable reform in the near future’. Various stakeholders were concerned that providing a fixed salary (instead of payment for performance) may negatively affect the quality and quantity of service they provide. While ASHAs expressed their preparedness to receive more training and to acquire additional skills, they stressed the importance of receiving enough remuneration before they can accept further tasks. Other ASHAs also highlighted the idea that if expanding their role would involve longer work hours, it might not be suitable for all ASHAs, especially the ones with family responsibilities. In general, most ASHAs expressed their hope for a government reform in the near future, that can provide them with a basic salary as in the case of other States of India, as this provides ASHAs with economic security especially with the often delayed performance-based incentive. This certainly improves ASHA’s satisfaction and help motivate and sustain them in the health system.

## DISCUSSION

This study shows that although ASHAs in Guntur are well accepted by the communities they serve, yet, they are not recognised as an integral part of the NPCDCS service delivery team. While NPCDCS is well designed and described on the policy papers, its roll out lacks details and has led to the sub-optimal implementation of the program through ASHAs at the community level. ASHAs are not officially delegated any NCDs tasks, however they are asked to provide basic NCD services without specific training or remuneration to fulfil the NCD related targets. They contribute to their communities and the health system, and seek opportunities to upskill and advance their career. All stakeholders agreed that ASHAs are not appropriately utilised by the health system, even though, they can provide community-oriented care as part of efforts to address the growing burden of NCDs. They are capable of connecting and relating to their community based on their relationships and understanding of their community's culture, beliefs and norms.

Our findings are in line with literature which highlight the support needed for CHWs to play a fundamental role in improving access to healthcare.<sup>3,16</sup> Previous studies have demonstrated that trained and supervised CHWs can effectively screen individuals at high-risk of cardiovascular disease,<sup>17</sup> for cardiovascular risk factors<sup>16,18</sup> and promote healthy lifestyles for primary prevention of NCDs.<sup>19</sup> Similar to the findings of our study, the literature shows that key enablers to optimize CHW programs include adequate recognition and integration of CHWs into the health system, functional infrastructure, and a clear role description.<sup>20</sup> In order to optimise the efficiency of the ASHA program, we recommend that the Indian government commits towards the development and

capacity building for the ASHA program for NCD control. This will involve training, monitoring and support, with evaluation and career development options.

ASHAs need to be trained to effectively deliver NCD services to their communities. There is a gap between community expectations and what CHWs are empowered to do. Training should reflect the job description, position requirements, and needs to include both technical and non-technical competencies. CHWs training mainly focuses on how to fulfil the different mandatory tasks, including filling up forms, and didactic medical oriented training. More practical and interactive training of the different tasks is favoured by the CHWs. Topics such as communication, confidentiality and problem solving skills to deal with their daily challenge have been shown to improve motivation, and performance of CHWs.<sup>21</sup> The prerequisite level of education of the ASHAs influence their capability to gain more knowledge and skills to be able to provide appropriate care to the community. In addition, higher educated members tend to be more ambitious for career development opportunities and are more enthusiastic to receive training. The previous chapter provides evidence that ASHAs with higher education do not mind a temporary pay cut for a training opportunity that can help them secure a better career opportunity with the health system.<sup>22</sup> The recent WHO recommendations for optimizing CHW programs identified community embeddedness, where the community has a sense of ownership of the program as an effective way of sustaining community-CHW relationship and strengthening CHW programs. This can be facilitated by updating CHWs selection procedures to include community contribution towards the CHW selection process. Furthermore, ongoing supportive supervision and quality improvement approaches are critical for the effectiveness of CHWs.<sup>23, 24</sup> The literature highlights the consequences of the poor supervision in negatively affecting the performance of the CHWs.<sup>25</sup>

While policy decisions in India are made at the national level, there is variation in implementing these policies at the State level. One of the limitations of our study is that it reports findings from only one district in south India. The findings of our study may not be applicable to ASHAs in other states, especially where ASHAs receive a fixed salary and support from their supervisors.<sup>26</sup> Furthermore, cultural, gender and societal influences differ across India, which have an impact on service delivery at the community level. These differences could not be captured in our study. Furthermore, while this study identifies some of the needs of ASHAs and what may be required to support them to deliver NCDs services optimally, our findings do not indicate how policymakers may prioritise which support to provide. The use of other research methods, such as Discrete Choice Experiments may indeed be necessary to identify what those priorities might be. It is of value to make the best use of the often limited resources of the health systems, to implement contextualised policy interventions that can be attractive to the CHWs and help sustain the established programs.<sup>22</sup>

The findings of this study may inform the implementation of few relevant policies announced by the Government of India. The first policy relates to an increment in ASHAs' performance-based incentives along with social security coverage.<sup>27</sup> More recently, the Government of Andhra Pradesh announced an increase in ASHAs' basic salary or honorarium from 3,000 Indian Rupees to 10,000 Indian Rupees per month, in addition to their performance-based incentive.<sup>28</sup> These were announced in response to a demand from ASHAs for income commensurate to their workload. The second policy includes strategies to support ASHAs seeking to complete secondary education through the Open School System and will prioritise them for the ANM course.<sup>29</sup> Third, the government has introduced 38 incentivised tasks for ASHAs in 2017 in addition to the routine activities announced in 2014,<sup>30</sup> to provide some level of predictable income,

however, none of these activities are NCD service related. While these policies have not yet been implemented, it will be important to measure the impact of these policies over time.

As the range of services provided by ASHAs expands, there will be a debate on whether to increase the number of ASHAs or to create a separate NCD specific cadre.<sup>31</sup> However, in empowering ASHAs for more responsibilities, knowledge and skills, it is important that they continue to be embedded in the community so that they develop a strong relationship that is necessary to effectively provide healthcare across the life course. With recent evidence suggesting that there is value in incorporating digital technologies with CHW programs, India is currently undergoing a digital transformation with an aim to improve health service delivery. This strategy has the potential to support ASHAs via training, decision support, referrals and follow-up, thereby helping them deliver a broader range of quality health services.<sup>32</sup> However, there is need for more evidence about how these technologies may support the workforce and strengthen health systems.<sup>33</sup>

Based on the findings of this study, our recommendations include: having a clear job definition and description of responsibilities, expand training to include NCDs with regular retraining, provision of guidelines and protocols, having supportive supervision, a clear policy for career progression and appropriate remuneration.

## **CONCLUSION**

This study shows that in addressing the increasing burden of NCDs in LMICs, CHWs are considered particularly appropriate to provide culturally adapted care to communities residing in rural and remote areas, where there is lack of adequate health services. They have the potential to deliver NCD services effectively, if provided with

appropriate training and supervision to maintain quality of service and adequately remunerated to keep them motivated. Community embeddedness, better health system recognition such as being employees of the system, having a regular wage, career pathway, supporting infrastructure with suitable funding for remuneration schemes are critical for success of CHW programs. Understanding the needs and motivational factors for CHWs can help improve their performance and improve health outcomes.

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# **PART FIVE: Discussion, future directions and conclusion**

# **CHAPTER SEVEN: Discussion and conclusion**

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## **CHAPTER OVERVIEW**

This chapter provides a summary of the main findings of the thesis as well as a discussion based on the findings of each study. The strengths and limitations of the studies included in this thesis are also discussed together with future directions and recommendations.

The central objective of this thesis was to investigate the role expansion of community health workers (CHWs) to provide comprehensive primary health care (CPHC) that incorporates non-communicable diseases (NCDs). I used multiple methods to understand the role of CHWs and factors that influence their performance and have summarised the results in four parts. Part one described the history of CHW initiatives including India's CHW program, one of the world's largest CHW initiatives. Part two assessed the potential of training CHWs for NCD prevention and management services in low- and middle-income countries (LMICs). I performed a systematic review of the literature and evaluated a hypertension training program for the Accredited Social Health Activists (ASHAs) of India. Part three looked at the factors that influence the motivation and retention of ASHAs in the workforce. First, I described the development of a technology based discrete choice experiment (DCE) to explore financial and non-financial factors that motivate ASHAs to remain in service and then I reported the methods and findings of the DCE conducted among 300 ASHAs in rural India. Part four explored the perspectives of the key stakeholders of the ASHA program of the current capacity and challenges facing the ASHAs. This was assessed via focus group discussions and in-depth interviews with the ASHA program stakeholders including ASHAs, ANMs, primary care doctors, community members, and district medical officers.

### **Summary of the main findings of the thesis**

The role of CHWs has evolved over time and has been shaped by the epidemiological and demographic transition. Initially, the focus of CHWs was on maternal and child health and infectious diseases, but as the disease burden shifted, they were trained to provide care for common infectious diseases such as HIV/ AIDS and tuberculosis.

With the advent of NCDs such as cardiovascular disease and cancers, CHWs are now being trained to deliver basic management for these conditions. The systematic review<sup>1</sup> demonstrated that CHWs can be effectively trained to provide NCD services. However, their training evaluation should be beyond the usual pre-post tests and standardised frameworks such as the Kirkpatrick evaluation model, Anderson's value of learning model,<sup>2</sup> and Kaufman's model of learning evaluation<sup>3</sup> should be utilised to capture the impact of training on the change in knowledge, behaviour and perception of CHW to the training.<sup>4</sup>

One of the major challenges in implementing CHW programs is to retain CHWs in service and motivate them to do their job. The discrete choice experiment demonstrated that CHWs are motivated by both non-financial and financial factors.<sup>5</sup> A defined career pathway and fixed salary together with non-financial factors such as priority free family health-check are all influencing factors on the CHWs decision to stay in service. In addition, the level of education prior to becoming CHWs played a major role in shaping the preference profile of the CHWs, the more educated the CHWs, the more likely they are interested in an opportunity for career progression.<sup>5</sup>

Empirical data from the qualitative work<sup>6</sup> showed that ASHAs are the backbone to India's public health system, linking the community to the primary health care services. They provide culturally adapted care that is acceptable to the community.<sup>6</sup> However, ASHAs remain to be volunteers and are not recognised as formal employees of the health system. They receive task-based incentive for routine activities with some states of India providing them with a basic monthly honorarium on top of their performance-based incentive. They deliver basic NCD related tasks without appropriate training or remuneration, but they are enthusiastic to gain more knowledge



and skills to help their communities. Indeed, ASHAs have the potential to deliver a broad range of services, if supported by the health system appropriately.

While the evidence from this thesis relates mostly to the Indian context, it can be applicable to similar CHW initiatives in other LMICs. Understanding the needs and motivational factors of CHWs can help enhance their performance, thereby improving the health service delivery and the population health outcomes. In the following section, I will discuss how CHWs can be involved and supported in primary health care teams to deliver care.

### **CHWs and the primary health care team**

In order to deliver comprehensive primary health care effectively, health systems need to adopt a team-based approach involving the entire primary health workforce including CHWs. CHWs need to have a predefined job description with clear responsibilities to help them perform their tasks well and achieve their goals without being overburdened with extra workload. Our policy review in Chapter Six showed that roles are broadly described on paper,<sup>7</sup> with no clear understanding of how the roles interact, communicate and collaborate with each other on the ground. In order to understand these questions, there is need for operational research to understand team dynamics and estimate the workload. It is necessary for CHWs to be skilled at the appropriate level, provided with standard protocols, and appropriately supervised to maintain the quality of care provided. This approach needs to be supported by functional communication channels and referral pathways for the CHWs to function collaboratively with the rest of the PHC team, especially with auxiliary nurse midwives and for streamlining the flow of information.<sup>8</sup>

## Training CHWs for NCDs

The training program of CHWs should reflect the job description, position requirements, and needs to include both technical and non-technical competencies. Apart from disease specific knowledge, training should also include counselling, communication and problem solving skills to help CHWs develop confidence and the skillset to deal with local traditions, and cultural norms.<sup>9</sup> In order for the training to be easily understood by CHWs, it needs to be culturally adapted and delivered in the local language through interactive workshops and sessions rather than traditional didactic training.<sup>4</sup>

Training evaluation is necessary to assess the performance of the CHWs, their ability to implement the knowledge and skills gained, and to schedule refresher training accordingly. Several CHW initiatives have extensive training programs<sup>6</sup> however; evaluation of the post-training performance via frameworks such as the Kirkpatrick's framework is not usually part of the program.<sup>1</sup> Observation of behaviour change can be incorporated by involving supervision, and retraining can be included via on-the job training or via monthly meetings as is in the case of the Indian health system.<sup>6</sup> There is growing evidence suggesting that technology-enabled training can be cost-effective and can provide efficient off-site training opportunities even for hard to reach areas<sup>10</sup> as mobile technology is readily accessible across most LMICs.<sup>10</sup> Technology-enabled training also allows for basic training content to be standardised and shared across different countries with the flexibility of adapting the content to local context and language.<sup>11</sup>

## **Supervision**

Supervision is a critical element for the success of CHW programs.<sup>12</sup> While supervision is context-specific, CHW programs should clearly define the role of supervisors and train them accordingly. Effective supervision allows the evaluation of CHW's skills and performance and the decision on further training.<sup>13</sup> Available evidence suggest that improving supervision quality by adopting problem-solving approaches and using assessment checklists is of more impact than increasing supervision frequency.<sup>14</sup> As per recent WHO recommendations, supervision should follow a mentorship approach where supervisors provide needed support for the CHWs and allow for their professional development.<sup>15</sup> The qualitative study<sup>7</sup> and other literature shows that CHW-supervisor relationship plays an important role in CHW performance.<sup>16,17</sup> Government commitment is essential to implement appropriate supervision structure with clearly defined objectives in order to maintain the quality of the service delivered.

## **Remuneration**

Remuneration has a great impact on the CHWs satisfaction and performance, as it is considered as an acknowledgment of their role or contribution to the health systems.<sup>18</sup> Adequate or satisfactory remuneration of the CHWs influences the effectiveness of health programs and is suggested as a means for achieving better health outcomes.<sup>18</sup> The recent WHO recommendation emphasised the importance of adequate financial incentive for the CHWs to be proportionate to the workload they perform and to be accompanied by non-financial incentives that can be adapted to the local context of each CHW program.<sup>15</sup> While financial incentives are preferred as they provide financial security and allow for personal development of the workers; factors such as delays in payment or insufficient salaries might cause dissatisfaction among the CHWs.<sup>18</sup> Non-

financial incentives can be a source of motivation to the CHWs too, and can be adapted to the local context of the CHW program. Non-financial incentives can vary between identification badges or uniforms, to system support items as job aides including counselling cards or training opportunities that can provide more knowledge and hence confidence dealing with the community.<sup>18</sup>

CHWs are mostly non-salaried volunteers receiving performance-based incentives for performing certain tasks<sup>19</sup> and are often asked to perform tasks that are not linked to incentives.<sup>9</sup> In India, as several incentives are linked to maternal and child health, CHWs assigned areas with an older population are financially disadvantaged due to the demographics of the community assigned to them. Furthermore, performance-based incentives are mostly focused on certain tasks leaving many CHWs activities unacknowledged or sometimes these activities may be ignored by the CHWs as they are not incentivized, such as general sanitation and hygiene and nutritional counselling.<sup>15</sup> On the other hand, governments have concerns that CHWs can be complacent in their job if they are on a regular salary.<sup>6</sup> One of the suggested model is using a mixed-scheme remuneration, which provides basic salary for the CHWs with opportunities for extra income through performance-based incentives. This is similar to the remuneration offered by the Government of Andhra Pradesh as it provides the CHWs with some economic security in addition to their performance-based incentive. Having a mixed-remuneration scheme through a fixed base salary and performance based incentives could potentially allow CHWs to be recognised as employees of the health system, covered by the employment legislations and laws and at the same time ensure the CHWs are actively performing their role in the community to be able to earn an appropriate income.

ASHAs in India are not formal employees of the health system and do not have access to the legal protections offered by employment and labour legislations. They are involved in multiple service delivery programs but the health system offers employee benefits to Auxiliary Nurse Midwives but not for them.<sup>6</sup> This difference in benefits between different cadres creates a rift in the team dynamics and cause high attrition rates among the ASHAs. ASHAs have demanded an appropriate income commensurate to their workload and have organised strikes on many occasions to escalate their demands. In response, the Indian government has recently announced an increase in ASHAs' performance-based incentives along with social security coverage.<sup>20</sup> In addition, the Government of Andhra Pradesh announced an increase in the ASHA's basic salary or honorarium from 3,000 Indian Rupees to 10,000 Indian Rupees per month.<sup>21</sup> As these policies have just been announced it will be important to measure the impact of these policies on the performance of the ASHAs over time.

### **The role of CHWs across the life course**

The role of the CHWs has evolved globally over time and now they are being trained to provide basic NCD related services. Studies have demonstrated that CHWs can be trained to screen, refer and follow up patients with cardiovascular disease,<sup>22-24</sup> diabetes,<sup>25</sup> mental health,<sup>26</sup> in addition to cervical cancer screening.<sup>27</sup> India like many other LMICS, has a NCD policy involving primary care services. However, it is not clear how the NCD services will be delivered at the community level through CHWs. There is a gap between community expectations and what CHWs are trained to do. CHWs have the potential to play an important role as a member of the comprehensive primary health care team, extending their services to incorporate basic NCD services. These services are similar to their original role but more specific to NCDs, including

health education and raising community awareness about NCDs and their risk factors; following-up patients and checking for medication adherence (similar to the Directly Observed Treatment short-term (DOTs) program, but not as intensive). Furthermore, advancement in digital health technologies like mobile Health (mHealth) clinical decision support systems have created opportunities to standardise and improve the quality of services provided by CHWs.<sup>28</sup> mHealth allows the data to be shared with the primary health care team in real time and streamlines referral pathways.<sup>29</sup> Recognising CHWs as one of the team members with official sharing of tasks with the extended primary care team would improve patient access to care across a range of conditions, thereby lead to better health outcomes.

### **Future research recommendations**

The work in this thesis has pointed out a number of areas that deserve further investigation. First, while there is increasing need for CHWs to be able to provide NCD related care, few studies provide a description of the training required. Future studies should ideally report the content, length and effectiveness of the training. In addition, researchers should consider making training resources publicly available to other researchers and governments. Furthermore, research is also needed to investigate the best interval for retraining CHWs to retain the gained knowledge and skills. The use of technology in training and supervision needs to be further explored, especially to assess the feasibility of scaling up the use of technology in low resource settings.

Second, there is a growing interest in formally certifying CHWs after they complete the initial in-service training. On one hand, this is proposed to standardise the CHWs practices, legitimize their work and offer them more flexibility for career progression. On the other hand, it may impose more cost to the health systems and limit the

availability of certified CHWs. More research is needed to investigate the feasibility and long-term effect of certifying CHWs on quality of service provision and population health outcomes.

Finally, while CHWs are now required to be upskilled with appropriate NCDs skills to answer their community's needs, they are overburdened by multiple tasks and workload. Operational research is necessary to understand the workload capacity of the CHWs to ensure quality of service provision. Scaling-up and feasibility studies need to consider the population size served by each CHW in order to improve quality of care.

### **Policy recommendations**

In recognition of the role of CHW and efforts since the Alma-Ata declaration 40 years ago, the World Health Assembly has recommended the recent CHWs guidelines<sup>15</sup> to all countries and endorsed CHWs as members of the primary health care team. The unique embeddedness of CHWs in their communities allows them to play an important role in providing quality care of service that can help countries achieve universal health coverage. For LMICs to have real commitment and investment in their CHWs' programs there are few points to be considered to empower CHWs and facilitate their role in primary health care delivery:

- In selecting CHWs, the prerequisite education level should be suitable to the range of tasks performed by the CHWs.
- CHWs need to be recognised as an integral member of the health team, have a detailed role description and protected by worker's rights.

- CHWs should be offered appropriate remuneration schemes matching their role description and expected workload. Future policy decisions should incorporate contextualised bundled incentives of both financial and non-financial packages targeting those areas that are most valued by the CHWs to maximise the value of investments into these workers.
- CHWs need to have a defined career pathway with promotion opportunities.
- The health system needs to invest in proper training plans including pre-service training and ongoing refresher training
- Appropriate supervision procedures are essential to ensure quality of care provision by the CHWs.
- Functional institutions with basic resources together with resources such as essential medicines and equipment e.g. BP machines used by the CHWs are essential for the credibility of the CHWs among the community.

In empowering CHWs, it is important to emphasise the unique position that CHWs have within the health system and communities which help link the two via community engagement, relationships and trust. This unique status makes them the backbone of health systems and help provide better health care access. Upskilling the CHWs should not lead them to give up these important responsibilities that help them build the trust within their communities.

### **Strengths and limitations**

This thesis formally evaluated the role of CHWs in delivering CPHC that incorporates NCD services to the community. It looked into the policy settings of the CHW programs and drew attention to identifying the different factors that make CHW programs more



effective rather than focusing on whether CHW programs are effective or not. Using robust methodologies we provided evidence for operational recommendations and knowledge gaps to be prioritised in future research. The empirical studies included in this work were conducted in Andhra Pradesh, a region in south India. While there is variation in the implementation of the ASHA program across different states, the findings of this thesis are likely to be relevant to the program in other states. Given the similarities of CHW programs across LMICs, the methods developed in this thesis and the results can be applicable to other CHW programs in different LMICs taking into account variation in the local context and settings.

## **CONCLUSION**

In conclusion, CHWs provide a unique opportunity for LMICs to achieve realistic progress towards the United Nation's Sustainable Development Goals and Universal Health Coverage. CHWs have a distinctive capacity to deliver culturally adapted comprehensive primary health care that incorporates NCD services effectively for under-served populations. Understanding the policies, program strategies and CHWs' needs is essential to optimise their performance. Health systems should include evidence-based strategies as part of a comprehensive health workforce policy to avoid fragmentation, and to ensure efficiency and improved health outcomes. Finally, it must be noted that there is no single strategy or guideline that will fit all. Each health system will have to adapt, and customise these guidelines to the local context for implementation and up-scale. Through good policies, strong governance and commitment, CHW programs can be revitalised and help health systems recruit, train, retain and sustain CHWs.

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# APPENDICES

# **APPENDIX I. DISCRETE CHOICE EXPERIMENT QUESTIONNAIRE**

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This appendix presents the questionnaire used in the study presented in Chapter Five





ASHA ID

Date

1. How old are you?

 years

2. What is the highest level of education you have completed?

<input type="checkbox"/>	Class I-IV (Primary)
<input type="checkbox"/>	Class VI-VIII (Upper Primary)
<input type="checkbox"/>	Class IX-X (Secondary)
<input type="checkbox"/>	Class XI-XII (Junior college)
<input type="checkbox"/>	Diploma graduate

3. How long have you worked as an ASHA?

<input type="checkbox"/>	< 2 years
<input type="checkbox"/>	2 - 4 Years
<input type="checkbox"/>	4 - 6 Years
<input type="checkbox"/>	> 6 Years

4. What are your average working hours per day as an ASHA?

<input type="checkbox"/>	< 2 hours
<input type="checkbox"/>	2 - 4 hours
<input type="checkbox"/>	4 - 6 hours
<input type="checkbox"/>	> 6 hours

5. How far do you live from the area where you practice?

<input type="checkbox"/>	< 4 km
<input type="checkbox"/>	4 – 8 km
<input type="checkbox"/>	9 – 12 km
<input type="checkbox"/>	> 12 km

6. Have you been trained on Non-Communicable Diseases (Chronic diseases like Hypertension, diabetes or cancer)?

<input type="checkbox"/>	Yes
<input type="checkbox"/>	No

7. When was the last time you attended a training session on Non-Communicable Diseases?

<input type="checkbox"/>	< 3 months
<input type="checkbox"/>	3 - 9 months
<input type="checkbox"/>	10 - 12 months
<input type="checkbox"/>	> one year



8. Are you doing any other paid job along with the ASHA duties?
- Yes  
 No
9. Are you the main source for household income?
- Yes  
 No
10. How many people live in your household (share food from the same kitchen)?
- 4 or less  
 5 – 8  
 9 – 12  
 More than 12
11. What is your average household income?
- less than INR 5000 per month  
 INR 5000 – INR 20000 per month  
 INR 20000 – INR 50000 per month  
 > INR 50000 per month






*Thank you*



1. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 <b>Salary</b>	Monthly salary of INR 1,000	Monthly salary of INR 5,000
 <b>Workload</b>	4 hours a day	8 hours a day
 <b>Transport</b>	Bicycle provided	Travel allowance provided
 <b>Supervision and evaluation</b>	Health centre meetings every 3-6 months	Field visits every 3-6 months
 <b>Benefits</b>	Priority free family Health-check	Mandatory regular training leading to promotion to ANM

• If this job was offered to you, would you accept it?






YES	NO
<input type="checkbox"/>	<input type="checkbox"/>



2. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 <b>Salary</b>	Monthly salary of INR 2,500	Monthly salary of INR 2,500
 <b>Workload</b>	8 hours a day	8 hours a day
 <b>Transport</b>	Bicycle provided	Travel allowance provided
 <b>Supervision and evaluation</b>	Field visits every 3-6 months	Health centre meetings every 3-6 months
 <b>Benefits</b>	Mandatory regular training leading to promotion to ANM	No additional benefits provided

• If this job was offered to you, would you accept it?






YES	NO
<input type="checkbox"/>	<input type="checkbox"/>



3. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 <b>Salary</b>	Monthly salary of INR 5,000	Monthly salary of INR 1,000
 <b>Workload</b>	8 hours a day	4 hours a day
 <b>Transport</b>	Travel allowance provided	Bicycle provided
 <b>Supervision and evaluation</b>	Field visits every 3-6 months	Health centre meetings every 3-6 months
 <b>Benefits</b>	No additional benefits provided	Free household products worth INR 400

• If this job was offered to you, would you accept it?






YES	NO
<input type="checkbox"/>	<input type="checkbox"/>



4. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 <b>Salary</b>	Monthly salary of INR 5,000	Monthly salary of INR 1,000
 <b>Workload</b>	8 hours a day	4 hours a day
 <b>Transport</b>	Bicycle provided	Travel allowance provided
 <b>Supervision and evaluation</b>	Health centre meetings every 3-6 months	Field visits every 3-6 months
 <b>Benefits</b>	Mandatory regular training leading to promotion to ANM	No additional benefits provided

- If this job was offered to you, would you accept it?






YES	NO
<input type="checkbox"/>	<input type="checkbox"/>



5. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 <b>Salary</b>	Monthly salary of INR 2,500	Monthly salary of INR 7,500
 <b>Workload</b>	4 hours a day	8 hours a day
 <b>Transport</b>	Travel allowance provided	Bicycle provided
 <b>Supervision and evaluation</b>	Health centre meetings every 3-6 months	Field visits every 3-6 months
 <b>Benefits</b>	Priority free family Health-check	Free household products worth INR 400

• If this job was offered to you, would you accept it?






YES	NO
<input type="checkbox"/>	<input type="checkbox"/>



6. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 <b>Salary</b>	Monthly salary of INR 1,000	Monthly salary of INR 5,000
 <b>Workload</b>	4 hours a day	8 hours a day
 <b>Transport</b>	Travel allowance provided	Bicycle provided
 <b>Supervision and evaluation</b>	Field visits every 3-6 months	Health centre meetings every 3-6 months
 <b>Benefits</b>	Free household products worth INR 400	Priority free family Health-check

• If this job was offered to you, would you accept it?






YES	NO
<input type="checkbox"/>	<input type="checkbox"/>



7. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	<input type="checkbox"/> <b>Job A</b>	<input type="checkbox"/> <b>Job B</b>
 <b>Salary</b>	Monthly salary of INR 7,500	Monthly salary of INR 7,500
 <b>Workload</b>	4 hours a day	4 hours a day
 <b>Transport</b>	Bicycle provided	Travel allowance provided
 <b>Supervision and evaluation</b>	Field visits every 3-6 months	Health centre meetings every 3-6 months
 <b>Benefits</b>	No additional benefits provided	Mandatory regular training leading to promotion to ANM

• If this job was offered to you, would you accept it?






<b>YES</b>	<b>NO</b>
<input type="checkbox"/>	<input type="checkbox"/>



8. Please choose whether you would prefer Job A or Job B from the jobs described below.

The jobs do not differ in any ways not described here.

Note, there will be no extra monetary incentives based on work completed other than what is described below

	Job A <input type="checkbox"/>	Job B <input type="checkbox"/>
 <b>Salary</b>	Monthly salary of INR 7,500	Monthly salary of INR 2,500
 <b>Workload</b>	8 hours a day	4 hours a day
 <b>Transport</b>	Travel allowance provided	Bicycle provided
 <b>Supervision and evaluation</b>	Health centre meetings every 3-6 months	Field visits every 3-6 months
 <b>Benefits</b>	Free household products worth INR 400	Priority free family Health-check

- If this job was offered to you, would you accept it?

YES	NO
<input type="checkbox"/>	<input type="checkbox"/>

*Thank You*

## **APPENDIX II. PUBLISHED MANUSCRIPTS**

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This appendix presents the published manuscripts for chapters Two, Three, Four, Five and Six.

## **Chapter Two manuscript**

# BMJ Open Effectiveness of community health worker training programmes for cardiovascular disease management in low-income and middle-income countries: a systematic review

Marwa Abdel-All,<sup>1,2</sup> Barbara Putica,<sup>2</sup> Deversetty Praveen,<sup>3</sup> Seye Abimbola,<sup>1,2</sup> Rohina Joshi<sup>1,2,4</sup>

**To cite:** Abdel-All M, Putica B, Praveen D, *et al.* Effectiveness of community health worker training programmes for cardiovascular disease management in low-income and middle-income countries: a systematic review. *BMJ Open* 2017;7:e015529. doi:10.1136/bmjopen-2016-015529

► Prepublication history and additional material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2016-015529>).

Received 11 December 2016  
Revised 13 September 2017  
Accepted 15 September 2017



CrossMark

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## ABSTRACT

**Introduction** Community health workers (CHWs) are increasingly being tasked to prevent and manage cardiovascular disease (CVD) and its risk factors in underserved populations in low-income and middle-income countries (LMICs); however, little is known about the required training necessary for them to accomplish their role. This review aimed to evaluate the training of CHWs for the prevention and management of CVD and its risk factors in LMICs.

**Methods** A search strategy was developed in line with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, and five electronic databases (Medline, Global Health, ERIC, EMBASE and CINAHL) were searched to identify peer-reviewed studies published until December 2016 on the training of CHWs for prevention or control of CVD and its risk factors in LMICs. Study characteristics were extracted using a Microsoft Excel spreadsheet and quality assessed using Effective Public Health Practice Project's Quality Assessment Tool. The search, data extraction and quality assessment were performed independently by two researchers.

**Results** The search generated 928 articles of which 8 were included in the review. One study was a randomised controlled trial, while the remaining were before–after intervention studies. The training methods included classroom lectures, interactive lessons, e-learning and online support and group discussions or a mix of two or more. All the studies showed improved knowledge level post-training, and two studies demonstrated knowledge retention 6 months after the intervention.

**Conclusion** The results of the eight included studies suggest that CHWs can be trained effectively for CVD prevention and management. However, the effectiveness of CHW trainings would likely vary depending on context given the differences between studies (eg, CHW demographics, settings and training programmes) and the weak quality of six of the eight studies. Well-conducted mixed-methods studies are needed to provide reliable evidence about the effectiveness and cost-effectiveness of training programmes for CHWs.

## Strengths and limitations of this study

- First systematic review to evaluate the effectiveness of training community health workers for the prevention and management of cardiovascular disease and its risk factors in low-income and middle-income countries.
- The review was conducted in accordance to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.
- Quality of studies was assessed and papers were critically appraised using Effective Public Health Practice Project's Quality Assessment Tool.
- Limited number of studies with insufficient data regarding training methods, outcomes and characteristics of CHWs.
- Most of the studies were not controlled, which made it difficult to investigate the effect of potential confounders on the performance of the CHWs.

## INTRODUCTION

### Cardiovascular diseases in low-income and middle-income countries

Globally, the burden of non-communicable diseases (NCDs) is rising with the cause-specific mortality fraction due to NCDs estimated to be 69% in 2030 compared with 59% in 2002.<sup>1</sup> This shift is largely driven by a demographical and epidemiological transition, coupled with rapid urbanisation and nutritional transitions in low-income and middle-income countries (LMICs).<sup>2</sup> Currently, cardiovascular disease (CVD) is the leading cause of morbidity and mortality in developed countries and LMICs alike, with a greater burden being felt by the latter, as they carry a higher proportion of premature deaths from cardiovascular events.<sup>3 4</sup> Most health systems in LMICs are unprepared to manage the increasing burden of CVDs

as their health systems are often focused on infectious diseases and maternal and child health, rather than chronic diseases.<sup>5 6</sup>

### Health workforce for CVD

Access to primary care for CVD prevention and treatment in LMICs can often be challenging<sup>7</sup> as these countries have the highest global disease burden and tend to experience some of the greatest shortages in physicians and health workers.<sup>8</sup> For example, there are 2.3 health workers per 1000 population in Africa and 4.3 per 1000 population in Southeast Asia.<sup>9</sup> A maldistribution of these health workers often exists with a higher concentration of health workers in urban areas compared with rural regions where large proportions of the population reside.<sup>9–11</sup> This poor distribution and shortage of health professionals has led some countries to rely on trained community health workers (CHWs), who take on specific tasks for the prevention and management of diseases.

### Community health workers

WHO defines CHWs as individuals who perform functions related to healthcare delivery, have shorter training than professional health workers, are community members, selected by and answerable to the community for their activities and are usually supported by the health system but not necessarily a part of its organisation. Typically, they are trained for specific tasks such as provision of antenatal care or immunisation and often do not hold any formal certifications.<sup>12</sup> CHWs have been effective in providing essential healthcare services in a cost-effective manner.<sup>13 14</sup> They have been instrumental in reducing maternal and neonatal mortality rates through their presence in at-home births and making referrals for emergency obstetric care<sup>15–17</sup> and by promoting vaccination uptake, breast feeding and education on infectious disease.<sup>18 19</sup> More recently, CHWs have been useful in HIV/AIDS prevention and control, educating communities and performing tasks such as testing, counselling and prescribing antiretroviral drugs.<sup>20–24</sup> This transfer of responsibilities onto CHWs is commonly referred to as task shifting, which is common in regions with limited access to physicians.<sup>25–27</sup> This increase in responsibility has been noted throughout the global health community, and it is not uncommon for CHWs to hold different titles based on the country where they work or the tasks for which they are responsible (such as non-physician healthcare worker, lay health worker, traditional birth attendant, accredited social health activist, barangay health worker, etc).<sup>12</sup>

Over the last 10 years, CHWs have had an increasing role in CVD prevention and control.<sup>28–32</sup> Although research into the effect of CHWs in CVD prevention and control is relatively new, there is emerging evidence that yields promising results.<sup>33–36</sup> There is considerable amount of data and manuals available to help train CHWs for management of infectious diseases and maternal and child health in LMICs<sup>37–39</sup>; however, there is a lack of

evidence-based information regarding the content and method to train CHWs for CVD prevention and control.<sup>40</sup> Effective training and retraining are essential for the knowledge and skill set required for good quality performance. This systematic review aims to provide comprehensive insight into CHW training programmes for CVD prevention and control and provides an evidence base for the effectiveness of training programmes in the LMIC context.

### METHODS

A protocol was written to define the inclusion and exclusion criteria and the methods for the review prior to data extraction in accordance to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.<sup>41</sup> Five databases including Medline via OvidSP, Global Health via OvidSP, ERIC via OvidSP, Embase via OvidSP and CINAHL via EBSCO were reviewed.

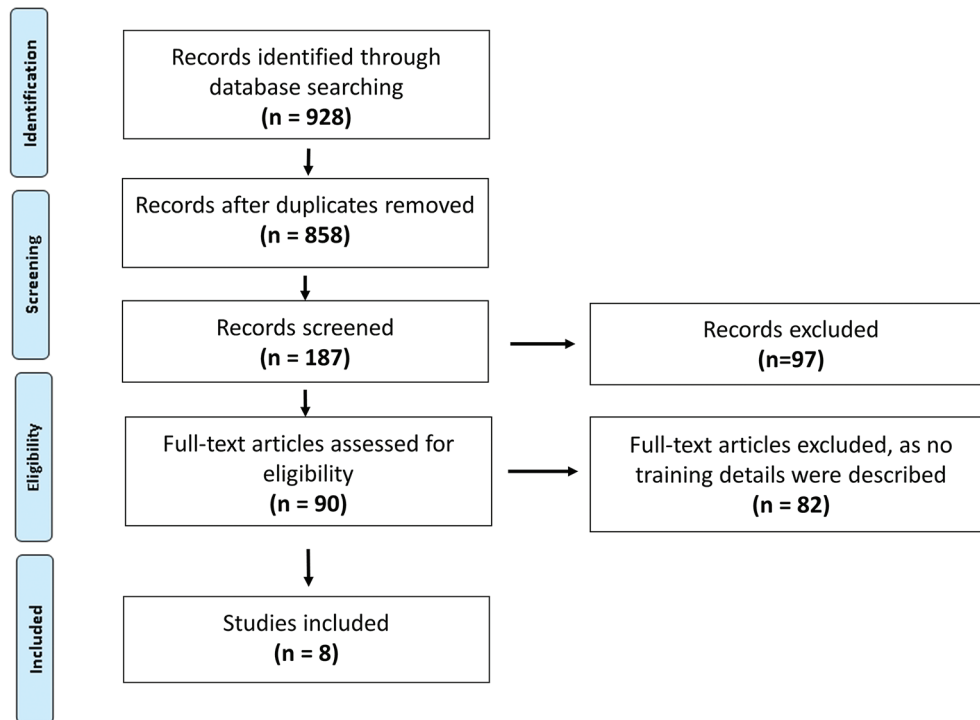
### Inclusion and exclusion criteria

The population considered for this systematic review was CHWs in LMICs. Synonyms for CHWs included in the search were taken from the WHO report on CHWs<sup>12</sup> and other terms based on literature reviews.<sup>42–44</sup> A medical librarian was consulted to ensure integrity of our search. The review included intervention studies that offered training programmes for CHWs in CVD and cardiovascular risk factor prevention (screening, health promotion) or control (monitoring, management). Papers included were specific in what type of training methods were used (ie, which topics were covered, length and outcomes of the training programmes, etc). Studies were limited to CVDs and their modifiable risk factors including high blood pressure, diabetes, dyslipidaemia, alcohol consumption, tobacco use and physical inactivity. A complete list of free text search terms and subject headings are supplied in online supplementary appendix 1. The comparator variable for this paper included preservice training, and the outcome of interest was an improvement in skills and knowledge of CHWs in the prevention and control of CVDs and their risk factors after the training programme. Types of studies included were preobservational and postobservational studies and randomised controlled trials published until 31 December 2016. Papers in all languages were searched, and those in a language other than English were translated. If a study was reported in more than one paper, information from all the papers was included in the review, but the study was counted once.

Studies were limited to those that were explicit in specifying what type of training was done and reported pretest and post-test scores for CHWs. They included countries classified during 2015 as low-income, lower-middle-income and upper-middle-income countries in the World Bank's Income Classifications.<sup>45</sup>

### Data collection

After agreeing on the search strategy to be used, two authors (BP, MA) reviewed the literature and extracted



**Figure 1** Flow diagram for systematic review process.

the data independently. The number of studies included at each stage of literature search was agreed on between the two authors to ensure that no papers were missed and discrepancies were dealt by consensus (figure 1). Data were collected on a prespecified Excel sheet after approval of all reviewers, with variables clearly outlined. The first paper to be included was extracted independently and then the data were compared between authors to confirm what was to be expected to report for each variable. This sheet was modified to include all information that was important as data extraction continued. Weekly meetings were held between the data extractors to discuss any disagreements about the inclusion of a paper. In case of disagreements, a third author (RJ) was asked to adjudicate. At the end of data extraction, all reviewers met to note any discrepancies and agree on the final data extraction. The references of all the included papers were checked for additional relevant papers. When necessary, corresponding authors of included papers were contacted regarding missing information in the published papers. Quality of studies was assessed and papers were critically appraised using Effective Public Health Practice Project (EPHPP)'s Quality Assessment Tool.<sup>46</sup> The Tool provides an overall methodological rating of the studies of strong, moderate or weak as per six components including selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts. Studies were rated strong if the study population was representative of the target population, had a robust study design such as a randomised controlled trial, controlled for confounding, used validated data collection tools and had a low drop-out rate of the study participants. Two authors (BP, MA) followed the quality assessment tool and rated

the studies independently and discussed discrepancies by consensus. No study was excluded based on the quality assessment.

### Data analysis

To demonstrate the change in knowledge and skills among CHWs, pretest and post-test scores and postintervention scores published in the eight papers were used to evaluate the effectiveness of training. No additional statistical analysis was done as individual test scores were not available and scores were not standardised across the eight studies. All studies were reviewed and a narrative synthesis was conducted to assess the studies comprehensively. The data were tabulated to explore the relationship between and within the included studies. Themes from the qualitative data reported were used to assess the CHWs' perception and experience of the training. A meta-analysis was not performed due to heterogeneity of the studies.

## RESULTS

### Characteristics of included studies, CHWs and trainers

The initial search yielded 928 citations published between the period of 1959 and 2016. After removing duplicates, 858 titles and 187 abstracts were screened. Ninety studies were assessed for a full review, of which 8 studies were included. Figure 1 outlines the systematic review process. The selected studies were conducted between the year 2000 and 2013 and published between the year 2007 and 2015. Four of the studies were conducted in rural or semiurban areas, and four studies did not mention details about the study site.<sup>47–50</sup> None of the studies discussed the cost of training involved or the cost-effectiveness of the training.

The studies included CHWs from Bangladesh, Guatemala, Mexico, South Africa<sup>51</sup> and Thailand<sup>52</sup>; community health agents from Brazil<sup>48</sup>; cadres posbindu and community health centre staff from Indonesia<sup>49</sup>; barangay health workers from the Philippines<sup>53</sup>; female health workers from Pakistan<sup>54</sup>; and healthcare volunteers from Iran<sup>50</sup> and Thailand.<sup>47</sup> The number of trained health workers varied from 35<sup>52</sup> to 299<sup>54</sup> and were mostly women (75%–100%). The education of CHWs varied from primary school<sup>47 53</sup> to master degree holders.<sup>51 52</sup> In most studies, the health workers were part of the health system receiving a salary, except in Guatemala where a monthly incentive was provided,<sup>51</sup> and Iran and Thailand, where CHWs were volunteers from the community.<sup>47 50</sup> The training team included health professionals,<sup>51</sup> project officers<sup>54</sup> and researchers.<sup>48</sup> Four studies did not provide details

about the trainers.<sup>47 49 50 52</sup> Detailed characteristics of the CHWs and trainers are provided in table 1.

### Details regarding training methods

Studies used different approaches to develop the curriculum and disseminate knowledge. Training methods included interactive modes like problem-based learning, classroom discussions, demonstrations, media presentations, role plays, as well as self-training quizzes and assignments, which were either online<sup>52</sup> or paper based.<sup>51</sup> Training designs included the T5 instructional learning design (tasks, tutorials, tools, topics and teamwork), allowing interactive learning,<sup>55</sup> or adapting existing education and training materials available from high-income countries.<sup>51</sup> In one of the studies, CHWs were trained alongside nurses on hypertension, its treatment and its

**Table 1** Characteristics of community health workers and trainers

Study	Type of health workers (country of study)	CHWs (n)	CHWs		Education	Relation to health system	Trainers
			Sex	Age			
Abrahams Gessel <i>et al</i> <sup>51</sup>	Community health worker (Bangladesh, Guatemala, Mexico and South Africa)	64	84% females	Not reported	B: secondary to master's degree, G: secondary, M: secondary, SA: secondary	B: NGO employed G: NGO employed M: Government employed SA: NGO employed	Health professionals: physicians, nurses, and nutritionists
Da Silva <i>et al</i> <sup>48</sup>	Community health agents (Brazil)	37	90.9% females	50% of CHWs were up to 40 years	Secondary (67.3%)	Government employed	Researchers
Fatmah <sup>49</sup>	Cadres posbindu and community health centre staff (Indonesia)	45	100% females	Mean age 43.3	Primary (26.7%), secondary (46.7%), diploma (26.7%)	Government employed	Not reported
Ku and Kegels <sup>53</sup>	Barangay health worker (Philippines)	87	Not reported	Not reported	Primary (8%), secondary (42%), university (50%)	Government employed	Principal investigators and trained nurses
Nishtar <i>et al</i> <sup>54</sup>	Female health worker (Pakistan)	299	100% females	Not reported	Not reported	Government employed	Heartfile Officer (project officer)
Sangprasert <sup>47</sup>	Healthcare volunteer (Thailand)	75	75% females	Mean age 49.5	Primary (56.4%), secondary (30.1%), diploma (9.7%), university (3.8%)	Volunteers	Not reported
Seyed Emami <i>et al</i> <sup>50</sup>	Health volunteer (Iran)	80	100% females	Not reported	Primary (39.0%), secondary (48.1%), university (12.2%)	Volunteers	Not reported
Sranacharoenpong and Hanning <sup>52</sup>	Community healthcare worker (Thailand)	35	97% Females	25–34 years (17%), 35–44 years (63%), 45–54 years (20%)	Diploma (5.7%), university (88.6%), master's (5.7%)	Government employed	Not reported

B, Bangladesh; CHW, community health worker; G, Guatemala; M, Mexico; NGO, non-governmental organisation; SA, South Africa.



**Table 2** Training methods and duration for CVD and its risk factors management for community health workers in low-income and middle-income countries

Study	Training details	Duration of training programme	Methods of training (workshop, online)
Abrahams-Gessel <i>et al</i> <sup>51</sup>	Non-invasive screening of cardiovascular risk score	Hours of training not reported (2 weeks training over 4 months)	Lectures and interactive lessons On-site training for anthropometrical measurements BMI and CVD risk score calculation
Da Silva <i>et al</i> <sup>48</sup>	Hypertension knowledge and basic skills practices development	16.5 hours (11 sessions fortnightly over 6 months)	Lectures and practical sessions
Fatmah <sup>49</sup>	Obesity and hypertension knowledge BMI metric tool measurements	11 hours (2 days)	Lectures and interactive sessions On-site training for BMI metric tool measurements
Ku and Kegels <sup>53</sup>	Diabetes knowledge and basic skills practices development	32 hours	Lectures, two-way demonstrations and hands-on workshops
Nishtar <i>et al</i> <sup>54</sup>	Cardiovascular disease prevention	6 hours	Interactive training workshops
Sangprasert <sup>47</sup>	Hypertension knowledge and basic skills practices development	Not reported	Lectures and group discussions
Seyed Emami <i>et al</i> <sup>50</sup>	Health education about physical activity	2.5 hours (three weekly sessions)	Lectures and group discussions
Sranacharoenpong and Hanning <sup>52</sup>	Hypertension knowledge and basic skills practices development	40 hours (16 sessions, over 4 months)	Lectures, group discussion, problem-based learning, e-learning and online support Community-based application Assignments and self-evaluations

BMI, body mass index; CVD, cardiovascular disease.

burden through interactive classes.<sup>48</sup> The training varied, from 2.5 hours<sup>50</sup> up to 40 hours<sup>52</sup> over a 4–6 month period (table 2). Training took place at the local health units in four studies,<sup>48 50 52 54</sup> while the other three studies did not mention details about the training site. Training focused on CVD and its risk factors, healthy lifestyle and dietary habits and physical activity. Four of the studies<sup>47 51–53</sup> trained CHWs on anthropometrical measurement skills and their interpretation, and one study trained CHWs to use a body mass index metric tool for nutritional status assessment of the elderly.<sup>49</sup> None of the studies made their training materials publicly available. Please see table 3 for details about training content of each study.

### Impact of the training on knowledge and skills

All the studies assessed the knowledge<sup>47–54</sup> and five of them assessed knowledge and skills<sup>47 49 51–53</sup> before and after the training sessions. In addition, two studies evaluated the effect of training at 3–6 months<sup>51</sup> and 8 months after the intervention study.<sup>52</sup> Pretraining and post-training mean scores were reported by all studies as a measure of effectiveness of training. Of the eight studies included in the review, we could use scores from seven studies; the eighth study<sup>47</sup> could not be included in the figure as the measure of test scores was not described. All the studies

showed increase in the knowledge mean scores among CHWs pretraining and post-training ranging from 3%<sup>48</sup> to 40%,<sup>51</sup> with six of the studies reporting statistically significant difference between the base knowledge level and post-training knowledge level of the CHWs.<sup>47 49 50 52–54</sup> In the two studies (including five sites) that assessed the knowledge postintervention, the knowledge level of CHWs in Bangladesh did not change, the CHWs in Guatemala<sup>51</sup> showed an average increase of 11% and the scores of CHWs in Mexico, South Africa<sup>51</sup> and Thailand<sup>52</sup> decreased over time. Figure 2 provides details regarding the change of the test scores and reported statistical significance of the pretraining–post-training knowledge scores.

One study assessed the counselling skills of the participant CHWs at baseline, 1 month and 2 months post-training through field visits.<sup>49</sup> In addition, two projects used qualitative methods to assess the potential challenges and enablers of CHW training programmes, through observation, interviews and focus group discussions.<sup>51 56 57</sup>

CHWs preferred a minimum 2-week training programmes with interactive classes. Since this was the first time many CHWs were offered training in such a setting, it wasn't clear to them what to expect from the training session or workshops. Language barrier was

**Table 3** Training content for CVD and its risk factors management for community health workers in low-income and middle-income countries

	Knowledge	Skills
Abrahams-Gessel <i>et al</i> <sup>51</sup>	Cardiovascular disease and its risk factors	Blood pressure measurement Weight and height measurements and BMI calculation Obtaining a 5-year CVD risk score using a 'Risk Scoring Chart'
Da Silva <i>et al</i> <sup>48</sup>	Hypertension and its treatment Epidemiological data regarding hypertension to clarify its problem Healthy lifestyle promotion Treatment adherence and its importance	N/A
Fatmah <sup>49</sup>	Obesity risk factors and consequences Balanced nutrition and salt restriction Physical activity for the elderly Hypertension and its risk factors	BMI meter tool measurements for nutritional status assessment
Ku and Kegels <sup>53</sup>	Diabetes diagnosis and management Foot care Diabetic diet and dietary counselling Physical activity	Anthropometrical measurements (weight, height, waist and hip circumference), BMI and waist:hip ratio calculation and their interpretation Blood pressure and blood glucose measurement Psychosocial skill development (active listening, patient and family empowerment and social mobilisation)
Nishtar <i>et al</i> <sup>54</sup>	Blood pressure measurement importance and desired frequency Healthy life style and its role in preventing CVD and its complications	N/A
Sangprasert <sup>47</sup>	Health promotion and health education practices Healthy dietary habits Physical activity Relaxation skills	Blood pressure measurement Weight, height and waist and hip circumference measurements BMI calculation and its interpretation
Seyed Emami <i>et al</i> <sup>50</sup>	Food and nutrition Healthy eating and physical activity Current challenges for physical activity Overcoming barriers for a healthy lifestyle adoption	N/A
Sranacharoenpong and Hanning <sup>52</sup>	Healthy dietary habits and providing proper dietary recommendations Physical activity and motivating at-risk population	Weight, height and waist circumference measurements and their interpretation

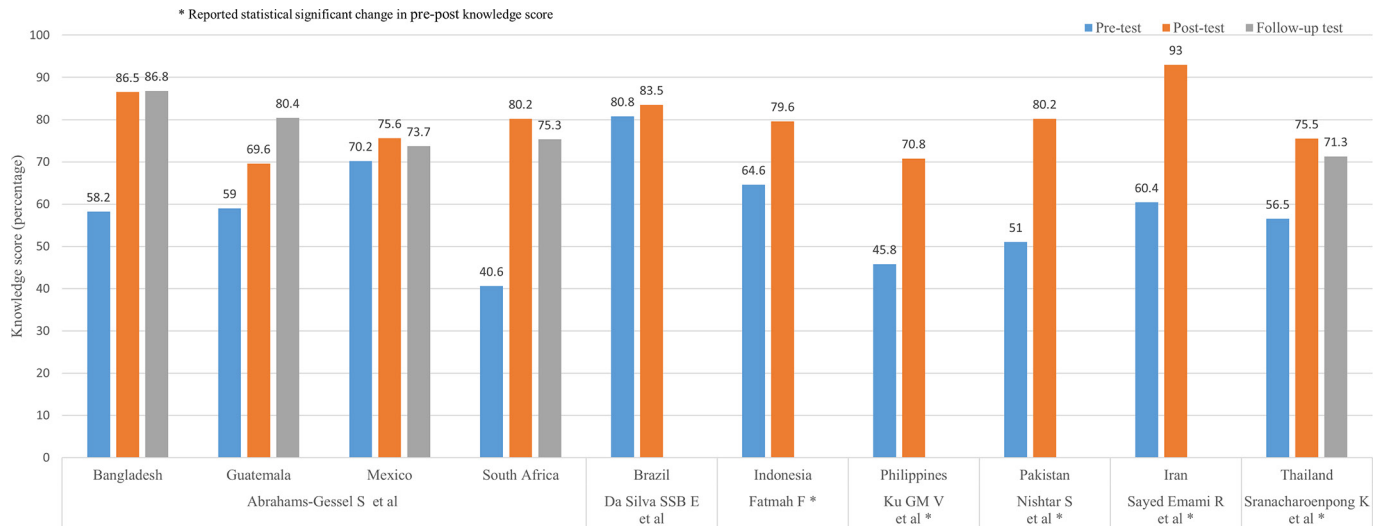
BMI, body mass index; CVD, cardiovascular disease.

another challenge; as the training manual was written in the local language, while the medium of instruction was in English, this made it difficult for the CHWs to link the manual with the verbal instructions provided. Barriers experienced while working in the field included gender issues such as taking anthropometrical measurements of the opposite sex, lack of trust among community to share their health concerns with CHWs, safety and other cultural issues.<sup>51 58 59</sup> In addition, heavy workload, underestimation of the time required to carry out the work and low remuneration provided were other barriers raised by CHWs. In terms of frequency of access to learning materials and satisfaction with the training programme (including length, methods and usefulness of the programme, computer skills and using electronic and paper-based materials), CHWs seemed satisfied with the content of training programme and the assignments.

However, about 46% did not feel that computer skills were easy to learn.

### Study quality

One out of the eight studies was a randomised controlled trial,<sup>52</sup> while the others were preobservational and postobservational studies. The CHW retention rates varied across the studies from 77%<sup>51</sup> to 88%<sup>53</sup> with two studies retaining 100% of CHWs<sup>48 52</sup> and one study not reporting CHW turnover during the study period.<sup>47</sup> Detailed information about CHWs,<sup>54</sup> trainers,<sup>47 52</sup> development of the training programme<sup>48 54</sup> and process of knowledge evaluation<sup>54</sup> was not reported in some studies. The quality of all included studies was assessed using EPHPP's Quality Assessment Tool.<sup>46</sup> Evaluated across six quality domains, each study was assessed with the potential of an overall rating of weak, moderate or strong. The quality of two



**Figure 2** Change in knowledge scores among community health workers.

studies was rated moderate.<sup>50 52</sup> The others were rated weak. Please see [table 4](#) for details of the quality assessment for each of the six quality domains.

## DISCUSSION

In this review, we assessed the effectiveness of training CHWs for the prevention and management of CVD and its risk factors. We reviewed eight studies, which focused on CVD, hypertension, diabetes or physical activity. The limited evidence available from this review demonstrates that CHWs with low levels of formal education can be trained effectively for CVD and risk factor prevention and management. The results of this review need to be assessed in light of the study quality, which was rated as weak to moderate using the EPHPP's tool. The knowledge and skill set of CHWs improved in the immediate post-training period for all studies and varied in performance in the 6–8 months after the initiation of the intervention. The limited qualitative data from two studies<sup>51 56 57</sup> indicate that interactive training, hands-on workshops and case scenarios were preferred over traditional didactic training. Training sessions adapted to local culture and delivered in the local language were found to be easier for the CHWs to understand and retain. Since measurement of cardiovascular risk factors involves taking blood pressure, height, weight and waist measurements in both men and women, understanding the cultural norms was an essential component to deliver the training to CHWs who were women in most studies.

Regardless of the baseline knowledge scores of the trained CHWs, most of the post-training knowledge scores ranged between 70% and 80%. The two studies<sup>51 52</sup> that measured knowledge at 6–8 months post-training showed that the majority of CHWs had a small decline in their scores, demonstrating their retention of knowledge to certain degree over a period of 6–8 months. Further research is needed to assess the ideal interval for retraining to ensure long-term improvement in knowledge and

consequent improvement in health outcomes for the community. A review of CHW training for maternal and child health-related conditions<sup>60</sup> and mental health<sup>61</sup> found that, without retraining, acquired skills and knowledge are lost over time. Different time intervals of refresher training were found to be effective to retain the capability and performance of CHWs. Various studies conducted in different countries had diverse experiences using monthly, quarterly and yearly refresher trainings to help CHWs maintain consistent performance.<sup>60</sup> While training is an important determinant of performance, other factors related to training include recognition of competence in skills to perform related tasks. Hence, contemporary CHW training programmes now include competency-based training rather than the traditional knowledge-based training. Recent reviews on task shifting from physicians to non-physicians for management of CVD and other NCDs in LMICs have found that training, close supervision and feedback are essential for the success of task-shifting interventions.<sup>25 62</sup> Training of CHWs occurs through formal schooling, in-service training and on-the-job experience, and these, coupled with the working environment, supervision, motivation, career progression and incentives, determine the long-term effectiveness and performance of CHWs,<sup>63</sup> which ultimately impacts the health of individuals in the community.

While the focus of this paper was knowledge change, results from some of these studies have demonstrated the effectiveness of CHW training on health outcomes. For instance, trained CHWs in Bangladesh, Guatemala, Mexico and South Africa could correctly identify individuals at high risk of CVD,<sup>51</sup> and CHW screening had high concordance with health professionals. In Indonesia, the posbindu health workers were successful in motivating the elderly to actively engage with the healthcare providers and have better access to healthcare.<sup>49</sup> In the Philippines, barangay health workers trained in diabetes care

Table 4 Assessment of the quality of included studies using the Effective Public Health Practice Project's tool<sup>46</sup>

Study	Selection bias*	Study design†	Confounders‡	Blindings§	Data collection methods¶	Withdrawals and dropouts**	Overall rating
Abrahams-Gessel <i>et al.</i> <sup>61</sup>	Weak	Moderate	Weak	Weak	Moderate	Weak	Weak
Da Silva <i>et al.</i> <sup>48</sup>	Moderate	Moderate	Moderate	Weak	Weak	Moderate	Weak
Fatmah <sup>49</sup>	Moderate	Weak	Weak	Weak	Moderate	Weak	Weak
Ku and Kegels <sup>53</sup>	Weak	Moderate	Not reported (weak)	Weak	Weak	Strong	Weak
Nishtar <i>et al.</i> <sup>64</sup>	Weak	Moderate	Not reported (weak)	Weak	Weak	Weak	Weak
Sangprasert <sup>47</sup>	Moderate	Moderate	Moderate	Weak	Moderate	Weak	Weak
Seyed Emami <i>et al.</i> <sup>50</sup>	Strong	Weak	Strong	Weak	Strong	Moderate	Moderate
Sranachoenpong and Hanning <sup>52</sup>	Strong	Strong	Moderate	Weak	Strong	Strong	Moderate

\*Likelihood of the participants to be representing the target population.

†The likelihood of bias due to allocation process in the study design.

‡Effect of variables associated with the intervention and causally related to the outcome of interest.

§Likelihood of protection against reporting bias.

¶Reliability and validity of outcome measures.

\*\*Assessment of the description of numbers and reasons for withdrawals and dropouts.

were instrumental in improving glycaemic control among diabetics.<sup>53</sup> In Pakistan, trained CHWs were successful in educating communities in cardiovascular risk factors.<sup>54</sup>

Over the last 10 years, there have been several studies involving CHWs for the prevention and management of CVD risk factors via complex multifaceted interventions in LMICs.<sup>64–65</sup> While most studies that involve CHWs include a component of training, none of them report the content, length or effectiveness of training on CHWs. Studies from South Africa,<sup>66–67</sup> Pakistan,<sup>68</sup> India,<sup>69–71</sup> China,<sup>72</sup> Dominican Republic,<sup>73</sup> Guatemala,<sup>74</sup> Thailand,<sup>75</sup> Mexico<sup>76</sup> and the Mexican–USA border<sup>77</sup> have shown innovative ways of involving CHWs for the prevention and control of CVD and its risk factors. However, these studies did not measure the impact of training on CHW knowledge and skill set.

Testing knowledge and skills via pretraining and post-training tests does not necessarily reflect the trainee's competence and successful demonstration of behaviour change or change in capability. Standardised measures need to be considered for quality and efficacy assessment of CHW training programmes. Few standardised tools and methods for training evaluation and effectiveness assessment are available,<sup>78–81</sup> which focus on the short-term and long-term outcomes of the training. Kirkpatrick's Four-Level Training Evaluation Model<sup>81</sup> is one such method, which is based on evaluating the trainees' reaction to the training programme, improvement in knowledge, the degree to which they apply the knowledge and the long-term outcomes. Kaufman's 5 Levels of Evaluation<sup>80</sup> is another standard for evaluating the effectiveness of training, which evaluates the training design, materials and resources used and the final outcome on the whole community and the trainee. Using standardised methods of evaluation allows better comparison and interpretation of the data.

This review was not able to explain the difference in the knowledge gained by CHWs within and across knowledge and the variability of the training duration and contextual factors. For instance, the knowledge scores of the CHWs in South Africa, Guatemala and Bangladesh were higher than the scores of CHWs in Mexico, even though all four sites were part of the same trial with the same training protocol.<sup>51</sup> Hence, research is needed to understand the training needs of the CHWs and community requirements for the successful roll out of CHW-focused interventions on CVD prevention and control. Randomised controlled trials involving CHWs should provide details about the CHW characteristics, curriculum development, training provided and impact of the training, and these should ideally be costed. Mixed-methods studies would give a better understanding of the challenges involved with implementing training programmes for CHWs and provide evidence for best practice. Training design should consider the background education and prior training received, current roles of the CHWs and how the new skills should complement this role. Training should include demonstration, simulation and on-the-job supervision

to improve confidence of CHWs with their newly learnt skills. Communication skills training should focus on changing social norms and behaviours and encouraging the community to work on local fears and myths. CHW attitudes, expression of respect, responsibility and concern should be addressed in training design to assure development of appropriate relationship between the CHWs and the patients and rest of the community.<sup>82</sup> With the available mobile conferencing platforms, follow-up training can be provided to many trainees at a time, remotely as well. Training should be provided onsite where CHWs perform their roles, evidence suggest that onsite training tends to cost less and cause less disruption of the routine functioning of health services, compared with offsite training.<sup>83</sup> Better training programmes alone will not solve the problems related to opportunities for career growth and professional development via continuing education; the chance to move to the next level within the health system would help motivate CHWs to stay in the workforce.<sup>60</sup> Attention needs to be paid to CHW remuneration and career development as these are noted challenges affecting the retention of trained CHWs in the workforce. Governments should adopt innovative national planning and provide suitable financial and legal support to ensure the sustainability of implemented programmes.<sup>84–87</sup> Researchers should consider making the tool kits and resources for CVD management publicly available to other researchers and governments.

Even though our search included all the CHW terminologies used by WHO and recent reviews on CHWs,<sup>44</sup> we may have missed some studies. After expanding the search to include all languages and extending the time limit to the end of 2016, our search identified only eight studies. The insufficient reporting of study details such as CHWs' characteristics, training site and trainers' profiles led to limited understanding of the contextual factors that influenced the training. Most of the studies were not controlled trials, which made it difficult to investigate the effect of potential confounders. This review included CHWs who were part of the health system and those that volunteered their services. We acknowledge that there is a difference between health volunteers and CHWs,<sup>88</sup> but since the overall aim of the paper was to evaluate the effectiveness of training programmes, remuneration would have little impact on the change in knowledge and skill set. Despite these limitations, our review indicates that training CHWs about CVD and its risk factors is plausible in LMICs.

In conclusion, this review demonstrates that there is not much information about CHW training for CVD prevention and control in LMICs. While the results of the eight included studies suggest that CHWs can be trained effectively for CVD prevention and management, this finding would likely vary depending on context, given the numerous differences between studies (eg, populations, settings and programmes) and the weak quality of six of the eight studies. Well-conducted mixed-methods studies are needed to provide reliable evidence

about the effectiveness and cost-effectiveness of training programmes for CVD prevention and management.

**Contributors** BP drafted the protocol under the supervision of RJ. BP and MAA performed the search, extracted the data and contributed towards the interpretation of the results. MAA wrote the first draft. RJ conceived the research question, supervised the review and approved the final version of the manuscript. DP and SA provided critical input towards the manuscript. All the authors reviewed the final draft.

**Funding** This study was not funded by any agency

**Competing interests** None declared.

**Patient consent** Detail has been removed from this case description/these case descriptions to ensure anonymity. The editors and reviewers have seen the detailed information available and are satisfied that the information backs up the case the authors are making.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** All the data are included in the systematic review and the supplementary files. There are no extra data available.

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## Supplementary material S1

### Free text terms used in the databases on the OVID platform (Medline, Global Health, ERIC, Embase)

#### CHW Group (Population)

1. (Communit\* health\* adj3 (work\* or staff or employee\* or provider\* or distributor\* or surveyor\* or assistant\* or promoter\* or agent\*)).tw.
2. (Non-physician health\* adj3 (work\* or staff or employee\* or provider\*)).tw.
3. CHW.tw.
4. LHW.tw.
5. (Lay health\* adj3 (work\* or staff or employee\* or provider\*)).tw.
6. Volunteer health\* work\*.tw.
7. Voluntary health\* work\*.tw.
8. Promotoras de salud.tw.
9. (rural health adj3 (auxiliar\* or motivator\*)).tw.
10. Traditional midwi\*.tw.
11. TBA.tw.
12. Traditional birth attendant\*.tw.
13. Health\* promoter\*.tw.
14. Basic health\* work\*.tw.
15. Communit\* nutrition work\*.tw.
16. Communit\* resource person.tw.
17. (Female adj3 (multipurpose health\* work\* or volunteer\*)).tw.
18. (Maternal and child health\* work\*).tw.
19. Mother coordinator\*.tw.
20. Outreach educator\*.tw.
21. Paramedic\* work\*.tw.
22. (Village health\* adj3 (work\* or helper\* or guide\*)).tw.
23. Shasthyo Sebikas.tw
24. ASHA.tw

25. Female community health volunteer\*.tw

#### LMIC Group (Population)

1. LMIC.mp
2. ((Low or middle) adj income countr\*).mp
3. Developing countr\*.mp
4. South East Asia\*.tw
5. Southeast\* Asia\*.mp.
6. Sub-Saharan Africa\*.tw.
7. Sub-Saharan Africa\*.mp.
8. Afghan\*.mp.
9. Benin\*.mp.
10. Burkina\*.mp.
11. Burundi\*.mp.
12. Cambodia\*.mp.
13. Central African Republic\*.mp.
14. Chad\*.mp.
15. Comor\*.mp.
16. Congo\*.mp.
17. Eritrea\*.mp.app
18. Ethiopia\*.mp.
19. Gambia\*.mp.
20. Guinea\*.mp.
21. Haiti\*.mp.
22. North Korea\*.mp.
23. Liberia\*.mp.
24. Madagas\*.mp.
25. Malawi\*.mp.
26. Mali\*.mp.
27. Mozambi\*.mp.
28. Nepal\*.mp.



29. Niger\*.mp.
30. Rwanda\*.mp.
31. Sierra Leone\*.mp.
32. Somalia\*.mp.
33. South Sudan\*.mp.
34. Tanzania\*.mp.
35. Togo\*.mp.
36. Uganda\*.mp.
37. Zimbabwe\*.mp.
38. Armenia\*.mp.
39. Bangladesh\*.mp.
40. Bhutan\*.mp.
41. Bolivia\*.mp.
42. Cape Verd\*.mp.
43. Cameroon\*.mp.
44. Cote d'Ivoire.mp.
45. Ivorian.mp.
46. Djibouti\*.mp.
47. Egypt\*.mp.
48. Salvador\*.mp.
49. Georgia\*.mp.
50. Ghana\*.mp.
51. Guatemala\*.mp.
52. Guyan\*.mp.
53. Hondura\*.mp.
54. India\*.mp.
55. Indonesia\*.mp.
56. Kenya\*.mp.
57. Kiribati\*.mp.
58. Kosov\*.mp.
59. Kyrgyz\*.mp.
60. Lao\*.mp.
61. Lesotho\*.mp.
62. Mauritania\*.mp.
63. Micronesia\*.mp.
64. Moldova\*.mp.
65. Morocc\*.mp.
66. Myanmar\*.mp.
67. Burm\*.mp.
68. Nigeria\*.mp.
69. Pakistan\*.mp.
70. Nicaragua\*.mp.
71. Papua New Guinea\*.mp.
72. Philippin\*.mp.
73. Filipino.mp.
74. Samoa\*.mp.
75. Sao Tome\*.mp.
76. Senegal\*.mp.
77. Solomon\*.mp.
78. Sri Lanka\*.mp.
79. Sudan\*.mp.
80. Swazi\*.mp.
81. Syria\*.mp.
82. Tajik\*.mp.
83. Timor\*.mp.
84. Ukrain\*.mp.
85. Uzbek\*.mp.
86. Vanuatu\*.mp.
87. Vietnam\*.mp.
88. West bank.mp.
89. Gaza\*.mp.
90. Yemen\*.mp.
91. Zambia\*.mp.
92. Albania\*.mp.
93. Algeria\*.mp.
94. Angola\*.mp.
95. Azerbaijan\*.mp.
96. Belarus\*.mp.
97. Belize\*.mp.
98. Bosnia\*.mp.
99. Herzegovin\*.mp.
100. Botswana.mp.
101. Batswana.mp.
102. Brazil\*.mp.

103. Bulgaria\*.mp.
104. Chin\*.mp.
105. Colombia\*.mp.
106. Costa Rica\*.mp.
107. Cuba\*.mp.
108. Dominica\*.mp.
109. Ecuador\*.mp.
110. Fiji\*.mp.
111. Gabon\*.mp.
112. Grenad\*.mp.
113. Iran\*.mp.
114. Iraq\*.mp.
115. Jamaica\*.mp.
116. Jordan\*.mp.
117. Kazakh\*.mp.
118. Leban\*.mp.
119. Libya\*.mp.
120. Macedonia\*.mp.
121. Malaysia\*.mp.
122. Maldiv\*.mp.
123. Marshall Island\*.mp.
124. Mauriti\*.mp.
125. Mexic\*.mp.
126. Mongolia\*.mp.
127. Montenegr\*.mp.
128. Namibia\*.mp.
129. Palau\*.mp.
130. Panama\*.mp.
131. Paraguay\*.mp.
132. Peru\*.mp.
133. Romania\*.mp.
134. Serbia\*.mp.
135. South Africa\*.mp.
136. St Lucia\*.mp.
137. (St Vincent and the Grenadines).mp.
138. Vincentian.mp.
139. Suriname\*.mp.

140. Thai\*.mp.
141. Tonga\*.mp.
142. Tunisia\*.mp.
143. Turk\*.mp.
144. Tuvalu\*.mp.

#### **NCD/CVD Group (Intervention)**

1. Diabet\*.tw.
2. Obes\*.tw.
3. Overweight.tw.
4. Cardiovascular Disease\*.tw.
5. Hypertens\*.tw.
6. Non-communicable Disease\*.tw.
7. Chronic Disease\*.tw.
8. NCD.tw.
9. CVD.tw.
10. Coronary Heart Disease\*.tw.
11. Cerebrovascular disease\*.tw.
12. Peripheral arter\* disease\*.tw.
13. Rheumatic Heart disease\*.tw.
14. Congenital heart disease\*.tw.
15. Deep vein thrombosis.tw.
16. Deep venous thrombosis.tw.
17. Pulmonary embol\*.tw.
18. Unhealthy diet.tw.
19. Physical inactivity.tw.
20. Sedentary lifestyle\*.tw.
21. Tobacco.tw.
22. Alcohol.tw.
23. Hypercholesterol?emia.tw.
24. Hyperlipid?emia.tw.

#### **Training Programs Group (Intervention)**

1. ((education\* or train\*) adj2 program\*).tw.

Medical Subject Headings (MeSH) terms used for each database:

### Medline

#### **CHW Group (Population)**

26. Community health workers/
27. Home health aides/
28. Community health services/

#### **LMIC Group (Population)**

145. Developing Countries/
146. Asia, Southeastern/
147. exp "Africa South of the Sahara"/
148. "Democratic People's Republic of Korea"/
149. exp Micronesia/

#### **NCD/CVD Group (Intervention)**

25. Chronic Disease/
26. Diabetes Mellitus/
27. exp Diabetes Mellitus, Type 2/
28. exp Obesity/
29. Overweight/
30. Cardiovascular Diseases/
31. exp Heart Diseases/
32. exp Vascular Diseases/
33. Diet, High-Fat/
34. Diet, Western/
35. Diet/
36. exp "Tobacco Use"/
37. exp "Tobacco Use Cessation"/
38. exp lipoproteins, ldl/
39. exp lipoproteins, vldl/
40. Cholesterol, Dietary/
41. Hypercholesterolemia/
42. Hyperlipidemias/
43. exp Obesity/

44. Overweight/
45. Prediabetic state/
46. Sedentary Lifestyle/
47. exp Drinking Behavior/
48. exp Cerebrovascular Disorders/
49. Rheumatic Heart Disease/
50. exp Heart Defects, Congenital/

#### **Training Programs Group (Intervention)**

2. "early intervention (education)"/
3. health education/
4. Education/
5. Education, Nonprofessional/
6. Program Evaluation/

### Global Health

#### **CHW Group (Population)**

26. community health services/
27. medical auxiliaries/
28. health care workers/
29. traditional health services/"C
30. traditional birth attendants/

#### **LMIC Group (Population)**

145. developing countries/
146. south east asia/
147. exp indochina/
148. taiwan/
149. "africa south of sahara"/
150. korea democratic people's republic/
151. sudan/
152. exp micronesia/
153. exp "federated states of micronesia"/
154. least developed countries/

### **NCD/CVD Group (Intervention)**

25. chronic diseases/
26. exp diabetes/
27. type 2 diabetes/
28. obesity/
29. obesity hyperglycaemia syndrome/
30. overweight/
31. exp cardiovascular diseases/
32. exp hypertension/
33. thrombosis/
34. exp heart diseases/
35. exp vascular diseases/
36. diet/
37. physical activity/
38. exp tobacco/
39. tobacco smoking/
40. exp smoking cessation/
41. alcohol intake/
42. hyperlipaemia/
43. hypercholesterolaemia/
44. cholesterol/

### **Training Programs Group (Intervention)**

2. education/
3. program development/
4. Program effectiveness/
5. Program evaluation/
6. education programmes/
7. health education/
8. medical education/
9. professional education/
10. training/
11. training courses/
12. training officers/

ERIC

### **CHW Group (Population)**

26. community health services/
27. home health aides/
28. home programs/
29. exp Paraprofessional Personnel/
30. Lay people/

### **LMIC Group (Population)**

145. developing nations/

### **NCD/CVD Group (Intervention)**

25. chronic illness/
26. diabetes/
27. exp body weight/
28. hypertension/
29. exp Physical Activity Level/
30. physical fitness/
31. exp smoking/
32. exp alcohol abuse/
33. eating habits/

### **Training Programs Group (Intervention)**

2. caregiver training/
3. volunteer training/
4. health education/
5. nonformal education/
6. exp job training/
7. professional training/
8. "Institutes (Training Programs)"/
9. Professional development/
10. Professional education/
11. teaching methods/
12. health promotion/
13. exp formative evaluation/
14. program development/
15. program improvement/
16. summative evaluation/

17. Program Evaluation/
18. program effectiveness/
19. Duplication/
20. Programs/
21. Program validation/
22. Outcome measures/
23. "Outcomes of education"/
24. Pretests posttests/
25. Educational assessment/
26. Educational quality/
27. "replication (evaluation)"/
28. program guides/
29. program implementation/
30. program design/
31. Programmed Instructional Materials/
32. exp Instructional Materials/
33. material development/
34. Instructional Material evaluation/
35. exp training methods/
36. training/
37. trainers/

#### Embase

#### **CHW Group (Population)**

26. exp Health Auxiliary/
27. Health educator/
28. Diabetes educator/
29. exp Health care manpower/
30. Health care personnel
31. exp Traditional birth attendant/

#### **LMIC Group (Population)**

145. exp Lowest income group/
146. exp Developing country/
147. exp Africa South of the Sahara/
148. exp Southeast Asia

#### **NCD/CVD Group (Intervention)**

25. exp Cardiovascular disease/
26. exp Non communicable disease/
27. exp Chronic disease/
28. exp Diabetes Mellitus/
29. exp Hypertension/
30. exp Obesity/
31. exp hyperglycemia/
32. Weight gain/
33. Diet/
34. Western Diet/
35. exp Hyperlipidemia/
36. Alcohol consumption/
37. "tobacco use"/
38. tobacco dependence/
39. physical inactivity

#### **Training Programs Group (Intervention)**

2. exp Health program/
3. exp Education/
4. exp Accreditation/
5. exp Health education/
6. exp Medical education/
7. exp Teaching/
8. exp Staff training/
9. exp Training/
10. exp Program evaluation/

#### CINAHL

#### **CHW Group (Population)**

26. Community Health Worker
27. Lay Midwives
28. Community Health Services

**LMIC Group (Population)**

145. Developing Countries
146. Africa South of the Sahara
147. Asia, Southeastern

**NCD/CVD Group (Intervention)**

25. Alcohol Drinking+
26. Cardiovascular Diseases+
27. Cardiovascular Risk Factors
28. Cerebrovascular Disorders+
29. Chronic Disease
30. Diabetes Mellitus
31. Diabetes Mellitus, Type 2
32. Diet
33. Diet, Western
34. Hyperlipidemia+
35. Life Style, Sedentary
36. Lipoproteins, LDL+
37. Obesity+
38. Prediabetic State+
39. Smoking Cessation Programs
40. Tobacco Products+

**Training Programs Group (Intervention)**

2. Education+
3. Program Development+
4. Quality Assessment+
5. Professional Development


## **Chapter Three manuscript**

RESEARCH ARTICLE

Open Access



# Evaluation of a training program of hypertension for accredited social health activists (ASHA) in rural India

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## Abstract

**Background:** Hypertension is a major risk factor for cardiovascular disease, a leading cause of premature death and disability in India. Since access to health services is poor in rural India and Accredited Social Health Activists (ASHAs) are available throughout India for maternal and child health, a potential solution for improving hypertension control is by utilising this available workforce. We aimed to develop and implement a training package for ASHAs to identify and control hypertension in the community, and evaluate the effectiveness of the training program using the Kirkpatrick Evaluation Model.

**Methods:** The training program was part of a cluster randomised feasibility trial of a 3-month intervention to improve hypertension outcomes in South India. Training materials incorporated details on managing hypertension, goal setting, facilitating group meetings, and how to measure blood pressure and weight. The 15 ASHAs attended a five-day training workshop that was delivered using interactive instructional strategies. ASHAs then led community-based education support groups for 3 months. Training was evaluated using Kirkpatrick's evaluation model for measuring reactions, learning, behaviour and results using tests on knowledge at baseline, post-training and post-intervention, observation of performance during meetings and post-intervention interviews.

**Results:** The ASHAs' knowledge of hypertension improved from a mean score of 64% at baseline to 76% post-training and 84% after the 3-month intervention. Research officers, who observed the community meetings, reported that ASHAs delivered the self-management content effectively without additional assistance. The ASHAs reported that the training materials were easy to understand and useful in educating community members.

**Conclusion:** ASHAs can be trained to lead community-based group educational discussions and support individuals for the management of high blood pressure.

**Trial Registration:** The feasibility trial is registered with the Clinical Trials Registry - India (CTRI) [CTRI/2016/02/006678](https://www.clinicaltrials.gov/ct2/show/study?term=CTRI/2016/02/006678) (25/02/2016).

**Keywords:** ASHA, Training evaluation, India, Hypertension, Kirkpatrick evaluation model

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## Background

Cardiovascular disease (CVD) is the leading cause of premature death and disability in India, predicted to reach up to 2.6 million deaths by 2020 [1]. Hypertension, a major risk factor for CVD, is responsible for 57% of all deaths from stroke and 24% of all deaths from coronary heart disease in India [2]. About 33% of urban and 25% of rural Indians have hypertension but less than a third are aware of their status and have their blood pressure under control [3]. Populations residing in rural regions of India face several challenges in accessing care for CVD. These include poor knowledge of risk factors, lack of physicians and nurses, and unavailability of affordable medicines [4]. Prevention and control of hypertension can be enhanced at the individual level by improving knowledge of hypertension and risk factors, adoption of a healthy lifestyle, and adherence to medications [5, 6]. At the health system level, hypertension can be controlled by having adequate number of healthcare providers, provision of evidence-based management guidelines or decision support tools, improving the availability of medicines and access to health centres. When physicians and nurses are in short supply, tasks such as screening, education, referral and follow-up of individuals in the community can be shifted to non-physicians [7] such as community health workers (CHWs) [8, 9]. CHWs enhance coverage of essential healthcare services to the community [10], are cost-effective and are usually well accepted by the communities [11]. The Indian government launched the National Rural Health Mission (NRHM) in 2005 and created a new cadre of non-physicians called Accredited Social Health Workers (ASHAs) [12]. ASHAs are India's CHWs who act as an interface between the community and the public health system to improve access to health services, help raise community awareness about health and its social determinants and support the primary healthcare system in facilitating care specifically for maternal and child health [13]. They are female residents of the villages [14] who are paid a fee-for service for certain primary health care activities [15]. Previous evaluation studies of ASHAs have mostly focused on maternal and child care [16, 17]. Since the inauguration of the National Program for the Prevention and Control of Cardiovascular Diseases, Diabetes, Cancer and Stroke (NPCDCS) in 2010, ASHAs from 100 pilot districts across 21 States have been trained by the public health system to prevent and manage chronic diseases like hypertension, diabetes and their risk factors. The current study of control of hypertension in rural India was conducted at three sites, one of which was a pilot NPCDCS site. The objectives were to (i) develop training materials for an intervention to improve identification and control of hypertension, (ii) document the processes of training ASHAs, and (iii) evaluate the effectiveness of the training program in terms of the knowledge, skills and perception of ASHAs using the Kirkpatrick Evaluation Model [18].

## Methods

### Area settings and recruitment

This study was part of a trial aimed at improving self-management and control of hypertension in rural India (CHIRI) [19]. The main study was conducted to investigate whether populations at various stages of economic transition, with different levels of knowledge and awareness of hypertension, and with differing barriers to diagnosis and treatment of hypertension, could have their hypertension managed using a community-based education program. The late transition populations are characterized by rapid urbanization and a sedentary lifestyle. They will have higher prevalence of cardiovascular disease and its risk factors like hypertension and diabetes [20]. They also have relatively better access to health services and greater health awareness. On the contrary, early transition populations are economically disadvantaged with poor access to health services and have a lower socio-economic status. The study was conducted in three regions in South India, Trivandrum-Kerala (late transition), West Godavari-Andhra Pradesh (medium transition) and Rishi Valley-Andhra Pradesh (early transition) [19]. The outcome of the feasibility trial will be reported in due course.

During the first phase of the study, a cross-sectional survey was conducted amongst local community members to determine the knowledge, awareness, treatment and control of hypertension in these regions. This was supplemented by an audit of the health system and a qualitative study to understand the major barriers in the management of hypertension [19]. Based on the information gathered during this first phase, a community-based group intervention was developed and its feasibility was tested at the three sites. The intervention study comprised group-based education and support for self-management of blood pressure in individuals with hypertension. Individuals with hypertension could also invite their family members to attend, if they wished. At the community level, the intervention was led by ASHAs.

### Curriculum development and training

Content of the training materials (please see Additional file 1: Table S1) was created by the research team based on available literature, experience from relevant projects such as the Australasian Peers for Progress Diabetes Project, Kerala Diabetes Prevention Program (K-DPP) [21], the Andhra Pradesh Rural Health Initiative [22], and the available ASHA Training Modules [23]. Training materials were translated into the local languages (Telugu and Malayalam versions will be provided online) and a team of local research staff and clinicians reviewed the training materials to ensure it was culturally adapted to the local context. Content validity of the training materials was assessed by piloting it with four ASHAs from a non-study village that led to further modification and refinement of the resources.

Training was designed to provide ASHAs with knowledge regarding hypertension and its risk factors, strategies to manage hypertension via knowledge about healthy lifestyle and adherence to medications, and skills in facilitation of group meetings. ASHAs were also taught to deliver community group-based education, and provide support for individuals with hypertension.

Based on previous experience and available literature, five main themes were addressed during the training sessions. These included:

1. Hypertension, its risk factors, complications, management and clinical targets.
2. Healthy lifestyles and how to support the community to adopt a healthier lifestyle.
3. Goal-setting strategies and how to assist group members to set and achieve simple specific, measurable, achievable, realistic/relevant and time bound (SMART) goals to improve health outcomes.
4. Skills needed for taking clinical and anthropometric measures such as weight and blood pressure.
5. Group facilitation skills to conduct group meetings and skills in recording meeting progress, attendance, participant measurements and problems or issues faced by participants.

The ASHAs residing in the villages randomised to the intervention, received training in 15 sessions over 5 days (Table 1). Training was provided by members of the research team. The instructional strategies used to deliver the training content included lectures, interactive and problem-based learning such as group discussions, role-play and case studies. Training was delivered using electronic slide presentations and flip charts. The flipcharts for participants are pictorially based, and there is one for each of the six meetings. ASHAs flipcharts have the same pictures as for participants, but every second sheet (on the back of the flipchart) includes text that the ASHA could use to educate participants (Figshare: <https://figshare.com/s/7bbfcc22e0c9c91a5ca0>). Video feedback was also used to demonstrate correct, and incorrect, measurement techniques. The classroom based training sessions took place close to the community at each of the three sites. ASHAs were compensated for the time they spent during the training, including travel expenses.

Following the training, the intervention (community-based education support groups) was implemented among community members who were identified as having hypertension during the baseline survey [19]. The main tasks for the ASHA in the intervention group was to encourage community members to attend, and lead the community meetings. For the research study, the project manager at each site supervised ASHAs and a research fellow observed meetings. Community meetings were held every 2 weeks

over a three- month period by ASHAs who were paid an incentive to facilitate the meetings, on par with the Government of India standards. ASHAs measured blood pressure and weight of the attendees at the start of each session; led group-based learning about hypertension and its management; and assisted in promoting adoption of healthier lifestyles and setting SMART goals. All the ASHAs invited to participate in the study agreed and gave written informed consent in the local language; there was no penalty for refusal to participate.

Approval for the overall study was obtained from The Centre for Chronic Disease Control, India; Christian Medical College, Vellore, India; Sree Chitra Tirunal Institute for Medical Sciences and Technology, India; Health Ministry Screening Council, Ministry of Health and Family Welfare, India; Rishi Valley Ethics Committee, Rishi Valley School, Madanapalle, India; Monash University, Australia and Indian Council of Medical Research, Delhi, India.

#### Evaluation

There were four components to the evaluation of the training program (please see Additional file 1: Table S2),

1. A knowledge and skills test was developed to assess the ASHAs level of knowledge and skills at baseline and after training (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>). The test consisted of multiple choice and true/false type questions about hypertension, its risk factors, complications and healthy lifestyle and were based on previous research conducted by the team and existing literature [24, 25]. ASHAs at Rishi Valley and West Godavari had the same pre- and post-training test, while ASHAs at the Trivandrum site used a modified version of the test (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>). The modification was required, as ASHAs from Trivandrum had received initial training for NCDs from the public health system.
2. A research officer from the study, who participated in the baseline survey, attended the meetings and assessed the performance of ASHAs using a monitoring and evaluation reporting sheets. The monitoring sheet comprised of a checklist of the tasks delivered, use of resources, time management and problem solving skills that ASHAs were trained for earlier. The evaluation forms are available online (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>).
3. In addition to the written assessment, ASHAs were interviewed for 40–45 min in the local language to understand the major enablers and barriers in the implementation of the intervention. An external

**Table 1** Training agenda for ASHAs for the Control of Hypertension in Rural India Feasibility Study

Session	Title	Topics discussed
Day 1	Introduction	Roles and responsibilities of ASHA Aims of CHIRI project Expectations of research
	Pre-training test	Assessment of knowledge and skills
	Working with research group / research project	Expectation of data collection Need for consistency and accuracy
	Measurement training	Anthropometric measurement
	Prevention and control of Non-Communicable diseases (NCDs)	Modified from Ministry of Health and Family Welfare NCD ASHA training module number eight for prevention of NCDs [23]
Day 2	Measurement training	Measuring blood pressure and weight
	Goal setting	SMART Goals explanation and practice
	Hypertension knowledge	Community Meeting 1 Knowledge about high blood pressure, risk factors and complications
	Measurements	Measuring blood pressure and weight
Day 3	Review Goals & Problem-Solving	Review goals set previous day and problem solve if goals not achieved
	Self-care / management of hypertension	Community Meeting 2 Recommendations for self-management, medication adherence, diet, physical activity, tobacco alcohol Referral to clinical care, monitoring etc.
	Physical Activity	Community Meeting 3 Physical activity, recommended quantity, intensity and some practical and easy activities to practice
	Measurements	Measuring blood pressure and weight
	Goal Setting	Set another goal and complete action plan
Day 4	Review Goals & Problem Solving	Review goals set previous day and problem solve if goals not achieved
	Diet / Tobacco and Alcohol	Community Meeting 4 Dietary approaches to prevent hypertension, tobacco control and alcohol cessation recommendations
	Practical self-management	Community Meeting 5 Practical advice and support for self-management
	Measurements	Measuring blood pressure and weight
	Goal Setting	Goal setting and action plan
Day 5	Review Goals & Problem Solving	Review goals set previous day and problem solve if goals not achieved
	Putting it all together	Community Meeting 6 Review key messages from the program
	Preparation	Preparing for monthly meetings Dealing with informational needs Expectation of the group
	Measurements	Measuring blood pressure and weight
	Review Goals & Problem Solving	Review goals set previous day and problem solve if goals not achieved
	Conclusion and final wrap up Post-training test	Practicalities, (payment, who to contact, etc.), logistics Assessment of knowledge and skills

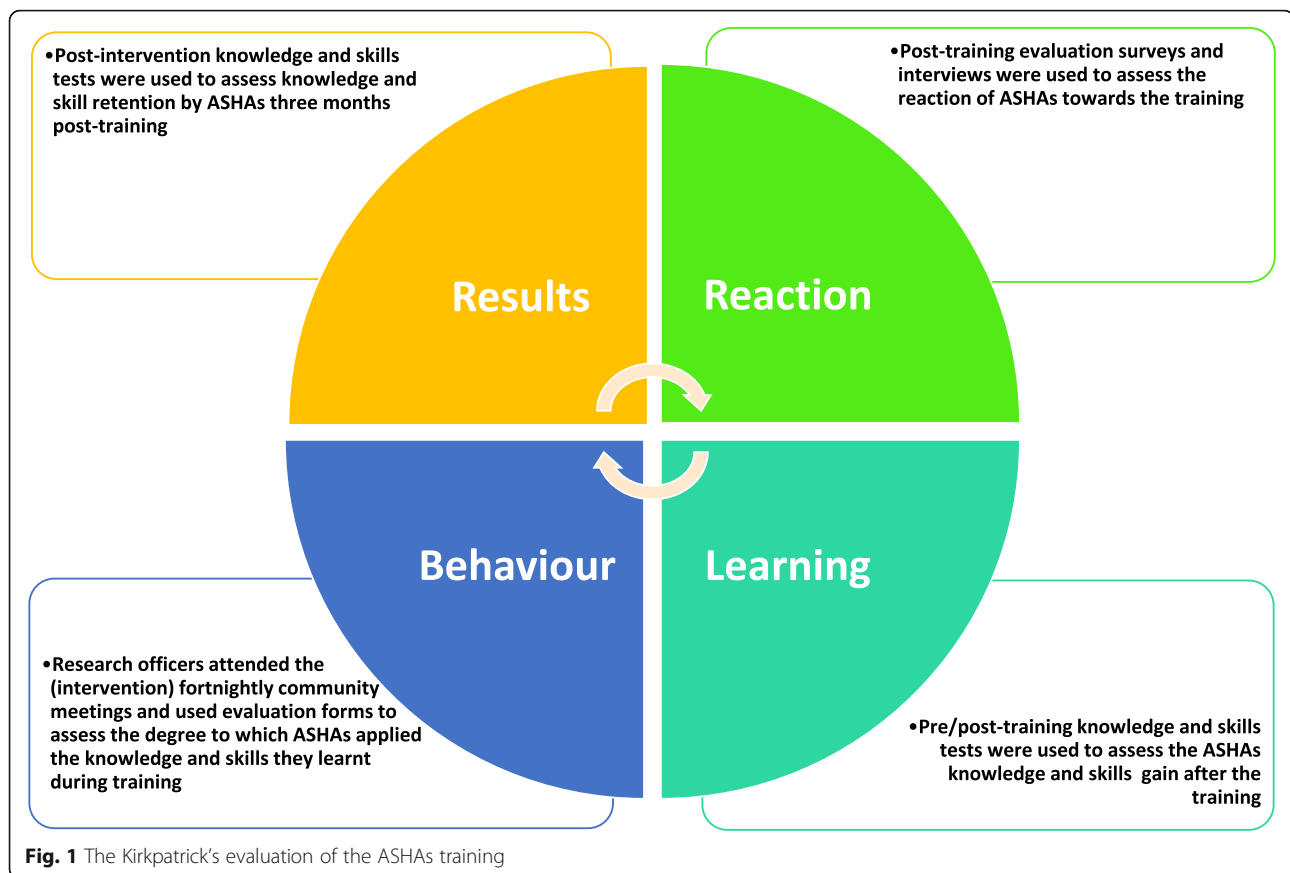
consultant, not involved in the training or the intervention implementation in all the sites, interviewed ASHAs. The interviewers used an interview guide to explore the perspectives of ASHAs about the training received. All the interviews were recorded, translated and transcribed into English. The interview guide is available online (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>).

- ASHAs were re-assessed for their knowledge and skills post-intervention using the same questionnaire

at all three sites. (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>).

The effectiveness of training was based on Kirkpatrick's four level evaluation model (Fig. 1) [18]:

- Learning: knowledge and skills achieved by trainees during training was assessed using the pre- (day 1) and post-training (day 5) tests;
- Result: the long-term outcomes of the training, i.e. the degree to which ASHAs could retain the



knowledge and skills gained during training and apply it to the community, was evaluated using the post-intervention tests;

- Behaviour: the degree to which trainees applied the gained knowledge and skills during the intervention was assessed using forms, completed by research officers during the community education meetings, designed to monitor and evaluate the competence and performance of ASHAs; and
- Reaction: trainee's perception and reactions toward the training was assessed in two ways. First, satisfaction of ASHAs with the training program was assessed at the end of training using evaluation forms that comprised both Likert-scale questions and open-ended questions. Secondly, at the end of the implementation period ASHAs were interviewed by external consultants about their experience of the training program and the implementation period. Training evaluation forms and interview guides are available online (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>)

#### Data analysis

Demographic characteristics of ASHAs were summarised using medians and ranges. Quantitative data on knowledge

and skills was assessed using two-tailed paired t-tests for comparing scores within groups (SPSS version 23 for Windows). Qualitative data were obtained from training evaluation forms and research officers' monitoring sheets. The forms comprised of structured and open-ended questions MA and RJ reviewed the evaluation forms and interview transcripts. The transcripts were manually coded and thematic analysis was conducted to determine ASHAs' perceptions of the training, their community experience, challenges faced during the intervention and recommendations for the future. MA and RJ met to note any discrepancies and agree on the final data coding and emerging themes.

#### Results

##### ASHA participation

Eleven of the 15 ASHAs from the CHIRI intervention sites were appointed by the panchayat (local government), while four were recruited for the purposes of the study, due to vacant positions in the villages. Seven of these ASHAs, were recruited from West Godavari, and four each in Rishi Valley and Trivandrum. All the ASHAs attended all the training sessions and participated in the intervention.

The majority of the ASHAs were married (87%) and had completed at least 10 years of education (67%; Table 2).

**Table 2** Demographics of ASHAs participating in the training program

	Rishi Valley	West Godavari	Trivandrum	Combined
Age (years)				
< 20	–	1 (13.0%)	–	1 (7.0%)
20–30	2 (50.0%)	2 (29.0%)	–	4 (27.0%)
30–40	2 (50.0%)	2 (29.0%)	2 (50.0%)	6 (40.0%)
> 40–50	–	2 (29.0%)	2 (50.0%)	4 (27.0%)
Median age	29	38	40	36
Education				
Class 10 and 11	4 (100%)	5 (71.0%)	1 (25%)	10(67.0%)
Class 12	–	2 (29.0%)	3 (75%)	5 (33.0%)
Knowledge of English				
Communicate well by reading and writing	1 (25.0%)	4 (56.5%)	3 (75.0%)	8 (53.0%)
Only read	2 (50.0%)	2 (29.0%)	–	4 (27.0%)
Do not communicate in English	1 (25.0%)	1 (14.5%)	1 (25.0%)	3 (20.0%)
Median age starting work as an ASHA (years)	21.5	21	31.5	23
Proportion of ASHAs having other paid duties*	1 (25.0%)	3 (43.0%)	–	4 (27.0%)
ASHA work experience (years)				
≤ 2	2 (50.0%)	2 (29.0%)	–	4 (27.0%)
3–6	1 (25.0%)	1 (14.5%)	–	2 (13.0%)
> 6	1 (25.0%)	4 (56.5%)	4 (100%)	9 (60.0%)
Mean work experience	7	12	7	9.5
ASHA usual working hours*				
< 2	2 (50.0%)	2 (29.0%)	–	4 (27.0%)
2–4	1 (25.0%)	1 (14.5%)	–	2 (13.0%)
4–6	–	3 (42.0%)	4 (100%)	7 (47.0%)
> 6	1 (25.0%)	1 (14.5%)	–	2 (13.0%)
Regular use of mobile phones	4 (100%)	7 (100%)	4 (100%)	15 (100%)
Proportion who share a phone with family members	2 (50.0%)	5 (71.0%)	–	7 (47.0%)
Ability to operate a smart phone	1 (25.0%)	1 (14.5%)	3 (75.0%)	5 (33.0%)

\*Excludes unpaid household duties

Their ages ranged from 19 to 50 years. The overall median age was 36 years but differed between sites, being least in Rishi Valley (29 years) and oldest in Trivandrum (40 years). Two thirds (60%) of the ASHAs had more than 6 years' experience working in their communities, and worked between 2 and 6 h per day. In West Godavari, the mean work experience was 12 years, while that of the two other sites was 7 years. Furthermore, 73% had no other paid job other than their role as an ASHA. Eighty percent of the ASHAs had previously attended at least one training session provided by the NHRM, the public health training that was provided by the government, while almost half had attended all seven of these government training modules [23]. Fifty three percent of the ASHAs could communicate well in English. While all of them used cell phones, 47% of them shared the phone with their families (Table 2). Previous training received and other demographic variables did

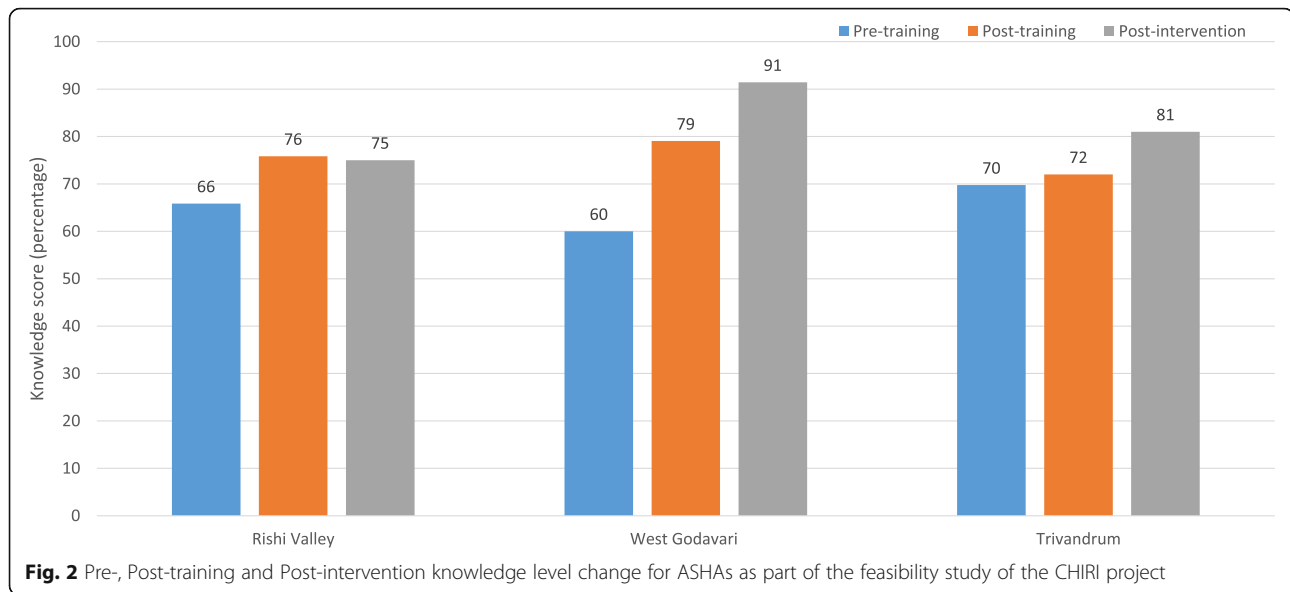
not seem to have an impact on the baseline knowledge of ASHAs.

### Learning outcomes

The mean knowledge score of all ASHAs at baseline was 64%, ranging from 60% in West Godavari to 70% in Trivandrum (Fig. 2). The mean overall knowledge score increased to 76% ( $t_{14} = 4.04$ ,  $p \leq 0.001$ ) at the post-training assessment. Test scores and mean increase in knowledge score varied between the three sites. Only West Godavari showed a statistically significant increase of 19% ( $p \leq 0.001$ ) in the post-training test compared to the pre-training test.

### Changes in knowledge post-intervention

The post-intervention mean knowledge scores ranged from 75% in Rishi Valley to 91% in West Godavari (Fig. 2). The mean overall knowledge score was 84% ( $t_{14} = 4.65$ ,



$p \leq 0.001$ ), demonstrating an increase of 20% from baseline and an 8% increase from post-training knowledge scores. Only West Godavari showed a statistically significant post-intervention increase of 12% ( $p = 0.02$ ) compared to the post-training test scores.

### Behaviour

Using records documented by Research Officers during the community meetings we found that ASHAs led and facilitated the community meetings; they measured blood pressure and weighed the participants, and demonstrated and explained handouts and (Figshare: <https://figshare.com/s/b94c7af22ae220540c45>) as trained. They also helped the participants to set SMART goals and reviewed their action plan.

### Reaction

Interviews with ASHAs indicated that they had developed a better understanding about hypertension and had improved their skills in clinical anthropometric measurement (Table 3). They further conveyed that the training content was easy to understand and captured a wide range of relevant topics important for their job, including developing confidence in discussing hypertension within the community. The ASHAs appreciated the interactive training activities, which they reported had equipped them to understand real life scenarios and enabled them to overcome some of the challenges related to their new roles. For several ASHAs, the CHIRI training was the first time they were trained in measurement of blood pressure and weight, and they appreciated the opportunity to learn new skills. The ASHAs stated that the trainers were supportive and helped them understand their role as “Group supporters”. They reported that the flip charts and the

pictures were useful in educating community members about risk factors for cardiovascular disease and adopting a healthy lifestyle. Most of the ASHAs used the knowledge gained to educate their families, neighbours and friends.

### Challenges and recommendations

Some of the challenges that were mentioned by the ASHAs in the interviews included a low response from community members, especially housewives and farmers who they perceived did not have sufficient time to attend group meetings. There was also concern about a lack of facilities for transportation to the meeting venue and failure to supply medicines during the community meetings. The topic of insufficient remuneration was raised by several ASHAs who reported that the incentives provided by the National Rural Health Mission were usually delayed. They reported a preference to be part of the health system and receive a regular salary. Some ASHAs also complained about the lack of supportive supervision and assistance from their line managers within the public health system.

ASHAs suggested the need for regular refresher training sessions. They also wanted to be trained on other chronic conditions such as diabetes mellitus. Some ASHAs suggested inviting young adults to their meetings so that they might be encouraged to adopt a healthy life style to prevent chronic diseases. Others suggested making monthly home visits for patients, to monitor hypertension and provide support in adhering to medications.

### Discussion

We have demonstrated that ASHAs can be trained to lead community-based group educational discussions, and support community members in the management of

**Table 3** Views and recommendations of ASHAs about the training

Training outcomes
<p>"Before I felt shy to talk, but now I'm more confident ..."</p> <p>"It brought more interest to work"</p> <p>"Now it's easy to motivate people"</p> <p>"I didn't know much before training, after training I learnt lot of things ... now I can give advice and help others"</p> <p>"It helped a lot; we learnt something new about health .... I learnt about blood pressure and how to control it"</p> <p>"The community members respect us because we are taking care of their health"</p> <p>"Our trainers taught us how to explain to people in understandable way and how to take decisions"</p>
Training material
<p>"Even though we explain things to them, it's hard to get them to understand .... by seeing flip charts and images they can understand easily"</p> <p>"I went home and taught my family members"</p> <p>"It helped a lot, now I can check all the blood pressure of my family members, I'm more experienced and advise them to eat good food and exercise daily"</p>
Community experience and recommendations
<p>"People smile when they see us and keep telling us that they learnt a lot of things from us and they are taking good care of themselves now and doing more exercise. When we hear these words, we know they are interested to listen to us.... we get satisfied"</p> <p>"We should conduct meetings for young people so that they learn to take care of their health"</p> <p>"They usually follow our advice, but soon they will forget. It's better if we can set up scheduled visits to keep reminding them"</p> <p>"It will be good if you increase training period and should do more training on other health issues"</p> <p>"It is a very good program; it would be better to continue for 3 months we can learn more things"</p>
Challenges and difficulties
<p>"I have been working as an ASHA for 10 years, but my family is not happy with my job due to insufficient pay, they want me to quit"</p> <p>"Sometimes it takes us up to 5 months to receive our pay"</p> <p>"Some ASHAs went on strike but were told by our supervisors, that you will never get a fixed salary only incentives"</p> <p>"Housewives and farmers are busy, they don't have time to come to the meetings"</p>

high blood pressure. We also showed that the methods and materials were amenable to each site, resulting in similar increases in knowledge of hypertension from baseline. The training program and training materials were appropriate for the different sites and no tailoring, except for the pre-and post-test questionnaire, was needed. The ASHAs were motivated and wanted to enhance their knowledge on other chronic diseases. The interviews suggested that the incentivisation (within government recommended salary structures) along with the aspiration to learn new skills and gain knowledge helped improve motivation levels, and practicing the skills each fortnight helped with the retention of knowledge over time.

Previous studies on the effectiveness of training CHWs for prevention and management of CVD and its

risk factors, in low and middle income countries (LMICs), demonstrate immediate improvement post-training in knowledge among CHWs as well as practical skills [26–30]. Baseline scores improved between 3% and 40% after training and up to 35% after delivering the intervention. In two of these studies [28, 29] knowledge was retained for up to six [28] and 8 months [29]. Evaluation of the effectiveness of training was mostly done using pre-post training scores but two of the studies [28, 29] incorporated interviews and focus group discussions to capture the CHWs' experiences of the training program. These are useful additions to the evaluation of the effectiveness of training using pre- and post-training tests as they enable assessment of both the motivation of trainees and their ability to implement the knowledge and skills gained in the work environment. Recent studies have provided evidence that behaviour change is necessary in implementation of evidence-based practice [31–33] which is usually the main aim of such training programs.

ASHAs were first engaged by the NRHM to be the primary interface between the community and public health system [15]. Their main role was to assist the Auxiliary nurse midwife (ANM) in providing maternal and child health related activities such as antenatal care and immunization. In some regions where the prevalence of NCDs is high, such as in the state of Kerala, ASHAs have been trained in prevention of NCDs and to provide support to the ANM in community-based preventive activities [34]. One of the challenges faced by ASHAs is that they are not employees of the health system and receive insufficient and sometimes delayed incentives for their work, which often translates, to poor motivation levels. ASHAs also reported feeling disadvantaged due to the lack of opportunities for advancement of their career. Similar findings were reported in another study where the lack of incentive and inappropriate career growth opportunities led to high turn-over rates and poor performance of CHWs [35].

In recent years, there have been several studies that have involved the training of CHWs to prevent and manage CVDs and risk factors in LMICs, while the authors are aware that a number of others are in progress [36, 37]. None of these studies has provided details about the effectiveness of the training or has published their training materials. With the expanding role of CHWs, which now also includes the prevention and management of NCDs, there is a need for effective training materials and methods to train them appropriately. At a health system level, it is important that CHWs have a defined job description, good supervision and appropriate remuneration. They should also have regular training and retraining which is evaluated and supported by appropriate supervision.

### Strengths and limitations

The primary strength of this study is the use of the Kirkpatrick's four level evaluation model [18] to assess not only the effectiveness of the training program in changing knowledge scores, but also in the assessment of behaviour change, motivation and reaction to the training. Like most feasibility studies, our main limitation is the relatively small number of ASHAs included and the relatively short duration of the intervention. A statistically significant improvement was detected in West Godavari (seven ASHAs) only. There were trends for improvement in the other two sites, so given the small sample sizes; the absence of a detectable effect could reflect type II error. Moreover, the relatively poor baseline levels of knowledge in West Godavari may have resulted in a larger effect size. We did not assess the knowledge level of ASHAs in the control group, and so are unable to exclude other factors that may have influenced knowledge. Nevertheless, we developed a culturally adapted CVD training program for ASHAs, and have made these materials publicly available for others to use (at Figshare). Most LMICs have a health workforce similar to ASHAs, such as Barangay health workers in Philippines, Lady health workers in Pakistan, and Shastho Shebikas in Bangladesh. These countries face similar challenges in terms of disease burden and access to healthcare [38] and hence, could potentially use culturally adapted training strategies and the available workforce to increase health-care access for managing hypertension.

### Conclusions

In summary, we demonstrate that training ASHAs for management of hypertension is feasible and leads to change in knowledge, skills and motivation. Our findings emphasise the need for culturally appropriate training materials for NCDs and their risk factors, which can be delivered using interactive and innovative methods. To get a better picture of the effectiveness of training, using frameworks such as the Kirkpatrick model [18] is important; since these models do not focus on a single outcome measure and emphasise the importance of using multiple measures for the evaluation of training, thereby allowing more comprehensive comparison and interpretation of training outcomes. Use of these models also draws attention to the learning transfer process and the behavioural change of the trainee to achieve the desired outcome of the training [39]. Future studies might be best focussed on assessment of the appropriate time and methods for re-training. In the era of technology, where most of the ASHAs had access to mobile phones, technology could also potentially be used for re-training or sending reminders. Use of these devices could also reduce the cost and time of training [40] and improve the

overall performance and quality of care provided [41]. Changes in the health system, such as career opportunities for ASHAs, performance based incentives delivered on time, and innovative training techniques would help improve the morale of this rural community based health workforce.

### Additional file

**Additional file 1: Table S1.** Description of Training Materials and Sessions. All downloadable from <https://figshare.com/s/7bbfcc22e0c9c91a5ca03> DOI: <https://doi.org/10.4225/03/5967f9a94970d>. ASHA Training Manual. **Table S2.** Evaluation Materials and ASHA Resources. All downloadable from <https://figshare.com/s/b94c7af22ae220540c45> DOI: <https://doi.org/10.4225/03/5975a0f9da160>. (DOC 78 kb)

### Abbreviations

ANM: Auxiliary Nurse Midwife; ASHA: Accredited Social Health Activists; CHIRI: Control of Hypertension In Rural India; CHW: Community Health Worker; CVD: Cardiovascular disease; LMIC: Low and Middle Income Country; NCDs: Non-Communicable Diseases; NPCPCS: National Program for the Prevention and Control of Cardiovascular Diseases, Diabetes, Cancer and Stroke; NRHM: National Rural Health Mission

### Acknowledgements

We would like to acknowledge Dr. Mini Joseph from Government College for Women, Thiruvananthapuram and Dr. Chaithanya Murthy Kocherlakota from Christian Medical College Vellore for their review of training materials and contributions (especially to the nutrition modules). We would also like to thank the ASHA from Thettu village for contributing to the review and revision of the training materials.

### Funding

The CHIRI study, funded by the National Health and Medical Research Council (NHMRC) of Australia under the Global Alliance for Chronic Disease [42] call for hypertension management [43]. RJ is funded by a Future Leader Fellowship funded by the Australian National Heart Foundation (GNT100484). AGT was funded by a Fellowship provided by the NHMRC (GNT1042600). PKM is a Wellcome Trust/DBT India Alliance Intermediate Career Fellow (IA/I/13/1/500879). The funding agencies had no role in the design or conduct of the study.

### Availability of data and materials

All the data are made publicly available on Figshare and the links are provided where applicable.

### Authors' contributions

RJ, AGT, MR and MA drafted this article and all authors revised the manuscript. The project design was developed by AGT; and implemented by MR, AR, KT, BO, CKC, RGE, RJ, RG, PKM, GKM, NT, KK1, KK2, OS and AM. All authors read and approved the final manuscript.

### Ethics approval and consent to participate

Approval for the overall study was obtained from The Centre for Chronic Disease Control, India; Christian Medical College, Vellore, India; Sree Chitra Tirunal Institute for Medical Sciences and Technology, India; Health Ministry Screening Council, India; Rishi Valley Ethics Committee, Rishi Valley School, Madanapalle, India; Monash University, Australia and Indian Council of Medical Research, Delhi, India. All participants gave written informed consent in the local language.

### Competing interests

The authors declare that they have no competing interests.



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Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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Received: 12 October 2017 Accepted: 22 April 2018

Published online: 02 May 2018

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## Chapter Four manuscript

METHODOLOGY

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# The development of an Android platform to undertake a discrete choice experiment in a low resource setting

Marwa Abdel-All<sup>1,2\*</sup> , Blake Angell<sup>1</sup>, Stephen Jan<sup>1,2,3</sup>, D. Praveen<sup>3,4</sup> and Rohina Joshi<sup>1,2,3</sup>

## Abstract

**Background:** Discrete choice experiment (DCE) is a quantitative technique which helps determine preferences from a definite set of choices. DCEs have been widely used to inform health services in high-income country settings and is gradually being used in low and middle-income countries (LMICs). There are challenges in deploying this method in LMIC settings due to the contextual, cultural and language related barriers. Most DCEs are conducted using paper-based tools. With mobile technology readily accessible across LMICs, we developed an Android-based platform to conduct a DCE among community health workers (CHWs) in rural India.

**Methods:** This paper describes the development of a DCE for low-literacy community health workers (CHWs) in low-resourced setting on an Android platform. We illustrate the process of identifying realistic and locally relevant attributes, finalising the tool and cognitively testing it among respondents with an average of 10 years of education using 'think aloud' and 'verbal probing' techniques. The Android application was tested in two rounds, first by the research team and second, by the CHWs. The 'think aloud' and 'verbal probing' techniques were essential in assessing the comprehension of the CHWs to the DCE choices.

**Results:** The CHWs did not take much time to familiarize themselves with the Android application. Compared to the paper based DCE, the time required for data collection using the Android application was reduced by 50%. We found the Android-based app to be more efficient and time saving as it reduced errors in data collection, eliminated the process of data entry and presented the data for analysis in real time.

**Conclusion:** Electronic administration of DCE on Android computer tablets to CHWs with basic education is more efficient, time-saving than paper-based survey designs once the application is provided. It is feasible to use technology to develop and implement DCEs among participants with basic education in resource poor settings.

**Keywords:** Discrete choice experiment (DCE), Community health workers (CHW), Low-income, Cognitive testing, Android platform

## Background

Discrete choice experiment (DCE) is a quantitative research method used to assess the preferences and priorities of individuals. DCEs analyse the trade-offs individuals make when choosing between sets of hypothetical choices with different attributes. It is regarded as a more useful tool than ranking techniques in policy

analysis and planning as respondents are forced to explicitly make trade-offs between the attributes of differing policy alternatives [1]. DCEs have been extensively used in fields such as marketing research and transport economics. More recently, DCEs are being used in health economics to determine consumer choices. For instance, DCEs are used to understand patient or provider preferences to guide decision-making in providing customized care and to navigate policy decisions on different implementation strategies. DCEs engage a variety of stakeholders including patients, healthcare providers and administrators to identify their personal preferences.

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This is critical for successful design and implementation of interventions; and to minimise the gap between policy and evidence-based practices [2].

The World Health Organisation and The World Bank have developed DCE guidelines to encourage policy makers in resource poor settings in order to identify health workforce retention strategies [3]. Furthermore, DCEs are also used to inform policies to reduce health disparities in resource poor settings [4]. Research indicates that DCEs may be cognitively challenging for individuals with low literacy levels, and have recommended pre-testing the tool during the development stage to ensure that the DCE captures the true preferences of respondents [5].

Electronic data collection has been proposed as a means to present the data in a user friendly way to make the choice sets less confusing for the respondents with low literacy levels [6, 7]. The median response time for electronic data collection is shorter compared to paper-based data collection and more cost-effective, apart from the initial cost of application development [8]. However, there is limited information on the role that electronic data collection processes can play in carrying out DCEs among participants with low educational level.

In India, a cadre of CHWs, the Accredited Social Health Activist (ASHA) are remunerated according to a performance-based incentive system. Similar to other CHW based programs, inadequate remuneration and the complex nature of tasks leads to high attrition rates of the CHWs [9]. We sought to understand the set of attributes and choices acceptable to CHWs, which would promote their retention and motivate them to stay in the health systems. In this study, we describe the development of an Android platform for the administration of a DCE among CHWs in rural India.

### Methodological developments

We developed an Android-based application to display a DCE in order to quantify the relative importance of different factors, which improve job-satisfaction and motivate ASHAs in a state in rural India. The DCE development process is described below:

#### Step 1: identification of attributes and levels

Literature and policy documents review along with qualitative research were essential to understand the contextual factors and challenges that the ASHAs face in delivering healthcare; and to guide the development of a list of key attributes relating to the ASHA's job conditions. Expert consultation allowed the editing of the terms used for different levels to be more comprehensible and relevant to the ASHAs. The software "Ngene" (version 1.2.0, Choice Metrics Pty Ltd., Sydney,

NSW, Australia) [10] was used to generate the DCE experimental design based on the final sets of attributes. All the documents and tools were translated into the local language (Telugu).

#### Step 2: cognitive testing

A team of three field staff who were independent of the local health system conducted the cognitive testing. The team was trained on the study protocol, ethics and administration of DCE. All the surveys were administered in the local primary health centre. All the invited ASHAs agreed to participate in the DCE and provided written informed consent. The pre-test was used to assess the understanding of the DCE choice sets and concepts by the ASHAs. The cognitive testing involved administering the DCE in a paper-based form to 20 ASHAs. We used 'think aloud' and 'verbal probing' techniques to assess the ASHA's comprehension (ability to understand the question as intended), retrieval of information (thinking about the question and drawing conclusions), judgement and selection of response to the question. The first 10 surveys were conducted on the first day as one-to-one survey administration. The second day, a different approach was used where a group of ASHAs were seated in a classroom setting and each responded to the DCE on her own. At the beginning of the sessions, the DCE procedure and job-sets were explained after which the ASHAs completed the survey without further assistance. The team ensured that the choices were made individually and group discussion was discouraged. At the end of each data collection day, the team discussed the survey with the ASHAs to understand the strategies used to make the choices.

The field staff were asked to complete a debriefing report summarising their observations and reflections of the survey and their discussions with the ASHAs. We used this report to identify cognitive challenges faced by the ASHAs in completing the survey. Since there were no changes in the choice sets or attributes, the paper based DCE was then converted to an Android application.

#### Step 3: development of the Android application

A detailed Microsoft Excel spreadsheet with all the demographic items and DCE choice sets was prepared. This spreadsheet imitated the expected data output required for analysis of the DCE results. All the variables were provided to the team to develop an offline Android-based application using Java programming with Android studio as an integrated development environment (IDE). Android custom layouts were used for designing the user interface and Android emulators were used as virtual device for testing the application. Data

was stored locally in the internal storage of the device using SQLite database. The application was first developed in English and then into the local language (Telugu). A screenshot of both versions of the DCE is presented in Fig. 1. Samsung Tab 4 with Android version 4.2 was used to collect the information. First demographics were collected, presented in the form of drop-down choices. Next, DCE choice sets were presented with pictures and graphics to engage the respondents. The DCE choice sets required the respondents to tick their preferred job, which took them to a pop-up screen with their chosen job choice to confirm their acceptance to take the job, if offered to them. Forced response functionality, which forces the respondent to answer each question in order to proceed to the next section, was used to prevent missing data. The collected data was securely saved on the computer tablets, and later sent to the developer team to be extracted into the desired output for analysis.

**Testing of the Android application**

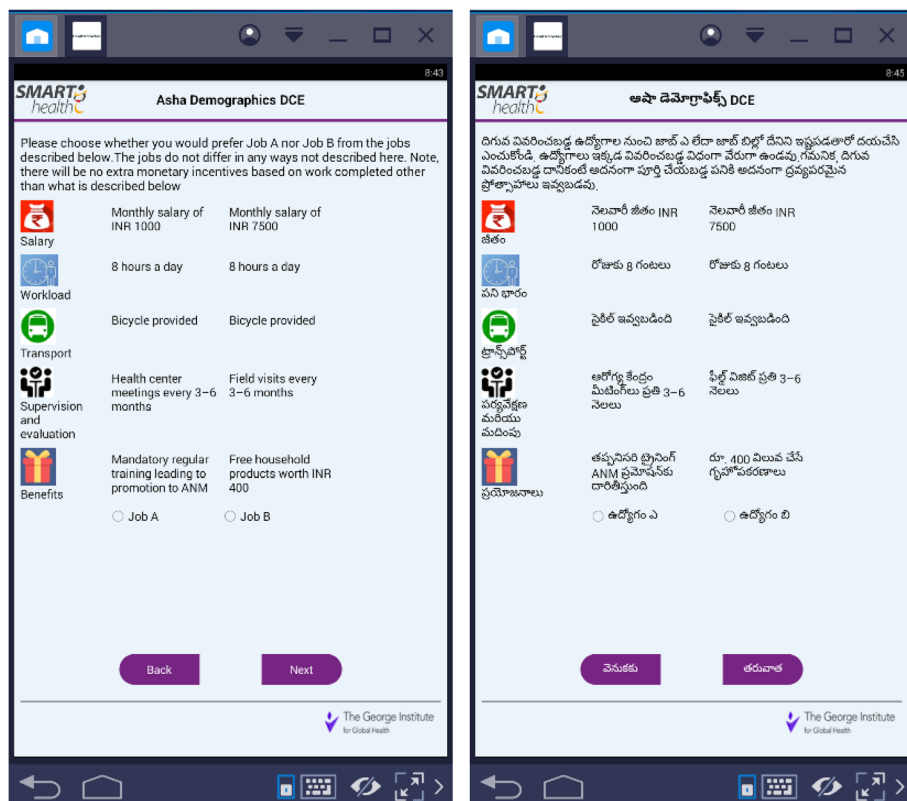
The research team conducted the first round of user testing of the Android application to check for any errors in the sequence or display of questions. Then a

second round involved user testing of the application among ASHAs to assess if they could use the mobile tablets with ease.

**Results**

The average age of participated ASHAs was 31 years and 60% of them had completed secondary education. The research team conducting the survey reported that the DCE was well received by the ASHAs and that they did not find it difficult to understand the choice sets presented to them. The introductory statement with the choice set example helped to explain the hypothetical nature of the DCE and confirmed the cognitive understanding of the ASHAs of the DCE.

Data collection using the paper based format occurred over 2 days during February 2018. Once we had clarified the cognitive understanding of the choice sets, we piloted the DCE data collection using the Android application with ASHAs. This step was essential to ensure that the ASHAs could use the tablets with ease. Twenty ASHAs were invited for the pilot session, the DCE procedure and job-sets were explained to them and they were allowed to complete the DCE individually without any group discussions. The research team who observed



**Fig. 1** Screenshot of the English and Telugu versions of the DCE application

the Android-based data collection, reported that the ASHAs did not take much time to familiarize themselves with the computer tablets. The observers noticed that the younger ASHAs used the tablets with more ease compared to the older ASHAs. Most ASHAs had never used a computer tablet prior to the study, but almost all of them had access to a smart mobile phone. The Android-based answers were in line with the paper-based tool answers. Data collection time was notably shorter using the computer tablets, (10 to 15 min) compared to (20 to 25 min) for completing the paper based DCE. In addition, data collection time was notably quicker, since no additional data entry or cleaning was required.

## Discussion

This methods paper describes the approach used to develop an Android-based DCE for CHWs with basic education in a rural region of India. The user testing of the DCE on the Android tablets showed that the ASHAs had no difficulty using the tablets especially those who had access to a smart phone. Apart from the initial cost of developing the Android application, the application required minimum user interaction with the device and allowed no skipping of questions by respondents. Data collected using the computer tablets is easily transferred to the main server to allow for real time analysis. In addition, the electronic administration of the DCE allows a better design to display the choice sets by incorporating graphics and pictures. Presenting different options using graphics is advantageous, especially when dealing with respondents with basic education.

While all studies use similar steps to develop DCEs, there are particular challenges in implementing DCEs in LMICs where the culture, context, literacy levels and language need to be considered during the design stage. Cognitive testing of the DCE is necessary to assess the respondent's comprehension of the choice sets. In addition to literature reviews, we found qualitative research and expert consultation to be particularly helpful in identifying realistic attributes that were relevant to the local context. Mobile technology is increasingly being used in LMICs in improving public health services especially by frontline health workers [11]. Although LMICs can greatly benefit from the increasing use of the mobile phones, they can be limited by the service cost. In order to support researchers in LMICs, the United States Agency for International Development (USAID) has developed a rapid DCE tool for LMICs to simplify the design and implementation of evidence-based recruitment and retention strategies which eliminate the need of expertise [12].

It was important that the data collectors were independent of the health system, and the data collected was

de-identified and confidential. This ensured that the ASHAs could trust the research team and answer the questions honestly. The two approaches used to test cognition of the questionnaire were 'think aloud approach' and 'verbal probing'. The think-aloud approach is where respondents verbalize their thoughts as they try to answer the questions [13]. This helped us understand the main concerns of the ASHAs while answering the DCE. In the 'verbal probing' approach the interviewer asks a series of questions designed to elicit information beyond that normally provided by the respondent [14]. These two approaches helped us assess the respondent's understanding of the options. It also explained the ASHA's thought process and the factors used to guide their decisions regarding the jobs offered. Most of the ASHAs used smartphones in their daily routine, while using a tablet was novel to display the DCE, it was not challenging for them.

Although, one of the main advantages of using technology is connecting with remote people using network connections, this study did not investigate the capability of the low-literate community health workers to handle the complete DCE experiment without the research team guidance to explain the nature of the experiment. Our study only needed minimal interaction with the computer tablets, hence, further research need to be conducted to investigate the capabilities of community health workers to use the computer tablets on their own.

## Conclusion

This paper illustrates the steps needed to develop an Android-based application used to conduct a DCE among CHWs in rural India. The CHWs with basic education found it easy to use Android computer tablets to complete the DCEs. Data collection using an Android platform was time-saving, and more efficient compared to the paper based tools as it had inbuilt checks, eliminated data entry, and produced a data set which was clean and ready for analysis. India is one of the largest smartphone markets in the world and has extensive phone networks; this in turn can facilitate the administration of the DCEs to a wider population. In conclusion, it is feasible to use digital technology to develop and implement a DCE for CHWs with low literacy levels in a low-income setting.

## Abbreviations

ASHA: Accredited Social Health Activist; CHWs: Community Health Workers; DCE: Discrete Choice Experiment; IDE: Integrated development environment; LMIC: Low and Middle Income Countries

## Acknowledgements

We would like to acknowledge Mr. Bhanu Bangari and Miss Nirosha Yeddalapudi for developing the Android-based application. We would also like to thank Mr. Mohammed Abdul Ameer, Ms. Gayatri Arani and Ms. Keerthana for conducting the cognitive testing of the DCE and all the ASHAs for their participation.

**Funding**

RJ was funded by the Australian National Heart Foundation.

**Availability of data and materials**

Not applicable.

**Authors' contributions**

MA and RJ drafted this article and all authors revised the manuscript. All authors read and approved the final manuscript.

**Ethics approval and consent to participate**

Approval for the overall study was obtained from The George Institute Ethics Committee of The George Institute for Global Health, India. A participant information sheet and consent form were used to gain consent of participating ASHAs. All participants gave written informed consent in the local language.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare that they have no competing interests.

**Publisher's Note**

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Received: 9 November 2018 Accepted: 19 March 2019

Published online: 17 April 2019

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## Chapter Five manuscript

# What do community health workers want? Findings of a discrete choice experiment among Accredited Social Health Activists (ASHAs) in India

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**To cite:** Abdel-All M, Angell B, Jan S, *et al.* What do community health workers want? Findings of a discrete choice experiment among Accredited Social Health Activists (ASHAs) in India. *BMJ Global Health* 2019;**4**:e001509. doi:10.1136/bmjgh-2019-001509

**Handling editor** Sanni Yaya

▶ Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/bmjgh-2019-001509>).

Received 15 February 2019  
Revised 24 April 2019  
Accepted 29 April 2019



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## ABSTRACT

**Introduction** A number of factors contribute to the performance and motivation of India's Accredited Social Health Activists (ASHAs). This study aims to identify the key motivational factors (and their relative importance) that may help retain ASHAs in service.

**Methods** A discrete choice experiment (DCE) survey presented ASHAs with eight unlabelled choice sets, each describing two hypothetical jobs that varied based on five attributes, specifically salary, workload, travel allowance, supervision and other job benefits. Multinomial logit and latent class (LC) models were used to estimate stated preferences for the attributes.

**Result** We invited 318 ASHAs from 53 primary health centres of Guntur, a district in south India. The DCE was completed by 299 ASHAs using Android tablets. ASHAs were found to exhibit a strong preference for jobs that incorporated training leading to promotion, a fixed salary and free family healthcare. ASHAs were willing to sacrifice 2530 Indian rupee (INR) from their monthly salary, for a job offering training leading to promotion opportunity and 879 INR for a free family health-check. However, there was significant heterogeneity in preferences across the respondents. The LC model identified three distinct groups (comprising 51%, 35% and 13% of our cohort, respectively). Group 1 and 2 preferences were dominated by the training and salary attributes with group 2 having higher preference for free family health-check while group 3 preferences were dominated by workload. Relative to group 3, ASHAs in groups 1 and 2 were more likely to have a higher level of education and less likely to be the main income earners for their families.

**Conclusion** ASHAs are motivated by both non-financial and financial factors and there is significant heterogeneity between workers. Policy decisions aimed at overcoming workforce attrition should target those areas that are most valued by ASHAs to maximise the value of investments into these workers.

**Trial registration number** CTRI/2018/03/012425.

## INTRODUCTION

The shortage of health workforce in low-income and middle-income countries is a

## Key questions

### What is already known?

- ▶ One of the major challenges faced by the Indian health system is keeping Accredited Social Health Activists (ASHAs) motivated, and retaining them in service.
- ▶ Several factors including individual, social, economic and work-related factors impact the motivation and retention of the ASHAs

### What are the new findings?

- ▶ Career progression was found to be the main influencing factor for ASHAs choosing between job options in addition to fixed salary and other non-financial factors such as priority free family health-check and reduced workload.
- ▶ There is a heterogeneity in the preference profile of ASHAs depending on their sociodemographic factors.

### What do the new findings imply?

- ▶ Policy recommendations should consider the preferences of health workers and target features most valued by ASHAs.
- ▶ Non-financial and financial incentives should be combined to improve health workers' satisfaction and performance.
- ▶ Discrete choice experiments provide evidence about effective incentives for community health workers in order to improve their motivation to remain in the workforce.

major challenge to achieve the United Nation's Sustainable Development Goals (SDGs). Projections by the WHO indicate that in order to achieve the SDGs by 2030, there is a worldwide shortfall of 18 million health workers, of which 6.9 million will be in Southeast Asia.<sup>1</sup> One promising approach to overcome workforce shortages has been the formal incorporation of community health workers (CHWs) in the health systems as frontline care providers and form a link

between the community and the health system.<sup>2</sup> CHWs are health workers who do not hold formal professional certification but receive job-related preservice training, and usually reside in the community where they work.<sup>3</sup> CHWs have been a cornerstone of health systems in several countries.<sup>4</sup> Over 26 different CHW programmes have been identified in the literature across more than 24 low-income and middle-income countries; with remarkable diversity in their remuneration, training and job description.<sup>5</sup>

One of the major challenges faced by health systems is keeping CHWs motivated and retaining them in service. Attrition rates for CHWs are variable and are reported to be between 3% in the Solomon Islands and 77% in other low-income and middle-income countries.<sup>6</sup> High attrition rates impact on service delivery as the continuous replacement of CHWs results in increased recruitment and training costs,<sup>7</sup> lost chances to build on experience and trust built between the community and the CHW. A number of factors contribute to the performance and motivation of CHWs including financial and non-financial incentives.<sup>6</sup> Despite a large literature describing the CHW motivation and retention in the local health settings,<sup>8–11</sup> there is limited empirical evidence on the importance of the different factors and the trade-offs that CHW may be willing to make between them.

In India, the National Rural Health Mission introduced a cadre of CHWs, the 'Accredited Social Health Activist' (ASHA) in 2005. ASHAs reside in the rural communities where they work and their main task is to link the community to the public health system. They are female volunteers who are remunerated according to a performance-based incentive system, where they receive money conditional on delivering services or attaining targets such as tracking and ensuring full childhood immunisation. They are often confronted by challenges such as lack of support by supervisors, and insufficient and/or delayed remuneration which impacts their motivation<sup>12</sup> and often leads to attrition. While some studies have explored factors which motivate ASHAs (eg, adequate compensation and community recognition),<sup>13 14</sup> there is no empirical evidence about the relative importance of the different incentives that may help to retain ASHAs in service.

Understanding the preferences of ASHAs is essential to the development of interventions aimed at reducing attrition rates across the health system. This is particularly important in settings where the resources available to fund health services are constrained. Discrete choice experiments (DCEs) have been widely used to elicit the preferences of healthcare workers across a variety of settings. A DCE is a quantitative research method that is regarded as a more useful tool than ranking techniques in policy analysis and planning. DCEs can be designed to provide insight into the relative value of specific components (attributes) of interventions, the trade-offs respondents may be willing to make between the attributes and the overall value attached to a programme.<sup>15 16</sup>

This article aims to elicit the preferences of ASHAs in Guntur, a district in Andhra Pradesh, southern India, for attributes of their work that may increase motivation and reduce the rates of attrition, quantify the relative importance of the different attributes and the impact of demographic factors on preferences.

## METHODS

The study was registered with 'Clinical Trials Registry—India' (<http://ctri.nic.in>). A participant information sheet and consent form were used to gain consent of participating ASHAs.

### Patient and public involvement

This research was done without patient involvement. It was not appropriate or possible to involve patients or the public in this work

### Development of DCE for ASHAs

#### Identification of the attributes and levels

Contextual factors and challenges that CHWs face in undertaking their daily tasks were identified through a literature review of peer-reviewed articles and grey literature of the CHWs' perspectives and experiences and a review of policy documents relating to the recruitment, training, job description, remuneration, supervision and career progression of ASHAs.<sup>17</sup> In addition, synthesis of focus group discussions and in-depth interviews of ASHAs from a related study in the same region of India<sup>18</sup> helped us understand the enablers and barriers faced by ASHAs while performing their duties in the community. The emerging themes guided the development of a list of key attributes relating to the ASHA's job conditions, satisfaction, expectations and motivating factors. Once the attributes were finalised, the research team assigned levels to each attribute to reflect the realistic options that ASHAs experience in their work.

#### Expert consultation and construction of job sets

Attributes and levels were finalised after consulting researchers and programme managers familiar with the Indian health system. They were asked to review the attributes and provide insight regarding whether the attributes and levels depicted realistic options. In addition, the wording of the different levels was edited to ensure they were comprehensible and relevant to the ASHAs. From this process, the included attributes in the DCE were as follows: fixed salary, workload, travel allowance, supervision, job benefits incorporating training leading to promotion to the next level of auxiliary nurse midwife (ANM), free family health-check and free household products. A list of the attributes and levels in the DCE is presented in [table 1](#).

#### DCE design

The DCE was designed following standard practices<sup>19</sup> using the software Ngene V.1.2.0 (ChoiceMetrics Pty, Sydney, New South Wales, Australia).<sup>20</sup> We used a

**Table 1** Attributes and levels used in the discrete choice experiment

Attributes	Levels
(Monthly pay of)	7500 INR 5000 INR 2500 INR 1000 INR
Workload	4 hours a day 8 hours a day
Transport	Travel allowance Bicycle
Supervision	Health centres meetings Field visits
Benefits	Mandatory regular training leading to promotion to next level ANM Free household products worth 400 INR Priority free family health-check No benefit provided

ANM, auxiliary nurse midwife; INR, Indian rupee.

d-efficient fractional factorial design with two blocks of eight questions using a multinomial logit model with no interaction terms specified in the design. The ASHA's educational level was taken into consideration when determining the number of attributes in each choice set to minimise cognitive burden.<sup>21</sup> The final design was translated into the local language (Telugu). Participants were asked to respond to eight choice sets each containing two unlabelled job profiles. The respondents were required to choose their preferred alternative from the two options. After choosing the preferred job profile, they were asked if they would accept that job if it was offered, thereby providing an indication of preference relative to their current job. The DCE was piloted with 20 ASHAs to confirm cognitive understanding and ensure appropriateness of the wording of the questions, attributes and levels to the ASHAs. The data from the pilot were analysed and the estimated coefficients were used as prior estimates to maximise the statistical efficiency of the design of the DCE. The final design was split into two blocks (each answered by approximately half of the cohort). The DCE and collection of sociodemographic information (age, education, years of service, working hours, location of work, other paid job and main household earning status) were administered on computer tablets using an offline Android-based application developed by the research team.<sup>22</sup>

#### Data collection

The study was conducted in Guntur, the second most populous district of Andhra Pradesh, a southern state of India. Guntur was selected because of its rural status with more than 66% of its population living in the rural areas. Data collection occurred from April to June 2018 with

primary health centres (PHCs) as the sampling unit of the study. We randomly selected 53 PHCs out of a total of 84 PHCs in Guntur, representing all the rural and remote regions of the district. Six ASHAs from each of the selected PHCs were invited to participate in the study, the ASHA's supervisors facilitated the invitation of the ASHAs to the DCE sessions which took place within the PHCs' premises. The DCE was self-administered on the tablets in the local language (Telugu). A member of the research team explained the nature of the study to the participants, went through the introductory statement with them and explained the job sets. They also ensured that the ASHAs responded individually by discouraging group discussions. The introductory statement is provided in online supplementary material 1.

#### Analysis

DCEs are theoretically based on random utility theory where independent rational actors act to maximise their individual utility.<sup>23</sup> We assume that participants will choose the job that maximises their individual benefit or utility which depends on the attributes such that:

$$U(A \text{ or } B) = \beta_1 \text{ Salary} + \beta_2 \text{ Training} + \beta_3 \text{ Health} + \beta_4 \text{ Supervision} + \beta_5 \text{ Travel} + \beta_6 \text{ Workload} + \varepsilon$$

where:

Salary=Fixed monthly salary;

Training=Mandatory regular training leading to promotion to the next level ANM;

Health=Priority free family health-check;

Supervision=Field visits supervision;

Travel=Travel allowance;

Workload=Daily workload.

At the end of the study, data from the computer tablets were extracted into an Excel spreadsheet and analysed using NLOGIT software V.6 (7 September 2016. Copyright 1986–2016 Econometric Software). The analysis of the DCE has followed the general approach outlined by the International Society of Pharmacoeconomics and Outcomes Research and published guides to model specification.<sup>24 25</sup> The multinomial logit model was used to estimate the relative utility of job attributes. Salary and workload hours were modelled as continuous variables, and the others were specified as categorical and effects coded. A willingness to 'sacrifice salary' analysis was carried out in order to estimate the strength of the ASHAs' preferences to a single standard—how much salary are the ASHAs willing to sacrifice in order to secure their 'desired job'.

A latent class (LC) model was used to explore preference heterogeneity by identifying the existence of LCs with differing preference profiles. It is not possible to assign an individual participant to a specific LC; however, inclusion of sociodemographic factors as covariates in the LC model provides an understanding of the distinguishing characteristics of the classes. The final LC model was specified with three LCs based on log-likelihood tests and comparison with models having two or four LCs. The

**Table 2** Demographics of the ASHAs participating in the discrete choice experiment (n=299)

	n (%)
Age (years)	
Mean age	35
Range	20–55
Education	
Primary	64 (21.4)
Secondary	188 (62.9)
Higher education	47 (15.7)
ASHA years of service	
≤6	73 (24.4)
>6	226 (75.6)
ASHA usual working hours	
<6	100 (33.4)
6	94 (31.4)
>6	105 (35.1)
Proportion of ASHAs residing in the villages they worked in	295 (98.7)
Proportion of ASHAs having other paid duties	202 (67.6)
Proportion of ASHAs being main household earners for their families	89 (29.8)
Proportion of ASHAs having an average household income of less than INR 5000 per month	182 (60.9)

ASHA, Accredited Social Health Activist; INR, Indian rupee.

sociodemographic factors used to predict LC membership included education, other paid job and main household earning status. The final model included covariates that were statistically significant predictors ( $p < 0.1$ ) of an individual being a member of an LC.

**Table 3** Multinomial logit model results (n=299, McFadden pseudo  $R^2=0.263$ , log-likelihood function=-1222.07, number of observations=2392)

Utility parameters	$\beta$ Coefficient	P value	OR (95% CI)	Willingness to sacrifice salary (INR)
Constant	0.11	0.200	1.12 (0.94 to 1.33)	
Fixed monthly salary (per 1000 INR)	0.38	<0.001	1.46 (1.35 to 1.58)	–
Mandatory regular training leading to promotion to ANM	0.96	<0.001	2.62 (2.19 to 3.12)	2530
Priority free family health-check	0.33	<0.001	1.40 (1.18 to 1.66)	879
Field visits supervision	0.06	0.116	1.07 (0.98 to 1.16)	
Travel allowance	0.06	0.082	1.07 (0.99 to 1.15)	
Workload	0.02	0.644	1.02 (0.95 to 1.09)	
Free household products worth 400 INR	-0.66	<0.001	0.52 (0.44 to 0.61)	-1,745

ANM, auxiliary nurse midwife; INR, Indian rupee.

## RESULTS

### ASHA characteristics

A total of 318 ASHAs were invited to participate in the study from 53 PHCs across Guntur, of which 299 completed the DCE giving a response rate of 94%. The average age of participating ASHAs was 35 years, all were females and 60% of them had completed at least 12 years of education. All but 4 of the 299 ASHAs, resided in the villages they worked in. Most of the ASHAs (75%) had worked in the role for more than 6 years, worked for at least 6 hours/day (65%) and had another paid job (68%). The demographics of the ASHAs are presented in [table 2](#).

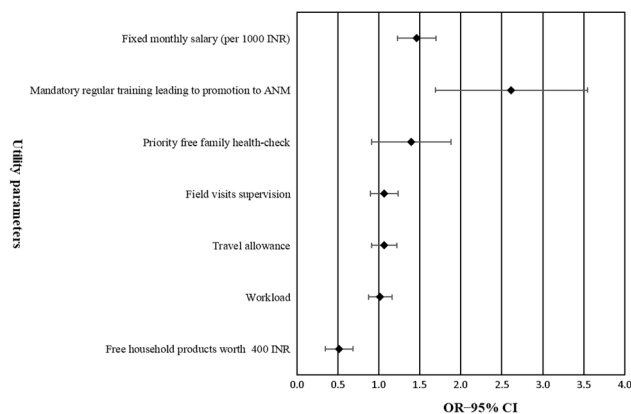
### Multinomial logit model

The multinomial logit model was a good fit to the data (pseudo  $R^2$  0.263); it showed that the main factor which influenced ASHAs' job choice was training leading to career progression to the cadre of ANM. This was followed by a fixed monthly salary and priority free family health-check at the local PHC. Provision of travel allowance, workload and supportive supervision did not have an influence on the ASHA's job choice. The option of having free household products was inversely related to motivation.

The willingness to sacrifice salary analysis showed that ASHAs were willing to sacrifice 2530 Indian rupee (INR) (US\$35.45) of their monthly salary for a job that offers them training with an opportunity for promotion to the ANM position and 879 INR (US\$12.32) for free priority family health-check at the local PHC. Multinomial logit model analysis results and willingness to sacrifice salary analysis results are presented in [table 3](#) and [figure 1](#).

### LC model

The LC model was a good fit to the data (pseudo  $R^2$  0.279); it identified three distinct classes of ASHAs. Group 1 and 2 ASHAs were both strongly influenced by the



**Figure 1** Willingness to 'sacrifice salary' analysis (per 1000 INR) after 'fixed monthly salary' (n=299, McFadden pseudo  $R^2 = 0.263$ ). ANM, auxiliary nurse midwife; INR, Indian rupee.

presence of training leading to promotion to the ANM position, followed by salary. In addition, group 2 ASHAs were highly influenced by priority free family health-check at the local PHC. Interestingly, both groups were less likely to accept the job choice if it offered them free household products worth 400 INR. In contrast, group 3 ASHAs preferred less workload and no other factor had a statistically significant effect on their choices. Results of LC model analysis are presented in [table 4](#).

The probability of belonging to a particular respondent class varied based on education level, having another paid job and whether they were the main household earner. Compared with group 3, group 1 ASHAs were more likely to have a higher level of education (OR 4.03; 95% CI 1.47 to 11.00) and less likely to be the main household earners for their families (OR 0.41; 95% CI 0.16 to 2.07). Group 2 ASHAs were more likely to have a higher level of education (OR 7.09; 95% CI 1.84 to 27.33), have another paid job (OR 3.64; 95% CI 1.14 to 11.60) and less likely to be the main household earners for their families (OR 0.21; 95% CI 0.07 to 0.70).

## DISCUSSION

Our findings demonstrate that more than 85% of the participating ASHAs were influenced by the opportunity of promotion through training and were willing to sacrifice 2530 INR (US\$35.45) out of their monthly salary for a job that offers them career progression. These data are in line with previous literature specifying the importance of career development for motivating CHWs in India.<sup>26</sup> Our results are also broadly consistent with previous human resource for health research utilising DCE, which indicate that career development and continuing education were the main influence shaping the preference profile for nurses in Malawi and Hanson,<sup>27</sup> Lao<sup>28</sup> and community health officers in Ghana.<sup>29</sup> Although training with a promotion opportunity is not a direct financial incentive, it offers the CHWs an opportunity to progress to the next cadre with higher salary, more authority and recognition. Priority free family health-check and low workload were

other driving factors that affected the ASHAs' choices. These findings support the growing evidence of the importance of the non-financial interventions in motivating CHWs in developing countries,<sup>15</sup> and the need for a bundle of combined non-financial and financial benefits.<sup>6</sup> The recent WHO guidelines for optimising CHW programs<sup>30</sup> recommended a fair financial incentive to be provided to the CHWs which should be proportionate to the workload they perform and could include career development pathway for the well performing members. This should be accompanied by a non-financial package that could be tailored to the local context. Both options are indispensable, where monetary incentives provide security and allow for personal development of the workers; non-monetary incentives provide satisfaction and can optimise the CHW's performance.

Our study showed a significant heterogeneity of ASHAs' preferences, which varied depending on their education level, having another paid job or by being the main household earner. Age did not have a significant effect on the ASHA's decisions. For instance, the ASHAs in group 2 valued the priority free family health-check at the local PHC, were more likely to have a second paid job and were less influenced by training opportunities compared with the ASHAs in group 1. This may be because ASHAs having larger families may need more health visits, and are more concerned that training might take them away from their families or cost them more days off their second job. This preference heterogeneity suggests that policy options are perceived differently by ASHAs depending on their individual circumstances. While policy decisions cannot be tailored to individual preferences, they need to be contextualised to the overall preferences of the ASHAs. Our study demonstrates that there are two broad groups of ASHAs, higher educated ones aiming for career progression with a better pay and recognition; and less educated ASHAs more interested in immediate high pay with no intention for further training to be promoted. These results could be used by policy makers to offer two or more packages for ASHAs. Since the educational requirement for ASHA's selection has recently increased to a minimum of 10 years of education, the less educated ASHAs may receive a fixed salary and the higher educated ASHAs could compromise some of their pay to cover their training expenses for an opportunity to be promoted to the next cadre. This can be applied until the less educated ASHAs are progressively eliminated out of the programme, allowing for a higher educated cadre with more capacity and tendency to advance.

The DCE is a useful method for human resource research and helps to investigate the impact of potential policy options on different subgroups within the study population. It is of value to low-income and middle-income countries where the need to make the best use of the limited resources. However, DCE requires expertise and competence in design and analysis. The United States Agency for International Development (USAID)

**Table 4** Latent class logit model results (n=299, McFadden pseudo R<sup>2</sup>=0.279, log-likelihood function=-1194.76, number of observations=2392)

	Group 1			Group 2			Group 3					
	β	P value	OR (95% CI)	WTS* (INR)	β	P value	OR (95% CI)	WTS* (INR)	β	P value	OR (95% CI)	WTS* (INR)
<b>Utility parameters</b>												
Constant	0.16	0.403			-0.42	<0.01			1.27	<0.01		
Fixed monthly salary	0.52	<0.01	1.68 (1.46 to 1.93)		0.15	<0.01	1.16 (1.04 to 1.28)		140.7	0.845	1.15 (0.88 to 1.17)	
Mandatory regular training leading to promotion to next level ANM	1.31	<0.01	3.71 (2.55 to 5.39)	2518.7	0.64	<0.01	1.90 (1.49 to 2.44)	4293.0	0.01	0.944	1.01 (0.71 to 1.43)	
Priority free family health-check	0.03	0.880	1.03 (0.73 to 1.44)		0.41	<0.01	1.50 (1.14 to 1.97)	2700.8	0.28	0.131	1.32 (0.92 to 1.89)	
Field visits supervision	0.14	0.135	1.15 (0.96 to 1.38)		0.11	0.206	1.11 (0.94 to 1.31)		-0.22	0.105	0.80 (0.58 to 1.05)	
Travel allowance	0.00	0.984	1.00 (0.87 to 1.15)		0.06	0.274	1.06 (0.96 to 1.18)		0.09	0.387	1.09 (0.90 to 1.33)	
Workload	0.06	0.254	1.06 (0.96 to 1.16)		-0.06	0.230	0.94 (0.86 to 1.04)		-0.21	0.012	0.81 (0.69 to 0.96)	
Free household products worth 400 INR	-0.73	<0.01	0.48 (0.32 to 0.71)	-1,410.5	-0.49	<0.01	0.61 (0.48 to 0.78)	-3,260.5	-0.14	0.517	0.87 (0.56 to 1.33)	
<b>Sociodemographic predictors</b>												
Education	1.39	<0.01	4.03 (1.47 to 11.00)		1.96	<0.01	7.09 (1.84 to 27.33)		Reference			
Other paid job	0.59	0.23	1.80 (0.70 to 4.62)		1.29	<0.1	3.64 (1.14 to 11.60)		Reference			
Main household earner	-0.89	<0.1	0.41 (0.16 to 2.07)		-1.54	<0.1	0.21 (0.07 to 0.70)		Reference			
Class probabilities	0.514			0.353				0.133				

\*WTS means willingness to 'sacrifice salary' analysis (per 1000 INR) after 'fixed monthly salary'. ANM, auxiliary nurse midwife.

has developed a rapid DCE tool<sup>31</sup> for low-income and middle-income countries to design and implement evidence-based recruitment and retention strategies. The tool is a simplified and reliable version of the DCE, and does not require a high level of expertise. It has been used to identify attraction strategies for Lao's health workers to accept rural positions.<sup>32</sup>

Although DCE is a reliable tool, the results will always be dependent on the attributes used and the clarity by which these attributes were presented to the participants. This highlights the importance of initial qualitative work to obtain pragmatic policy options that are realistic and accord well with the experiences of health workers. One of the limitations of our study is that we did not perform any tests to ensure internal validity of the DCE among the participants and that they have a complete understanding of the study. Instead, we used 'think aloud' and 'verbal probing' techniques to cognitively test our DCE survey.<sup>22</sup> While the results of our study can be generalised to the state of Andhra Pradesh due to similar remuneration policies, the findings may not be applicable to other states of India, due to the variation in the remuneration policies of ASHAs. All our participants were from the same Indian district and we did not compare them to other districts, where ASHAs might have a different preferences profile. Previously, human resource retention policies were exclusively decided by policy makers, this study provides a rigorous method for identifying the preferences of the local health workers to improve their motivation.

The Government of India has recently announced a revised pay scale for the ASHAs with a free social security cover.<sup>33</sup> These guidelines are supposed to come into effect immediately. Given that different states in India have the authority to implement the new recommendations,<sup>34</sup> the following years will see how this policy is rolled out in the different states and districts of India.

## CONCLUSION

Bundled incentives of both financial and non-financial packages are attractive to ASHAs. Policy decisions should be contextualised to local health worker's preferences to guarantee their satisfaction and better performance and improved quality of service. Our study demonstrates the potential value of using DCEs in other low-income and middle-income countries to analyse local CHW preference profile and identify the most effective policy interventions that can vary from one setting to another and from one country to another.

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**Acknowledgements** We would like to acknowledge Dr Praveen Deversetty for his involvement in the DCE attributes and for the logistics and planning for the development of the Android DCE application. We would also like to acknowledge the effort done by Mr Bhanu Bangari and Miss Nirosha Yeddalapati in developing the Android-based application. We would also like to thank Mr Mohammed Abdul Ameer for conducting the DCE and all the ASHAs for their participation.

**Contributors** The study design was developed by RJ and MA-A. BA and MA-A performed the analysis under the supervision of MH and KH. MA-A and RJ drafted this article and all authors revised the manuscript.

**Funding** RJ is funded by the Australian National Heart Foundation Future Leader Fellowship. SJ is funded by an NHMRC Principal Research Fellowship.

**Competing interests** None declared.

**Patient consent for publication** Not required.

**Ethics approval** Approval for the overall study was obtained from The George Institute Ethics Committee of The George Institute for Global Health, India (project number 009/2017).

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data sharing statement** All data relevant to the study are included in the article or uploaded as supplementary information.

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## **Chapter Six manuscript**

RESEARCH

Open Access



# What do Accredited Social Health Activists need to provide comprehensive care that incorporates non-communicable diseases? Findings from a qualitative study in Andhra Pradesh, India

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## Abstract

**Background:** The Indian National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke (NPCDCS) was introduced to provide non-communicable disease (NCD) care through primary healthcare teams including Accredited Social Health Activists (ASHAs). Since ASHAs are being deployed to provide NCD care on top of their regular work for the first time, there is a need to understand the current capacity and challenges faced by them.

**Methods:** A desktop review of NPCDCS and ASHA policy documents was conducted. This was followed by group discussions with ASHAs, in-depth interviews with their supervisors and medical officers and group discussions with community members in Guntur, Andhra Pradesh, India. The multi-stakeholder data were analysed for themes related to needs, capacity, and challenges of ASHAs in providing NCD services.

**Results:** This study identified three key themes—first, ASHAs are unrecognised as part of the formal NPCDCS service delivery team. Second, they are overburdened, since they deliver several NPCDCS activities without receiving training or remuneration. Third, they aspire to be formally recognised as employees of the health system. However, ASHAs are enthusiastic about the services they provide and remain an essential link between the health system and the community.

**Conclusion:** ASHAs play a key role in providing comprehensive and culturally appropriate care to communities; however, they are unrecognised and overburdened and aspire to be part of the health system. ASHAs have the potential to deliver a broad range of services, if supported by the health system appropriately.

**Trial registration:** The study was registered with “Clinical Trials Registry – India” (identifier [CTR/2018/03/012425](https://www.clinicaltrials.gov/ct2/show/study?term=CTR/2018/03/012425)).

**Keywords:** Accredited Social Health Activists, ASHAs, Community Health Workers, CHWs, Non-communicable diseases, NCDs, Comprehensive care, LMICs

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## Introduction

During the last decade, many low-income and middle-income countries (LMICs) have invested in community health worker (CHW) programmes due to their distinctive capacity to reach under-served populations [1]. CHWs have improved access to healthcare and led to better outcomes for maternal and child health [2], and for a range of programmes to control infectious diseases like malaria, human immunodeficiency virus (HIV), and tuberculosis (TB). In recent years, there have been research studies evaluating the effectiveness of CHWs to address common non-communicable diseases (NCDs) like cardiovascular disease [3, 4] and mental health [5, 6]. Since most of the evidence is from research and small-scale national programmes [7], it is important to understand how these interventions are implemented and embedded in the routine work of CHWs. It is also essential to understand how the knowledge and skill-set of CHWs is expanded, and workflow streamlined from traditionally focusing on selective vertical programmes to now working across horizontal programmes with a life-course approach.

The female community health workers of India, known as Accredited Social Health Activists (ASHAs), form one of the largest community-based health workforce in the world [8]. Each ASHA supports 1000 people for better access to public health services. In most states of India, ASHAs are volunteers who receive financial compensation for attending training and performance-based incentives to provide specific tasks like immunisation, referral of pregnant women to health centres, and accompanying them for institutional deliveries [9, 10]. Other responsibilities include linking the community to the health system, community sensitization to new initiatives, health education, referral to health centres, and supporting medication adherence for infectious diseases such as tuberculosis through the directly observed treatment short-term programme [11]. They support the auxiliary nurse midwives (ANMs) in delivering maternal and child health-related services.

India has been facing an escalating burden of non-communicable diseases (NCDs) which are responsible for almost six million deaths (60% of all-cause mortality) annually [12]. Cardiovascular disease, respiratory disease, cancer, and diabetes account for most of the NCD-related deaths, 26% of which occur prematurely between the age of 30 and 70 years [12]. In order to address this growing problem, the Government of India launched the National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke (NPCDCS) in 2010 [13]. NPCDCS was designed to provide comprehensive primary healthcare to communities through the primary health centres (PHCs). The programme aims to prevent and control common NCDs by increasing community awareness, facilitating early detection of undiagnosed cases, and

linking the identified cases with the health system for follow-up and continuity of care. An important component of the programme involves capacity building and training of the health workforce including the ASHAs to deliver these interventions.

In order to strengthen health services for NCD control at the community level, there is a need to understand the current capacity, working conditions, and challenges faced by ASHAs—this study aims to achieve these objectives. Furthermore, this study aims to understand the role of the health system to support ASHAs to perform these duties.

## Methods

This study involved two steps: first, a review of the current policies for NCDs management and the ASHA workforce and, second, a qualitative study including focus group discussions with ASHAs and community members and semi-structured in-depth interviews with ASHA's supervisors and senior medical officers at the district level.

### Study setting

This study was conducted in Guntur, the second most populous district of Andhra Pradesh, in south India. It took place between April and June 2018 in close collaboration with policymakers and key stakeholders of the ASHA programme. Guntur has 85 primary health centres serving around five million population, with two thirds classed as rural. Guntur was selected because its rural-urban distribution and health system is similar to most regions of India. Secondly, The George Institute has its field office and team in the region which enables collaboration with the local government and facilitates data collection.

### Study participants

We purposively selected 41 primary health centres for their geographic spread, encompassing all different serving population capacities and representing all the rural and remote regions of Guntur. We invited five ASHAs from each primary health centre to ensure that a broad range of perspectives are represented. In total, we conducted 13 focus group discussions with 180 ASHAs and five focus group discussions with 47 community members. We also interviewed 13 auxiliary nurse midwives and seven medical officers. In addition, we interviewed two senior medical officers at the district level. Each focus group discussion involved 9–14 participants and lasted approximately 75 min, and each interview lasted approximately 45 min.

### Study instruments

For the interviews and group discussions, we modified the Community Health Worker Assessment and Improvement Matrix (CHW-AIM) [14] to include interventions

for the screening and management of cardiovascular diseases and diabetes mellitus based on the World Health Organization's Package of Essential Non-Communicable Diseases Interventions (WHO PEN) [15] and NPCDCS [13]. The modified version was used as a guide for the qualitative interviews and group discussions. Respondents were asked to reflect on four key areas:

- a) Current engagement and responsibilities of ASHAs in the NPCDCS
- b) Support strategies including training, supervision, and reimbursement schemes
- c) Challenges and needs of ASHAs
- d) Expanding the role of ASHAs beyond maternal and child health

#### Data collection and management

For the document review component of the study, we obtained online all publicly available policy and programme documents relating to the NPCDCS, and ASHA recruitment, training, assessment, remuneration, career progression, supervision, and job description. Data extraction from the policy documents included information on the expected engagement and responsibilities of ASHAs in the NPCDCS, programme governance, and inputs such as remuneration, training, and evaluation schemes. We then identified the system components of the ASHA programme that were most relevant to the knowledge and skills required for NCD prevention and control. These were also used to inform the interviews and group discussion guides.

All in-depth interviews and focus group discussions were conducted in Telugu, the local language, and run by experienced facilitators and note takers who met the participants for the first time for the study. The auxiliary nurse midwives facilitated the invitation of the ASHAs and community members for the focus group discussions which took place within the primary health centres premises. At the beginning of each session, the study objectives were explained to the participants and confidentiality was assured. The facilitators were briefed regularly by two of the authors (MA and RJ) and discussion guide updated accordingly. The focus group discussions and interviews were audio recorded and transcribed verbatim and the data was translated to English.

#### Data analysis

Iterative-inductive thematic analysis of the qualitative data was conducted. We identified the different emerging themes, which were then categorised into codes and sub-codes and compared across participant groups to inform the interpretation of the data. We sought to identify how intersections between the ASHA programme and the NPCDCS influences the capacity and disposition of

ASHAs to deliver NCD services from the point of view of both the health system and of ASHAs themselves.

#### Ethics

Ethical approval was obtained from Ethics Committee of The George Institute for Global Health, India. All participants gave written informed consent in Telugu.

#### Results

Three themes emerged to characterise how the ASHA programme intersects with the NPCDCS to influence the capacity and disposition of ASHAs towards delivering NCD services. First, while ASHAs are identified as part of the NPCDCS team at the policy level, they are not recognised as part of the formal NPCDCS service delivery team on the ground. Second, ASHAs are overburdened, since they deliver several NPCDCS activities as well as their routine primary care workload without receiving training or remuneration for the NCD activities. Third, they aspire to be formally recognised as employees of the health system. ASHAs are enthusiastic about their work including the NPCDCS responsibility and remain an essential link between the health system and the community. See Fig. 1 for further characterisation of contextual enablers and constraints, activities delivered by ASHAs for NCD care, and the implications.

#### Unrecognised: ASHAs are not a formal member of the NPCDCS healthcare team

The NPCDCS policy review identified detailed guidelines about the role of various team members at the primary health centre and sub-centre levels. According to the policy, ASHAs are to perform a broad range of program-related tasks. These entail screening for chronic disease risk factors using "Community Based Assessment Checklist", surveying the community for family history of NCDs, mobilising the community to attend screening days, improving community awareness of the importance of following healthy lifestyle, and following up patients for medication adherence and continuity of care.

Our study found out that while ASHAs are not officially recognised as members of the NPCDCS services delivery team by the primary care team, they are involved in some NPCDCS activities. Community members discussed that ASHAs advised them about healthy eating and lifestyle to help them with their poorly controlled blood pressure and diabetes. ASHAs also remind the community members to attend the regular screening campaigns and to pick up their monthly medications when necessary. As part of NPCDCS, a NCD training module has been prepared specifically to train ASHAs about NCDs, their risk factors, how to raise community awareness of NCDs, and promoting healthy lifestyles [13]. However, ASHAs in this region have not been trained in this module. In addition, none of

Context	NCD related services provided by ASHAS	Implications and recommendations
<p><b>Enablers</b></p> <ul style="list-style-type: none"> <li>• ASHAs are volunteers who receive performance based incentives for 38 health related tasks.</li> <li>• Community embeddedness of ASHAs</li> <li>• Trust and good relationships built with the community.</li> <li>• ANMs trust the ASHAs and their capacity to perform basic tasks</li> <li>• Opportunity to learn at monthly meetings</li> </ul> <p><b>Constraints</b></p> <ul style="list-style-type: none"> <li>• ANMs have power to pressurise ASHAs to fulfil some of their own service targets</li> <li>• ASHAs are not part of the health system</li> <li>• There is no formal role for ASHAs in the delivery of NCD services</li> <li>• The performance based incentives are often delayed</li> <li>• Lack of support from the health system has led to low morale of ASHAs</li> </ul>	<ul style="list-style-type: none"> <li>• List all community members</li> <li>• Enlist all community members diagnosed with NCDs and provide this information to ANMs</li> <li>• Mobilise community members to attend the government operated NCD screening days</li> <li>• Refer patients to the PHC for follow-up</li> <li>• Refer complicated cases to ANMs</li> <li>• Refer and accompany patients to emergency or PHC as required</li> <li>• Mobilise the community to collect their medicines from the mobile pharmacy</li> <li>• Follow-up patients with NCDs by providing medication adherence support and lifestyle modification counselling</li> </ul>	<ul style="list-style-type: none"> <li>• Unrecognised part of the NCD program <ul style="list-style-type: none"> <li>◦ ASHAs should be recognised as formal CHWs of India who provide basic NCD related services</li> </ul> </li> <li>• Provision of NCD related services without formal training or remuneration <ul style="list-style-type: none"> <li>◦ ASHA focused training to provide basic services such as education and adherence support to improve the quality of care</li> <li>◦ Allocation of performance based incentives for NCD related services</li> </ul> </li> <li>• Aspirational <ul style="list-style-type: none"> <li>◦ Opportunities for career progression</li> <li>◦ Supportive supervision and a better working conditions</li> </ul> </li> </ul>

**Fig. 1** Enablers and barriers in the delivery of the National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke services through the Accredited Social Health Activists

the activities described in the NPCDCS policy guidelines are incorporated in the performance-based incentive scheme for ASHAs.

Although ASHAs are recognised as part of the primary care service delivery team, they are not formal employees of the health system. The perception among some of the medical officers interviewed was that ASHAs are not competent and do not have the knowledge and necessary skill-set to provide NCD services. In the words of one of the medical officers, “ASHAs are volunteers who can only perform tasks during their free time and their main role is to link the community to the health system”. Another medical officer added “ASHAs’ basic level of education would not allow them to learn as fast as other technical members of the healthcare team”. This has caused ASHAs to experience some harassment and disrespect by members of the primary healthcare team. One of the ASHAs explained “when we take a patient to the hospital, they would tell us “you are an ASHA, stay outside”. Patients would react by saying “there is no point for you to accompany us to the hospital” and consequently “they lose their trust in ASHAs”. But despite this, one of the senior medical officers highlighted that ASHAs are always considered a part of the health system—in his words: “any new program launched by the government with ASHAs will have their names listed on the program portal along with other healthcare providers”.

#### **Overburdened: ASHAs are the ones on the ground delivering NPCDCS services**

The main role of ASHAs is to mobilise their communities to increase health services’ utilisation. Apart from participating in a wide range of primary healthcare programs, they are required to carry out regular household surveys to update the demographic profile of the communities they serve. This role has helped the ASHAs understand their community’s needs, identify individuals requiring different health services, and build trust with the community members. A medical officer described ASHAs as “the first person to know community members’ symptoms”, and one of the senior medical officers added that “community members feel [the] ASHA as their own person ... [the] first thought which comes to their mind when they are sick is ASHA”. Counting on this unique status, auxiliary nurse midwives have relied on ASHAs to fulfil some of their own NPCDCS targets. These include reporting previously diagnosed cases of NCDs to auxiliary nurse midwives, inviting community members aged 30 years and above for screening days, and ensuring that patients have collected their monthly medication supply. Most ASHAs reported that they did not receive a job description defining their expected role.

Without formal training on NCDs, ASHAs often need to provide health education regarding nutrition and physical activity for individuals diagnosed with NCDs such as diabetes or high blood pressure. An ASHA noted “we visit the

patients at home and check if they are using their medicines and advise them to go for check-ups regularly. Sometimes, we give them our phone number and tell them to call us in case of any emergency to help refer them to a nearby hospital". When asked how they get to know about patient counselling, they mentioned that they often ask auxiliary nurse midwives for specific counselling to respond to community enquiries. Others mentioned that these topics were discussed during the monthly meetings at the primary health centre. One medical officer explained that ASHAs and auxiliary nurse midwives are invited for monthly refresher training meetings at the primary health centre, where different topics are discussed such as cardiovascular disease risk factors and healthy lifestyle promotion. Although these topics are not targeted for ASHAs, they acquired knowledge through these meetings.

Even though ASHAs are volunteers who are expected to work for a couple of hours per day, and receive performance-based incentives, they are overburdened by the additional workload and end up working long hours without receiving any incentives to perform many of these tasks (e.g. medicine adherence support). Several ASHAs have a second job to supplement their income. One ASHA said: "We get pressurised to finish more tasks and put aside our family needs ... We end up getting blamed by our families, or even losing the second job we have". The community members as well expressed their gratitude for the efforts of the ASHAs. One community member said: "ASHAs put in a lot of effort under hard conditions like rainy and hot days .... They provide us with lots of services".

#### **Aspirational: expectations for the expansion of the role of ASHAs**

Stakeholders felt that ASHAs are well placed to help address the growing burden of NCDs at the village level and that ASHAs are enthusiastic about helping people in their communities. The stakeholders acknowledged that ASHAs are interested to be trained and upskilled so that they can support the communities they serve. They also aspire for their role to be recognised by the health system. In the words of one of the senior medical officers: "some ASHAs have completed the auxiliary nurse midwife training themselves ... They want to progress their career". He also noted that the government has shown interest in these more ambitious ASHAs, and there are discussions about career advancement opportunities for ASHAs. Stakeholders emphasised the crucial need for ASHAs to be trained for NCDs. One medical officer said: "it will be very good to train ASHAs for NCDs .... They need to have some knowledge about the different diseases the population is suffering from like diabetes and hypertension which prevents further complications ... We can make a better community". One of the senior

medical officers also highlighted the importance of the prerequisite of basic education for recruitment of ASHAs to ensure that they can acquire further skills and knowledge. He said: "there are ASHA workers who have a higher level of education now ... If we can train those for screening and follow-up, it will be good and the community will definitely accept them". Community members welcomed the idea of ASHAs providing basic NCD services, as they would get better access to health services and save on transportation expenses to the primary health centres for problems that can be resolved by the ASHA. One community member said: "everyone from our village will come to her rather than going very far for check-up ... It will be convenient if they do it at home".

Remuneration for ASHAs was extensively discussed as a factor limiting their job satisfaction. All the stakeholders agreed that ASHAs were not being remunerated in accordance to the services they perform. One of the auxiliary nurse midwives explained: "ASHAs have been helping us in multiple programs; they do not get paid for many of the tasks .... They are not getting paid enough in overall, we have been asking for a pay rise for them". And community members expressed their concern regarding the poor income of ASHAs and how it is insufficient to cover their family needs. One community member said: "ASHAs care a lot about us ... they come to visit us at home and tell us about the available health services .... Hopefully they get paid enough to support themselves". One of the senior medical officers explained that "the remuneration scheme has been increasingly discussed in the governance meetings, and they are considering a suitable reform in the near future." Various stakeholders were concerned that providing a fixed salary (instead of payment for performance) may negatively affect the quality and quantity of service they provide. While ASHAs expressed their preparedness to receive more training and to acquire additional skills, they stressed the importance of receiving enough remuneration before they can accept further tasks. Other ASHAs also highlighted the idea that if expanding their role would involve longer work hours, it might not be suitable for all ASHAs, especially the ones with family responsibilities. In general, most ASHAs expressed their hope for a government reform in the near future that can provide them with a basic salary as in the case of other states of India.

#### **Discussion**

This study shows that although ASHAs in Guntur are well accepted by the communities they serve, yet, they are not recognised as an integral part of the NPCDCS service delivery team. While NPCDCS is well designed and described on the policy papers, its roll out lacks details and has led to the sub-optimal implementation of

the programme through ASHAs at the community level. ASHAs are not officially delegated any NCDs tasks; however, they are asked to provide basic NCD services without specific training or remuneration to fulfil the NCD-related targets. They contribute to their communities and the health system and seek opportunities to upskill and advance their career. All stakeholders agreed that ASHAs are not appropriately utilised by the health system, even though they can provide community-oriented care as part of efforts to address the growing burden of NCDs. They are capable of connecting and relating to their community based on their relationships and understanding of their community's culture, beliefs, and norms.

Our findings are in line with literature which highlight the support needed for CHWs to play a fundamental role in improving access to healthcare [3, 16]. Previous studies have demonstrated that trained and supervised CHWs can effectively screen individuals at high risk of cardiovascular disease [17], for cardiovascular risk factors [16, 18], and promote healthy lifestyles for primary prevention of NCDs [19]. Similar to the findings of our study, the literature shows that key enablers to optimise CHW programmes include adequate recognition and integration of CHWs into the health system, functional infrastructure, and a clear role description [20]. In order to optimise the efficiency of the ASHA programme, we recommend that the Indian government commits towards the development and capacity building for the ASHA programme for NCD control. This will involve training, monitoring, and support, with evaluation and career development options.

ASHAs need to be trained to effectively deliver NCD services to their communities. There is a gap between community expectations and what CHWs are empowered to do. Training should reflect the job description, position requirements, and needs to include both technical and non-technical competencies. Topics such as communication and problem solving skills to deal with their daily challenge have been shown to improve motivation, and performance of CHWs [21]. The prerequisite level of education of the ASHAs influences their capability to gain more knowledge and skills to be able to provide appropriate care to the community. In addition, higher educated members tend to be more ambitious for career development opportunities and are more enthusiastic to receive training [22]. The recent WHO recommendations for optimising CHW programmes identified community embeddedness, where the community has a sense of ownership of the programme and contributes towards the CHW selection process, as an effective way of sustaining community-CHW relationship and strengthening CHW programmes [23]. Furthermore, ongoing supportive supervision and quality improvement approaches

are critical for the effectiveness of CHWs [24]. The literature highlights the consequences of the poor supervision in negatively affecting the performance of the CHWs [25].

While policy decisions in India are made at the national level, there is variation in implementing these policies at the state level. One of the limitations of our study is that it reports findings from only one district in south India. The findings of our study may not be applicable to ASHAs in other states, especially where ASHAs receive a fixed salary and support from their supervisors [26]. Furthermore, cultural, gender, and societal influences differ across India, which have an impact on service delivery at the community level. These differences could not be captured in our study. Furthermore, while this study identifies some of the needs of ASHAs and what may be required to support them to deliver NCD services optimally, our findings do not indicate how policymakers may prioritise which support to provide. The use of other research methods, such as Discrete Choice Experiments, may indeed be necessary to identify what those priorities might be. It is of value to make the best use of the often limited resources of the health systems, to implement contextualised policy interventions that can be attractive to the CHWs, and to help sustain the established programmes [22].

The findings of this study may inform the implementation of few relevant policies announced by the Government of India. The first policy relates to an increment in ASHAs' performance-based incentives along with social security coverage [27]. More recently, the Government of Andhra Pradesh announced an increase in ASHAs' salary from 3000 Indian Rupees to 10 000 Indian Rupees per month [28]. These were announced in response to a demand from ASHAs for income commensurate to their workload. The second policy includes strategies to support ASHAs seeking to complete secondary education through the Open School System and that will prioritise them for the auxiliary nurse midwife course [29]. Third, the government has introduced 38 incentivised tasks for ASHAs in 2017 in addition to the routine activities announced in 2014 [30], to provide some level of predictable income; however, none of these activities are NCD service related. While these policies have not yet been implemented, it will be important to measure the impact of these policies over time.

As the range of services provided by ASHAs expands, there will be a debate on whether to increase the number of ASHAs or to create a separate NCD-specific cadre [31]. However, in empowering ASHAs for more responsibilities, knowledge, and skills, it is important that they continue to be embedded in the community so that they develop a strong relationship that is necessary to effectively provide healthcare across the life course. With recent



evidence suggesting that there is value in incorporating digital technologies with CHW programmes, India is currently undergoing a digital transformation with an aim to improve health service delivery. This strategy has the potential to support ASHAs via training, decision support, referrals, and follow-up, thereby helping them deliver a broader range of quality health services [32]. However, there is a need for more evidence about how these technologies may support the workforce and strengthen health systems [33].

## Conclusion

This study shows that in addressing the increasing burden of NCDs in LMICs, CHWs are considered particularly appropriate to provide culturally appropriate care among hard to reach populations. CHWs have the potential to deliver NCD services effectively if provided with appropriate training and supervision to maintain quality of service and adequately remunerated to keep them motivated. Community embeddedness, health system recognition, and supporting infrastructure with suitable funding for remuneration schemes are critical for success of CHW programmes. Understanding the needs and motivational factors for CHWs can help improve their performance and improve health outcomes.

## Abbreviations

ASHAs: Accredited Social Health Activists; CHWs: Community Health Workers; LMICs: Low- and Middle-Income Countries; NCDs: Non-communicable diseases; NPCDCS: National Program for Cardiovascular Disease, Diabetes, Cancer and Stroke

## Acknowledgements

We would like to acknowledge Mr. Mohammed Abdul Ameer, Mr. Gangaraju Chekuri, and Mr. M. Balraj for conducting the focus group discussions and interviews and thank all the ASHAs for their participation.

## Authors' contributions

The study was designed by RJ and MA. MA performed the analysis under the supervision of RJ and SA. MA drafted this article, and all authors revised the manuscript. All authors read and approved the final manuscript.

## Funding

RJ is funded by the Australian National Heart Foundation Future Leader Fellowship. SA is funded by an Australian National Health and Medical Research Council (NHMRC) Early Career Fellowship. The content is solely the responsibility of the authors and does not necessarily represent the official views of NHMRC or the Australian National Heart Foundation.

## Availability of data and materials

All the data are made publicly available.

## Ethics approval and consent to participate

Ethical approval was obtained from Ethics Committee of The George Institute for Global Health, India. All participants gave written informed consent in Telugu.

## Consent for publication

Not applicable.

## Competing interests

The authors declare that they have no competing interests.

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Received: 10 April 2019 Accepted: 20 September 2019

Published online: 22 October 2019

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