

Training Female Community Health Volunteers (FCHVs) for Cardiovascular Risk

Screening in Lalitpur, Nepal: A Mixed Methods Feasibility Study

by

Yuewen Sun

Graduate Program in Global Health  
Duke Kunshan University and Duke University

Date: \_\_\_\_\_

Approved:

\_\_\_\_\_  
Abu Abdullah, Supervisor

\_\_\_\_\_  
Lijing Yan

\_\_\_\_\_  
Qian Long

Thesis submitted in partial fulfillment of  
the requirements for the degree of  
Master of Science in the Graduate Program  
in Global Health in the Graduate School of  
Duke Kunshan University and Duke University

2018

ABSTRACT

Training Female Community Health Volunteers (FCHVs) for Cardiovascular Risk

Screening in Lalitpur, Nepal – A Mixed Methods Feasibility Study

by

Yuewen Sun

Graduate Program in Global Health  
Duke Kunshan University and Duke University

Date: \_\_\_\_\_

Approved:

\_\_\_\_\_  
Abu Abdullah, Supervisor

\_\_\_\_\_  
Lijing Yan

\_\_\_\_\_  
Qian Long

An abstract of a thesis submitted in partial  
fulfillment of  
the requirements for the degree of  
Master of Science in the Graduate Program  
in Global Health in the Graduate School  
Duke Kunshan University and Duke University

2018

Copyright by  
Yuewen Sun  
2018

## **Abstract**

Background: Faced with the surging trends of cardiovascular diseases (CVDs) and the limited numbers of health professionals in Nepal, more innovative measures should be explored to tackle the challenges of CVD prevention and control. This study explored the feasibility of shifting some CVD-related tasks to the community by engaging female community health volunteers (FCHVs) for CVD risk screening. Methods: This study was conducted in a rural and an urban study site in Lalitpur (Kathmandu Valley), Nepal. Mixed methods were employed in this study. Ten FCHVs were recruited and trained to use the Cardiovascular Risk Scoring Chart adapted from the World Health Organization's Package for Essential Non-Communicable Diseases (PEN). After the training, FCHVs administered cardiovascular risk factor questionnaires and used the risk scoring chart to screen eligible community residents in their catchment area. Using the data collected by FCHVs, a medical doctor calculated the second risk score with the same risk scoring chart. A kappa concordance test was used to compare these two sets of risk screening results for agreement, and a sensitivity and specificity test was conducted to assess the reliability of the FCHVs' CVD risk screening results. Two focus group discussions were administered to investigate the FCHVs' training and fieldwork experiences during the study. Results: There were 491 community residents screened for cardiovascular risk at two study sites. The mean level of agreement between the two sets

of risk screening results was 94.5% (Kappa = 0.77,  $P < 0.05$ ). The sensitivity of the FCHV screening test was 90.3% (95% CI [0.801, 0.964]); and the specificity was 97% (95% CI [0.948, 0.984]). In the FGD, FCHVs expressed a strong enthusiasm and readiness for NCD related work. Besides, all FCHVs agreed that they could manage their current workload and were confident that they could perform more tasks for the prevention and control of NCDs with the proper training. More NCD-related programs and training are called for by FCHVs. Conclusions: It is feasible to train FCHVs to use the simple cardiovascular scoring chart to screen and identify community residents at high risk of developing CVDs. Although FCHVs expressed interests in taking on more responsibility regarding the prevention and control of NCDs, further studies are needed to assess the feasibility of engaging FCHVs within the existing healthcare system.

## **Dedication**

This thesis is dedicated to all FCHVs in Nepal for their selfless work in improving public health.

# Contents

Abstract .....	iv
List of Tables .....	x
List of Figures .....	xi
Acknowledgements .....	xii
1. Introduction .....	1
1.1 The Growing Burden of Cardiovascular diseases .....	1
1.2 Country in Focus – Nepal.....	2
1.2.1 The Burden of CVDs in Nepal.....	2
1.2.2 The Situation of NCD management in Nepal .....	5
1.3 The Primary health care (PHC) system and NCDs .....	6
1.3.1 The importance of PHC for the prevention and control of NCDs .....	6
1.3.2 The role of community health workers in the prevention and management of NCDs.....	8
1.4 The FCHV program in Nepal .....	9
1.5 Project description.....	11
2. Methods.....	13
2.1 Setting.....	13
2.2 FCHV recruitment.....	13
2.3 FCHV training.....	13
2.4 Data collection.....	15
2.4.1 Quantitative data collection.....	15

2.4.2 Qualitative data collection .....	16
2.5 Data Analysis .....	17
2.5.1 Quantitative data analysis.....	17
2.5.2 Qualitative data analysis .....	18
2.5 Ethical Approval.....	19
3. Results.....	20
3.1 Profile of FCHVs in this study .....	20
3.2 Assessment of FCHVs' capacity for CVD risk screening .....	20
3.2.1 Direct degree of agreement and Kappa statistics.....	20
3.2.2 Concordance correlation coefficient .....	21
3.2.3 Sensitivity and Specificity of FCHVs' CVD risk screening.....	23
3.4 Profile of community participants.....	25
3.3 Cardiovascular risk based on CVD risk scoring among participants .....	26
3.5 Qualitative results.....	27
3.5.1 Effectiveness of the training.....	27
3.5.2 Difficulties encountered while performing community-based cardiovascular risk screening .....	28
3.5.3 FCHVs' attitude towards future involvement in NCD prevention and control	29
3.5.4 Motivation for FCHV .....	30
3.5.5 Perceived workload.....	31
4. Discussion .....	33
4.1 FCHVs' capability for community-based CVD risk screening .....	33

4.2 FCHVs' attitude towards community-based NCD programs .....	34
4.3 Cardiovascular risk among the study population .....	35
4.4 Strengths and Limitations .....	36
4.5 Implications for policy and practices.....	38
4.6 Implications for further research.....	39
5. Conclusion .....	41
Appendix A Data Collection Tool in English and Nepali.....	42
Appendix B Cardiovascular risk scoring chart in English and Nepali .....	44
Appendix C Focus Group Discussion Guide.....	46
Appendix D Training Schedule .....	51
References .....	53

## List of Tables

Table 1 Capacity assessment (direct degree of agreement and kappa statistic) by comparing FCHVs' and doctor's screening results.....	21
Table 2 Comparison of CVD risk screening test between FCHVs and medical doctor ....	24
Table 3 Sensitivity and Specificity of FCHV screening test .....	24
Table 4 Profile of community participants from rural and urban study sites.....	26
Table 5 Distribution of cardiovascular risk level in the rural and urban community .....	27

## List of Figures

Figure 1 DALY Attributed to three major groups of causes in Nepal from 1990 to 2015 (all ages, both sexes) *	2
Figure 2 Number of deaths attributed to CVDs and its percentage of total numbers of death from 1990 to 2016*	4
Figure 3 Flowchart of the processes in this study	11
Figure 4 Concordance Correlation between FCHVs' screening results and doctor's screening results in rural site	22
Figure 5 Concordance Correlation between FCHVs' screening results and doctor's screening results in urban site	23
Figure 6 Comparison of distribution of cardiovascular risk score by study site	27

## **Acknowledgements**

This thesis would not come to fruition without the kind support of my supervisors Prof. Abu Abdullah at Duke Kunshan University and Dr. Sushil Baral at HERD International. I also want to thank Prof. Yan Lijing and Prof. Long Qian for their constructive comments and suggestions in the writing of the thesis.

I would like to give special thanks to HERD International and my colleagues, Sudeepa Khanal, Abriti Arjyal, Shraddha Manandhar, who have provided selfless support in developing and implementing the project.

What's more, I'd like to express my sincere gratitude to the Global Health Program at Duke Kunshan University for providing such a great opportunity for me to conduct this study in Nepal.

Finally, I must express my very profound gratitude to my parents and my boyfriend for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them.

# **1. Introduction**

## ***1.1 The Growing Burden of Cardiovascular diseases***

In conjunction with the worldwide ageing trend, non-communicable diseases (NCDs) are causing a huge burden on the global health system, especially in low- and middle-income countries (LMICs). For many, NCDs have caused not only loss of life, but long-term disability and loss of productivity as well. Unfortunately, the health systems in developing countries are not prepared to manage the surging burden of chronic conditions (World Health Organization, 2002).

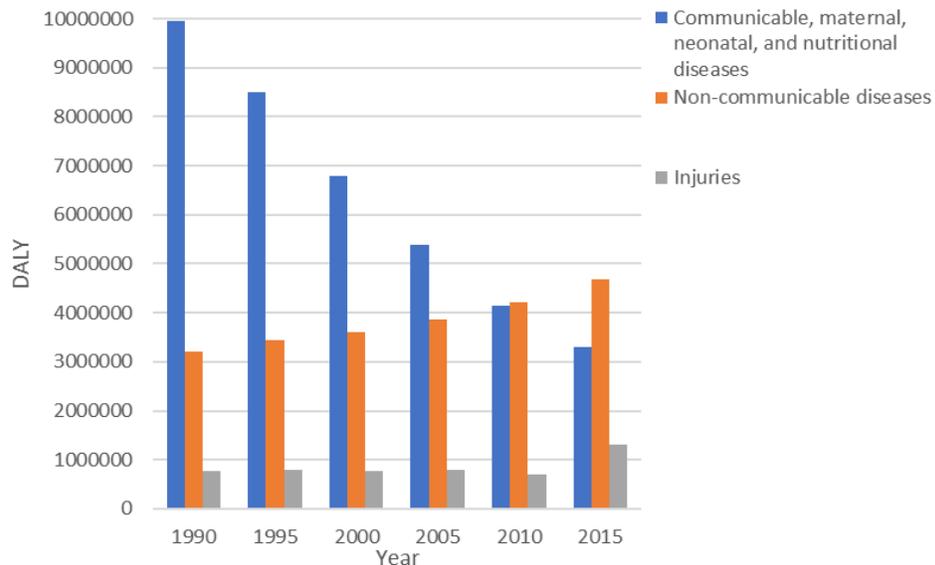
Among the four main groups of NCDs (chronic respiratory disease, cardiovascular diseases, cancer, and diabetes), cardiovascular diseases (CVDs) are the biggest threat to human lives. According to data from the Global Burden of Diseases (GBD) study, CVDs caused more than 17.6 million deaths globally in 2016, accounting for roughly 32% of total mortality (Global Burden of Disease Collaborative Network, 2017). Such a huge disease burden is affecting not only high-income countries (HICs), but LMICs, which are bearing the double burden of both infectious diseases and NCDs (Bygbjerg, 2012). Due to inadequate health system infrastructures, people in LMICs suffer from worse NCD outcomes, engage in more risky behaviors, and have less access to essential healthcare services (Di Cesare et al., 2013). Among all regions of the world, South Asia is in the most extreme need of international attention and support for the

prevention and control of NCDs due to its large population and the high percentage of population living below the poverty line (Ghaffar, Reddy, & Singhi, 2004).

## 1.2 Country in Focus – Nepal

### 1.2.1 The Burden of CVDs in Nepal

Nepal is a low-income country in South Asia, where rapid demographic and epidemiological transitions are happening. According to data from the World Bank, Nepalese GDP per capita was 729.1 USD in 2016, which is far below the regional average level in South Asia of 1637.9 USD in the same year (The World Bank, 2016). Many national and regional studies stress the fact that chronic diseases bring a heavier burden to this country (Dhitali & Karkiii, 2013; Dhungana, Pandey, Bista, Joshi, & Devkota, 2016; Murray et al., 2013; Vaidya, Pathak, & Pandey, 2012).



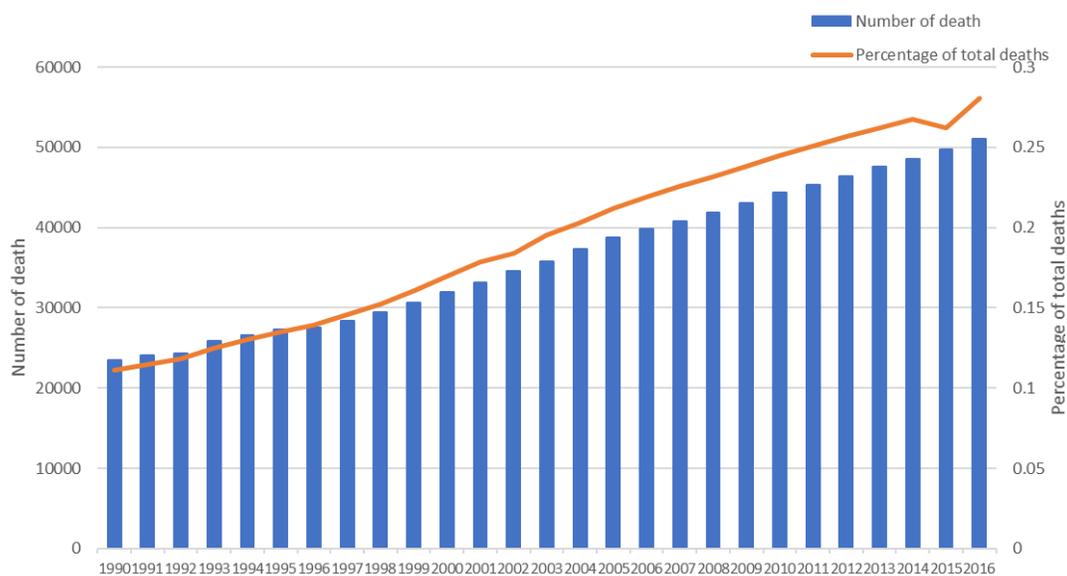
**Figure 1 DALY Attributed to three major groups of causes in Nepal from 1990 to 2015 (all ages, both sexes) \***

As shown in Figure 1, disability-adjusted life years (DALY) in Nepal attributed to communicable, maternal, neonatal, and nutritional diseases continuously declined by about 60% from 1990 to 2016, while DALY caused by NCDs increased by 47% in the same period (Global Burden of Disease Collaborative Network, 2017). Although the Nepalese health system bears the huge burden caused by NCDs, national representative studies on NCD morbidity and mortality are scarce in Nepal. Most published literature was conducted in hospital settings or confined within a geographical area (Upreti, Lohani, Magtymova, & Dixit, 2016). A national NCD surveillance and monitoring system has not been established yet (World Health Organization, 2014).

However, the magnitude of the NCD burden in Nepal could still be determined by the limited available evidence. The risk factors of CVDs, such as smoking, drinking, an inactive lifestyle, being overweight, raised blood pressure, and raised total cholesterol, are prevalent in Nepal. According to the 2013 STEPS Survey in Nepal, more than 80% of respondents between the ages of 15 and 69 of both sexes reported 1-2 risk factors (Aryal, 2014). A systematic review reported that the pooled prevalence of diabetes in Nepal was significantly higher among urban population (8.1%) than it is among rural populations (1.03%) (Gyawali et al., 2015). Reports about the prevalence of hypertension in Nepal ranged from 18.8% to 41.8% (Dhitali & Karkiii, 2013). A large community-based hypertension screening test in Nepal showed that 34% of the

participants had hypertension, and only 12.9% were previously diagnosed (Sharma et al., 2011).

Among all NCDs, CVDs are the biggest killers in Nepal. As shown in Figure 2, the number of deaths caused by CVDs continuously increased from 1990 to 2016. In 2016, CVDs accounted for 28.1% of total mortality, which make them the leading cause of death in Nepal (Global Burden of Disease Collaborative Network, 2017). Although CVDs cost so many their lives, the prevention and control of these killers still gets little attention in the Nepalese health system.



**Figure 2 Number of deaths attributed to CVDs and its percentage of total numbers of death from 1990 to 2016\***

\*Data Source: Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2017. Available from <http://ghdx.healthdata.org/gbd-results-tool>.

### **1.2.2 The Situation of NCD management in Nepal**

Relative to the rapidly growing disease burden attributable to NCDs, including CVDs, they receive disproportionately little attention and resources within the Nepalese health system (Gautam, 2013). The treatment and control rate for various chronic conditions are relatively low in Nepal. For example, the awareness and treatment rate in Nepal for hypertension and other chronic conditions is alarmingly low (Mishra, Kallestrup, & Neupane, 2016). A study in Kathmandu reported that only 1/3 of people with hypertension were aware of their condition (Vaidya et al., 2012). Among those who were aware, only 23.5% received treatment (Vaidya et al., 2012).

Although the situation is not optimistic, there is still hope on the horizon. The government of Nepal composed a phase-wise Multi-Sectoral Action Plan on the Prevention and Control of NCD together with WHO in 2014. The goal of this action plan is to reduce preventable morbidity, avoidable disability, and premature mortality due to NCDs in Nepal through four main action areas: leadership, advocacy, and partnership; health promotion and risk reduction; health system strengthening for early detection and management of NCDs and their risk factors; and surveillance, monitoring, evaluation, and research (Government of Nepal, 2014). This multi-sectoral Action Plan has proceeded to its second stage in 2017, where the WHO Package of Essential Noncommunicable (PEN) Disease was piloted at several representative districts across Nepal (Ministry of Health, 2017). PEN is an essential package of cost-effective

interventions for the four main groups of NCDs, including CVDs, diabetes, chronic respiratory diseases, and cancer, in the primary healthcare system in low resource settings (World Health Organization, 2010a). The Nepalese Primary Health Care Revitalization Division is determined to implement the full PEN package in all health facilities in all 75 districts across the country by 2021 (Ministry of Health, 2017).

Besides the National Action Plan for strengthening the health system for NCD prevention and treatment, the Nepalese government is also working to implement some population-based strategies to address common NCD risk factors. For example, Nepal adopted the Framework Convention on Tobacco Control in 2007 and has already undertaken a few tobacco control initiatives (Ministry of Health and Population, 2012).

### ***1.3 The Primary health care (PHC) system and NCDs***

#### **1.3.1 The importance of PHC for the prevention and control of NCDs**

The primary health care (PHC) system, consisting of community health centers, health posts, outreach clinics, etc., is usually considered as offering the most accessible and “close-to-client” healthcare service providers. In low-resource settings, primary health systems are extremely important in providing basic healthcare services.

PHC is crucial for the prevention, treatment, and management of NCDs, due to the high prevalence of NCDs and the need for long-term management. The “chronic” feature of NCDs makes primary health systems and community health systems extremely important in providing available, accessible, and affordable long-term care

(Maher, Ford, & Unwin, 2012). NCDs need not only the episodic care of health professionals, but continuous management and lifestyle intervention as well, which can be provided by training and engaging non-professionals such as community health workers (Hunter & Reddy, 2013).

However, PHC systems are usually not prepared for the looming, growing burden of NCDs, especially in developing countries (Maher, Harries, Zachariah, & Enarson, 2009). Primary health workers usually are not equipped to treat chronic conditions (Samb et al., 2010). What's worse, drugs for treating NCDs are usually either not on the essential drug list or, very often, are out of stock at primary health facilities (Mendis et al., 2012).

Faced with such a paradox, the WHO has issued many reports and guidelines to help member states reinforce their primary health system to tackle the challenges presented by demographic and epidemiologic transitions worldwide (World Health Organization, 2002, 2010b, 2013). One of the most important documents is PEN, which contains many cost-effective primary interventions to address the four main groups of NCDs, including diabetes, cancer, CVDs, and chronic respiratory diseases (World Health Organization, 2010a). Many LMICs are currently implementing PEN to strengthen their primary health systems, including Nepal, as discussed in the previous section (Ministry of Health - MOH/Nepal, New ERA/Nepal, & ICF, 2017). However, the

effectiveness of the PEN package implementation in Nepal would require rigorous evaluation before it could be more widely implemented.

### **1.3.2 The role of community health workers in the prevention and management of NCDs**

Community health workers (CHWs) are a crucial component of primary healthcare system. To tackle the challenge of the surging burden brought by NCDs in LMICs, some researchers have suggested shifting some tasks to CHWs to meet the increasing need of chronic disease prevention, management, and healthcare (Mishra, Neupane, Preen, Kallestrup, & Perry, 2015; Neupane, Kallestrup, McLachlan, & Perry, 2014; World Health Organization, 2013). CHWs are an important complementary work force to health professionals, especially in resource constrained settings. The role of CHWs in the primary prevention of NCDs is getting more attention than ever before. The USCDC even stated that “involving trained lay people called CHWs for reducing CVD risk and improving outcomes is one best practice” (Center for Disease Control and Prevention, 1994).

A systematic review presented two major forms of task-shifting in NCD management in LMICs: screening for NCDs and providing primary health care (Joshi et al., 2014). Many studies proved that CHWs can be adequately trained to perform community-based screening for various NCDs, such as CVDs (Gaziano et al., 2015), hypertension and diabetes (Pastakia et al., 2013), etc. There is also a wealth of evidence that trained CHWs could perform lifestyle interventions, improve medication

adherence, and manage various chronic conditions in community settings (Babamoto et al., 2009; Balagopal, Kamalamma, Patel, & Misra, 2012; Brownstein et al., 2007; Koniak-Griffin et al., 2015; Ndou, Van Zyl, Hlahane, & Goudge, 2013; Neupane et al., 2018; Norris et al., 2006; Xavier et al., 2016). However, many task-shifting studies were conducted in developed countries to improve health equality among disadvantaged populations with little attention to the situation in LMICs. Additionally, little research has been done to assess CHW's capacity for task-sharing.

#### ***1.4 The FCHV program in Nepal***

The female community health volunteer (FCHV) program is a crucial component of CHWs in Nepal. They are the most accessible frontline CHWs in the Nepalese primary health system, and they are respected and trusted by community members (Panday, Bissell, Teijlingen, & Simkhada, 2017). More than 55,000 Nepalese women have been trained to work as FCHVs since the project was founded in 1988 (Advancing Partners & Communities, 2015). An 18-day basic training for FCHVs is all that would be needed to qualify them for administering selected public health programs within their communities (Department of Health Services, 2015).

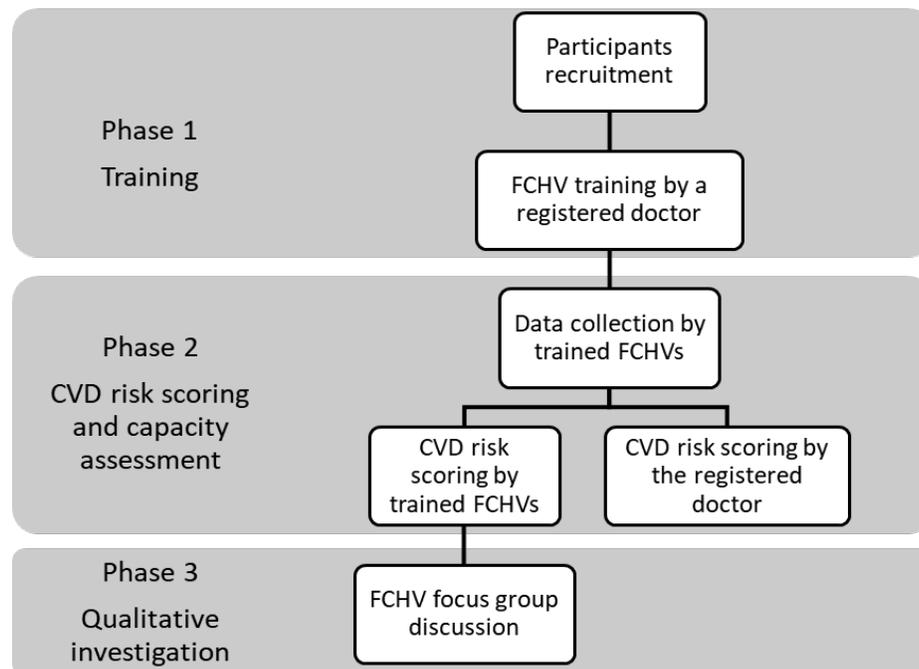
The Nepalese FCHV program is regarded as a prominent exemplar of engaging lay people in the primary healthcare system for the following reasons: First, the attrition rate (4%) was surprisingly low for the Nepalese FCHV program, although little compensation is provided to FCHVs by the government (Advancing Partners &

Communities, 2015). About half of all FCHVs have worked for more than 16 years in their community (Advancing Partners & Communities, 2015). Religious belief and community recognition are the greatest motivations for most FCHVs to continue working actively in the program (Glenton et al., 2010). Second, Nepalese FCHVs' general education profile is relatively low. According to the data from the National FCHV Survey Report 2014, only 21% of FCHVs completed high school or a higher level of education, and 55% of FCHVs reportedly were either unable to read or could only read partially (Advancing Partners & Communities, 2015). Last but not the least, FCHV-led programs have achieved many successes in maternal and child health, including a Vitamin A supplement program, a Polio Eradication project, and an Expanded Immunization Program (Khatri, Mishra, & Khanal, 2017).

As discussed in previous sections, NCDs are placing a heavy health burden on the fragile health system in Nepal. Faced with this situation, many researchers suggest engaging FCHVs in the prevention and control program of NCDs (Dhitali & Karkiii, 2013; Neupane et al., 2014). For example, Neupane and his colleagues trained FCHVs to perform community-based lifestyle interventions that were effective in controlling blood pressure among hypertensive patients (Neupane et al., 2018). Although several studies of engaging FCHVs in the control of NCDs have been conducted in Nepal, previous research has not addressed whether FCHVs could be trained to perform cardiovascular risk screening.

## 1.5 Project description

This study used a mixed methods approach to assess the feasibility of community-based cardiovascular risk screening by FCHVs for the primary prevention of CVDs in Nepal. There were 3 main phases of the study. The first phase consisted of the training of FCHVs to use the cardiovascular risk scoring chart for Southeast Asia Sub-Region D in the WHO PEN Package. The second phase was a quantitative assessment of FCHVs' capacity for community-based cardiovascular risk screening. The



**Figure 3 Flowchart of the processes in this study**

third phase was a qualitative study that consisted of two focus group discussions that investigated (a) FCHVs' training and fieldwork experiences during the study, and (b) their willingness and motivation for potential involvement in future NCD programs.

The processes of the project are shown in Figure 3.

The specific aims of this research were to:

1. Train FCHVs for CVD risk screening using the CVD risk scoring chart in WHO PEN package.
2. Evaluate FCHVs' capacity to screen for CVDs risk using WHO/ISH CVD risk scoring chart by making comparison between FCHVs and medical professionals.
3. Investigate FCHVs' training and fieldwork experience to understand their motivation, willingness, and difficulties in performing community-based CVD risk screening.
4. Estimate the distribution of CVD risk score among study population

## **2. Methods**

### **2.1 Setting**

This study was carried out in Lalitpur, the third largest city in Nepal. It is located 5 kilometers south-east of Kathmandu. A rural community and an urban community in Lalitpur were selected as study sites. The selection was made in consultation with the Lalitpur District Public Health Office.

### **2.2 FCHV recruitment**

FCHVs were recruited through two health posts in the selected study sites. There were four main criteria for recruiting FCHVs: working as an FCHV in the study sites; having an eighth-grade education or above; being older than 18; and willingly volunteering to participate in this research. Five FCHVs were purposively selected from each study site. Five FCHVs from the urban community met all selection criteria. However, due to the limited number of eligible FCHVs, we lowered the selection criteria for education level in the rural site for one FCHV who has a fifth-grade education.

### **2.3 FCHV training**

The training was delivered by a local health professional in Nepali during July 19-21, 2017. There were two main components in the training session: (a) a didactic training and (b) an operational training. The training content was adapted from the Nepal PEN Package training materials regarding CVD and CVD risk scoring. A training manual and an FCHV fieldwork handbook for CVD risk screening were developed

based on the content of the WHO PEN package. All training materials were translated from English to Nepali.

The didactic training was mainly about CVD-related knowledge and research ethics. The CVD-related knowledge session covered common CVD definitions, symptoms, and related risk factors. FCHVs were also trained to provide evidence-based lifestyle change health recommendations to their community members. The research ethics session was about the primary ethical principles and related ethical issues concerning the collection of data in communities. The operational training included blood pressure measurement training using the digital blood pressure measurement device, and the calculation of the CVD risk score.

After the training, a mock session was conducted to assess the FCHVs' ability to collect reliable data using questionnaires. For those who did not perform well during the mock session, additional training was provided to help them qualify and become confident for the fieldwork. The additional training was conducted one-on-one and was specially tailored for each unqualified FCHV to strengthen her capability for the component that she did not perform well during the mock session. Four FCHVs got additional training on obtaining informed consent, and five FCHVs got additional training on measuring blood pressure. All 10 FCHVs were qualified for the fieldwork after the original training and additional training.

## **2.4 Data collection**

### **2.4.1 Quantitative data collection**

Trained FCHVs were deployed to their own catchment areas for data collection and CVD risk screening. They went to target households, door-to-door, to recruit eligible community participants. The inclusion criteria for community participants were as follows: they must reside in the community; be between 35-74 years old; and have no previous history of diagnosed CVD, including established coronary heart disease, cerebrovascular disease, and peripheral vascular disease. Only one participant could be recruited from each household. Upon identifying the target participants, the FCHV introduced the project to the community members and got their signed consent to participate in the study. Each FCHV was required to recruit 50 eligible participants in her catchment area. During the fieldwork, FCHVs were supervised by study coordinators (on-site or remotely via telephone) who addressed any challenges that arose during the field visits.

FCHVs conducted data collection among the recruited community members through in-person interviews. A CVD risk factor questionnaire was used to collect information on age, gender, smoking habits, blood pressure, and diabetes status. The participants self-reported their birth date, diabetes status, and smoking behavior. Age was calculated from reported birth date. Diabetes status was self-reported by asking whether the participants were diagnosed by a physician with diabetes for which they

have to take medicine. For the smoking behavior, all current smokers and those who quit smoking less than 1 year before the assessment were considered smokers. Blood pressure was measured using an OMRON electronic blood pressure monitor (HEM-8712).

The FCHVs and a health professional independently calculated cardiovascular risk scores using the health information collected by the FCHVs. The CVD risk factor questionnaires were deidentified by researchers before the health professional used them to calculate cardiovascular risk score.

The CVD risk score results were not provided to community members, as there were no systematic referral or follow-up or management services in Nepalese health system that will benefit those who are at increased CVD risk. However, each community members received a pamphlet with the information of CVDs and lifestyle interventions to reduce cardiovascular risk.

#### **2.4.2 Qualitative data collection**

After the FCHVs finished their data collection and CVD risk scoring, focus group discussions (FGDs) were conducted to investigate the FCHVs' opinions regarding CVD risk scoring in their catchment, the difficulties they encountered during the study, and the resources they would need for better conducting CVD risk screening in their community. In this study, focus group discussion (FGD) was chosen over in-depth interviews, as FGDs would encourage participants to share their opinions and discuss

disagreements openly regarding a topic. Besides, as this is the first time that FCHVs are trained for cardiovascular risk screening, the focus group discussion would properly provide more information regarding FCHV's attitudes and reactions towards this program.

Two FGDs were administered separately for the FCHVs from two study sites. There were two reasons for this arrangement instead of holding one FGD for all participants. First, the researcher noticed that FCHVs from the urban study site were generally more talkative than their peers from the rural site during the period of training. To avoid one side from dominating the discussion, two FGDs were held respectively for both study sites. Second, the researcher would like to know if there would be different opinions regarding the discussion topics between rural and urban FCHVs.

Both FGDs took place in the office of the local collaboration organization and were administered in Nepali by two experienced local qualitative researchers. The FGD guide was developed by the author. Each FGD lasted for about 1 hour. The FGDs were digitally recorded and later transcribed and translated into English.

## ***2.5 Data Analysis***

### **2.5.1 Quantitative data analysis**

A total of 504 cases were screened for 10-year cardiovascular risk by FCHVs. Due to incomplete data or not meeting the selection criteria, 13 cases were excluded from

data analysis. Therefore, 491 screening cases were included for quantitative data analysis.

Quantitative data analyses were done using STATA 15. The significance level was set at 5%. The direct level of agreement between individual FCHV's and doctor's CVD risk screening results was reported. A kappa statistic was used to assess interrater reliability to control the agreement due to chance. A concordance coefficient was used to analyze the FCHVs' performance as a group. The comparison was made between rural FCHVs and urban FCHVs. A sensitivity and specificity test were also calculated to assess FCHVs' ability for screening CVD risk in their catchment. A medical doctor's CVD risk screening results were considered as the gold standard. The distribution of risk factors of CVDs was reported for the population of this study, and a comparison of the risk factors' distribution was made between rural and urban communities.

### **2.5.2 Qualitative data analysis**

The FGDs were digitally recorded and transcribe into English by two Nepalese researchers. The translation was checked by an experienced qualitative researcher from the collaborating organization for its accuracy and clarity. In addition, extensive notes were taken during the FGDs.

Qualitative data analyses were done using NVivo 11. Thematic analysis was used to analyze qualitative data. A set of codes was developed comprising the following five themes: (a) effectiveness of the training; (b) difficulties encountered during

performing CVD risk screening; (c) attitudes towards community-based cardiovascular risk screening; (d) motivation for FCHV work; and (e) perceived workload.

## ***2.5 Ethical Approval***

This study was approved by the Nepal National Health Research Council, Kathmandu, Nepal (Reference number: 2444) and the Duke Kunshan University Institutional Review Committee, Suzhou, China (Reference number: FWA00021580). All participants, including FCHVs and community members, provided written consent prior to participating in the study.

## **3. Results**

### **3.1 Profile of FCHVs in this study**

Ten FCHVs were recruited in this study, five from the rural site and another five from the urban site. The overall age ranged between 38 and 49 years (mean 43.4). The length of serving as an FCHV ranged between 1 and 24 years, with a mean of 14 years. The majority of participants (70%) had worked for more than 10 years as an FCHV. Eight out of ten participants had school leaving certificates—the equivalent of a high school diploma. Four out of ten participants reported having more than 200 households in their catchment area.

### **3.2 Assessment of FCHVs' capacity for CVD risk screening**

#### ***3.2.1 Direct degree of agreement and Kappa statistics***

Kappa concordance statistics were used to assess the FCHVs' capacity for CVD risk screening (Table 1). The mean level of agreement between the FCHVs' and the doctor's risk screening results was 94.5% (Kappa = 0.77,  $P < 0.05$ , 95% CI [0.705, 0.835]). The level of direct agreement ranged between 82.6% and 100% for participants. Only two out of ten FCHVs got a degree of agreement lower than 90%. Seven out of ten FCHVs got a degree of agreement above 95%. FCHVs from the urban community performed better than FCHVs from the rural community, with an agreement level of 95.51% versus 93.50%. However, when controlled for the effects of agreement due to

chance, the kappa statistics were lower than 0.6 for three FCHVs, which indicated a weak level of agreement. The kappa statistics were higher than 0.8 for half of all participants, suggesting strong agreement.

**Table 1 Capacity assessment (direct degree of agreement and kappa statistic) by comparing FCHVs' and doctor's screening results**

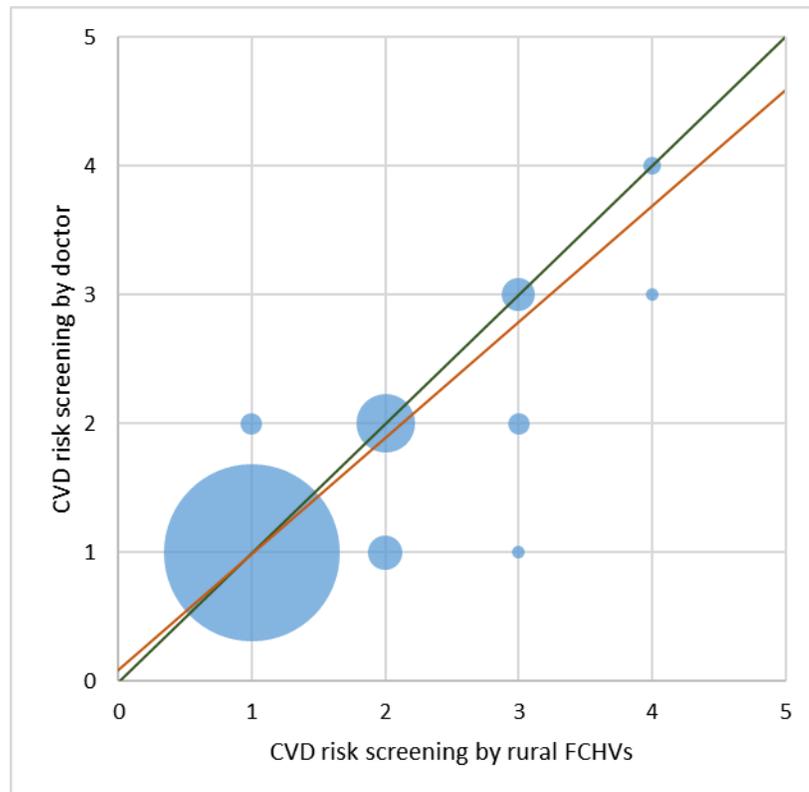
FCHV	Direct degree of agreement	Kappa (95% CI)	P>Z	Comment
1	92.0%	0.781 (0.576, 0.987)	0.0000	Moderate
2	98.0%	0.931 (0.779, 1.083)	0.0000	Perfect
3	96.0%	0.859 (0.677, 1.042)	0.0000	Strong
4	82.6%	<b>0.427</b> (0.146, 0.707)	0.0001	Weak
5	98.0%	0.901 (0.569, 1.233)	0.0000	Perfect
6	95.8%	<b>0.584</b> (0.105, 1.064)	0.0000	Weak
7	89.8%	<b>0.543</b> (0.183, 0.903)	0.0000	Weak
8	95.9%	0.841 (0.669, 1.013)	0.0000	Strong
9	96.0%	0.778 (0.394, 1.162)	0.0000	Moderate
10	100.0%	1.000 (-)	0.0000	Perfect
Overall	94.5%	0.770 (0.705, 0.835)	0.0000	Moderate

Note: Cohen's kappa is a widely acceptable statistics of interrater reliability testing. Interpretation of Cohen's kappa: 0-0.2 (No agreement), 0.21-0.39 (Minimal agreement), 0.40-0.59 (Weak agreement), 0.60-0.79 (Moderate agreement), 0.80-0.90 (strong agreement), above 0.90 (Almost perfect agreement) (McHugh, 2012).

### **3.2.2 Concordance correlation coefficient**

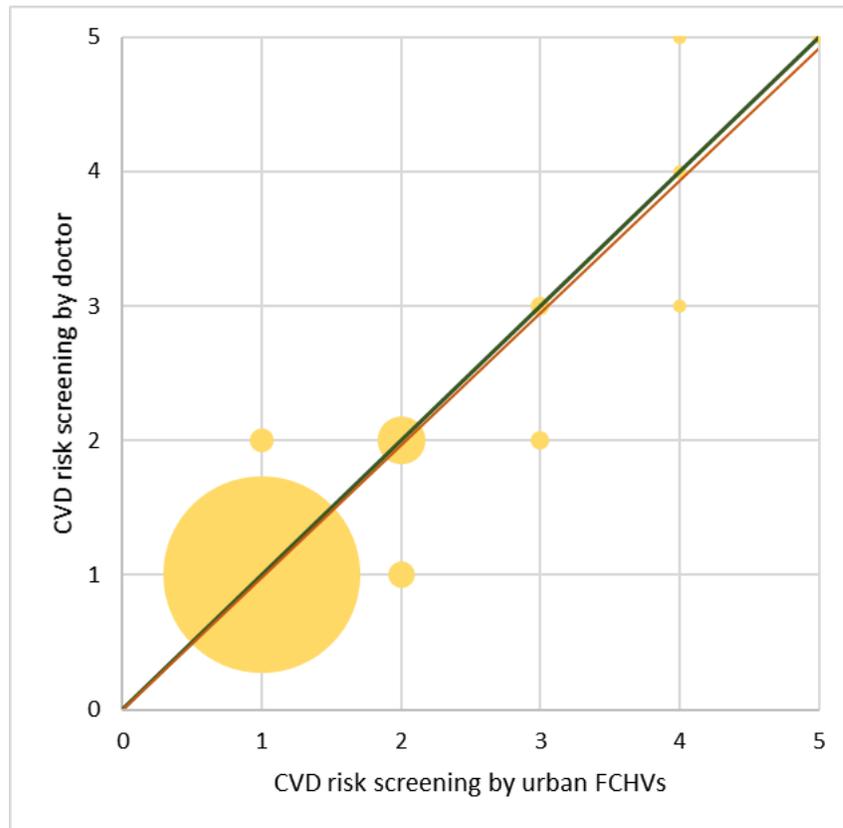
The concordance correlation coefficient for the FCHVs' CVD risk screening tests was 0.897 (95% CI [0.880, 0.914]), which indicated that FCHVs' CVD risk screening test results have good precision and accuracy. The concordance coefficient at the rural site was 0.877 (95% CI [0.849, 0.905]), and at urban site, it was 0.919 (95% CI [0.900, 0.939]). As shown in Figures 3 & 4, the urban FCHVs' screening tests are better in terms of

concordance with the gold standard. Therefore, the urban FCHVs performed better than the rural FCHVs in this study.



**Figure 4 Concordance Correlation between FCHVs' screening results and doctor's screening results in rural site**

Note: The size of the circle shows the number of dots falling on the same coordinate. The green line ( $y = x$ ) represents perfect agreement between the two sets of scores. The orange line (reduced major axis:  $y = 0.89x + 0.094$ ) represents the actual degree of agreement between the two sets of scores.



**Figure 5 Concordance Correlation between FCHVs' screening results and doctor's screening results in urban site**

Note: The size of the circle shows the number of dots falling on the same coordinate. The green line ( $y = x$ ) represents perfect agreement between the two sets of scores. The orange line (reduced major axis:  $y = 0.97x + 0.022$ ) represents the actual degree of agreement between the two set of scores.

### **3.2.3 Sensitivity and Specificity of FCHVs' CVD risk screening**

The sensitivity and specificity of FCHV screening test was calculated to show the reliability of the FCHVs' CVD risk screening as compared to the doctor's, which was treated as the gold standard in this study. The cardiovascular risk level is treated as a dichotomous variable here for calculating the specificity and sensitivity of FCHV screening test. A cardiovascular risk higher than 10% is regarded as elevated

cardiovascular risk for the next 10 years; cardiovascular risk lower than 10% is regarded as no elevated cardiovascular risk. The sensitivity of FCHV screening test as a group is 90.3% (95% CI [80.1%, 96.4%]), and the specificity is 97% (95% CI [ 94.8%, 98.4%]).

**Table 2 Comparison of CVD risk screening test between FCHVs and medical doctor**

FCHVs' CVD risk screening	Doctor's CVD risk screening		Total
	Elevated risk ( $\geq 10\%$ )	No elevated risk ( $< 10\%$ )	
Elevated risk ( $\geq 10\%$ )	56	13	69
No elevated risk ( $< 10\%$ )	6	416	422
Total	62	429	491

The specificity for each FCHV ranges between 66.7% and 100.0%. The specificity for each FCHV is in the range between 89.7% and 100.0%. As shown in Table 4, the high sensitivity and specificity indicates that FCHVs' CVD screening results were reliable as compared to the doctor's screening results, which are treated as gold standard in this study.

**Table 3 Sensitivity and Specificity of FCHV screening test**

FCHV	Sensitivity (95% CI)	Specificity (95% CI)	Accuracy (95% CI)
All	90.3% (80.1%, 96.4%)	97.0% (94.8, 98.4%)	96.1% (94.0%, 97.7%)
1	100.0% (66.4%, 100.0%)	90.2% (76.87%, 97.3%)	92.0% (80.8%, 97.8%)
2	100.0% (63.1%, 100.0%)	97.6% (87.4%, 99.94%)	98.0% (89.4%, 100.0%)

---

**Table 3 Continued**

---

3	100.0% (63.1%, 100.0%)	100.0 % (91.6%, 100.0%)	100.0% (92.9%, 100.0%)
4	71.4% (29.0%, 96.33%)	89.7% (75.8%, 97.1%)	87.0% (73.7%, 95.1%)
5	83.3% (35.9%, 99.4%)	100.0% (92.0%, 100.0%)	98.0% (89.4%, 100.0%)
6	66.7% (9.4%, 99.2%)	100.0% (92.1%, 100.0%)	97.9% (88.9%, 100.0%)
7	80.0% (28.4%, 99.5%)	93.2% (81.3%, 98.6%)	91.8% (80.4%, 97.7%)
8	100.0% (59.0%, 100.0%)	100.0% (91.6%, 100.0%)	100.0% (92.8%, 100.0%)
9	80.0% (28.4%, 99.5%)	97.8% (88.2%, 99.9%)	96.0% (86.3%, 99.5%)
10	100.0% (39.7%, 100.0%)	100.0% (92.1%, 100.0%)	100.0% (92.8%, 100.0%)

---

### **3.4 Profile of community participants**

A total of 491 participants were screened for CVD risk by ten FCHVs (246 from the rural community and 245 from the urban community). The mean age of participants was 50. Of the participants (N=491), the majority (71.5%) were female, 10.2% reported a history of diagnosed diabetes, 14.7% had elevated blood pressure, and 18.5% were current smokers.

The overall prevalence of self-reported diabetes and elevated blood pressure were 9.0% and 14.7% respectively among the study population. As shown in Table 5, there is a significant difference in self-reported diabetes prevalence between the rural (7.3%) and urban (13.1%) communities. However, the prevalence of hypertension showed an opposite trend: high blood pressure was more prevalent among the rural

population. The prevalence of high blood pressure was significantly higher in the rural site (18.3%) than in the urban site (11.0%). The prevalence of smoking was 18.5% among the study population with no significant difference between rural and urban sites.

**Table 4 Profile of community participants from rural and urban study sites**

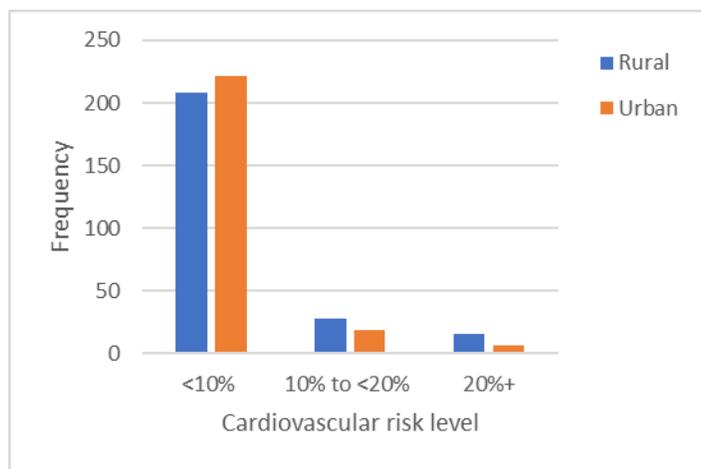
<b>Variables</b>	<b>Rural</b>	<b>Urban</b>	<b>P value</b>
<b>Age (mean; 95% CI)</b>	50.9 (49.6, 52.2)	49.1 (47.8, 50.3)	0.0511
<b>Gender</b>			
Male	58	82	<b>0.015</b>
Female	188	163	
<b>Self-reported diabetes</b>			
Yes	18	32	<b>0.0035</b>
No	228	213	
<b>High Blood pressure</b>			
Yes	45	27	<b>0.023</b>
No	201	218	
<b>Current smoker</b>			
Yes	46	45	0.925
No	200	200	
<b>Total</b>	246	245	

### **3.3 Cardiovascular risk based on CVD risk scoring among participants**

According to the doctor's screening results, 87.4% of cases had a risk of developing CVD in the following ten years, less than 10% and 12.6% of cases had a risk greater than 10% (i.e., a relatively high risk of developing cardiovascular event(s) in the following 10 years). The cardiovascular risk was a bit higher in the rural than in the urban community; however, the difference was not statistically significant (Table 5).

**Table 5 Distribution of cardiovascular risk level in the rural and urban community**

CVD risk level	Rural	Urban	Total	P value
<10%	208	221	429	0.105
10% to <20%	28	18	46	
20% to <30%	8	3	11	
30% to <40%	2	1	3	
>40%	0	2	2	
<b>Total</b>	<b>246</b>	<b>245</b>	<b>491</b>	



**Figure 6 Comparison of distribution of cardiovascular risk score by study site**

## **3.5 Qualitative results**

### **3.5.1 Effectiveness of the training**

The effectiveness of the training was one of the main topics of both FGDs.

FCHVs from both study sites received 3 days of training by a local health professional and experienced researchers before conducting their fieldwork. While the training was mainly focused on CVD risk scoring and the prevention of CVDs, FCHVs were also trained to measure blood pressure using a digital BP device. All participants agreed that

the training was informational and effective in enabling them for community-based CVD risk screening. However, some of them suggested it would be better to prolong the training for several more days. One FCHV said, “I think if that [the training] was for a week or 10 days then it will have make us easier to learn more and we could get more information.”

Aside from prolonging the length, FCHVs also made some other suggestions to improve the training. For example, one FCHV suggested to move the training to the ward. She said,

Rather than coming here [office of the collaborator in Kathmandu], if the resources can be taken to the wards. And if you [the researchers] and the trainers of this organization can do these things in wards and health posts, it could have been easier.

### ***3.5.2 Difficulties encountered while performing community-based cardiovascular risk screening***

Most FCHVs reported no major difficulties of collecting health information, measuring blood pressure, and calculating cardiovascular risk scores during their fieldwork. However, some minor issues emerged during the process. Two FCHVs reported that their digital BP monitors did not work well several times during their fieldwork. The problems were solved when they restarted the monitor as instructed during the training.

Additionally, some FCHVs had difficulties in responding to the questions by community members. Three FCHVs were asked questions regarding the reliability of the digital BP monitor compared to a traditional BP measuring instrument. Some FCHVs were asked questions about hypertension and diabetes medication and its dosage. One FCHV reported that it was hard to explain the meaning of 10-year cardiovascular risk to the community participants. These difficulties indicate more training is needed on these particular aspects.

### ***3.5.3 FCHVs' attitude towards future involvement in NCD prevention and control***

FCHVs are the frontline community health workers in Nepal. They are trained to provide specific health services in their communities, mostly related to the prevention and treatment of communicable diseases focusing on improving maternal and child health. This study, though, was aimed at expanding FCHVs' roles and exploring their potential involvement in NCD prevention and control. During the FGDs, FCHVs were asked about their attitudes regarding being engaged in the prevention and control of NCDs. FCHV's opinions and attitudes are fundamental in exploring the possibility of expanding the scope of FCHV program to the prevention and control of NCDs in the future.

FCHVs were active when asked about their attitudes towards the future involvement in the prevention and control of NCDs. Nearly all FCHVs had noticed the growing number of patients with chronic conditions in their community and wanted to

help their community members in related areas. One FCHV said, “Cardiovascular diseases can be reduced. Those who have been already suffering cannot be cured. But we can prevent those who have not suffered yet.”

In addition to cardiovascular risk screening, FCHVs expressed their eagerness to receive more training on NCDs. Some FCHVs said this study provided the training that they had been waited to get for a very long time. One FCHV said,

We had been asking for a long time with the health post, DPHO [District Public Health Office] to give us a BP set [BP monitoring set]. We had been telling we need BP set, we need training. To get it [training and BP set] now, to work in this project, makes us very happy.

Almost every FCHV in this study expressed a strong interest and motivation for being involved in NCD prevention and control. Specifically, FCHVs from both study sites expressed their interest in receiving training on the prevention and management of diabetes and hypertension. They are also confident of their ability to provide services related to NCDs if proper training could be provided.

#### ***3.5.4 Motivation for FCHV***

FCHVs are a voluntary health workforce employed by the Nepalese government to work in the communities. It is important to understand their motivations in working as FCHVs. Compared to full-time community health workers in other countries, internal motivations play an important role for FCHVs. Most FCHVs think the respect and

recognition of their communities are the main motivators for them to continue working as FCHVs. One FCHV said:

when we visit the community wearing the uniform of Nepal Government, as soon as they see us they [the community people] say what is today's program? Is there Vitamin A [distribution], are you vaccinating children?

Another FCHV said, "And even when we don't wear dress [FCHV dress] and walk, the ones who know us ask "Oh FCHV didi [sister], where are you going now" and it makes us happy."

When asked about their attitudes towards financial motivation, almost all participants said that financial compensation is not necessary, but it would certainly contribute to their motivation and long-term engagement. Some FCHVs mentioned that lunch and snack incentives would be good enough for them to work in the community. One FCHV said,

It would be good if Government gives us some snack incentive in return of the work we do, in meetings, mothers group meeting. If some transportation. . . snack incentive is defined in return of the work that we do, we will be more motivated.

### ***3.5.5 Perceived workload***

FCHVs in Nepal are trained to handle basic health needs in the community, including organizing monthly mother's groups, supporting the Expanded Program on

Immunization, dressing wounds, distributing nutritional supplements, etc. In addition, community members would go to an FCHV's house when in need of basic health services. FCHVs would also walk in the community from time to time and respond to some service queries. FCHV's perceived daily workload is an important pre-requisite if we want to incorporate NCD control and prevention into FCHV program.

Most FCHVs did not feel particularly burdened by the work they were providing and thought that they could manage more work with proper training. However, some FCHVs also agreed that the situation can become difficult when they need to deal with more household work. For example, one FCHV said:

We do not feel that much work burden. It has been 17 years that we are providing services. It was a bit difficult before when we were daughters-in-law. We had to give our time in our home. Now we have got experience and I am so happy that we can provide the service from our own house.

## **4. Discussion**

### ***4.1 FCHVs' capability for community-based CVD risk screening***

To the best of our knowledge, this study is the first to analyze the training of FCHVs for CVD risk screening in Nepal. The findings proved that FCHVs with a secondary level education could properly perform community-based CVD risk screening upon receiving training. After the three-day training, FCHVs were able to accurately identify people with high risk of developing CVDs in the following 10 years using the non-invasive cardiovascular risk scoring chart. FCHVs' screening results also showed high levels of sensitivity and specificity when compared with a registered doctor's screening results.

FCHVs' capacity for community-based CVD risk screening varied between the two study sites in this project. The results of the kappa concordance, sensitivity, and specificity tests all suggested FCHVs in the urban site performed better in conducting CVD risk screening than their peers in the rural site, although the difference was not significant.

There are several possible explanations for this finding. First, FCHVs from the urban site in this study had a longer duration of service (shown in Table 1), indicating the fact that they could have been more experienced in delivering community-based health services. Second, FCHVs from the urban site were better educated compared to those in the rural setting, indicating that they might have been more able to comprehend

new knowledge. However, this study could not produce a concrete conclusion for the varied level of capability between urban and rural FCHVs due to the small sample size and data availability.

The variability of participants' capacity for CVD risk screening in this study also inform us to be cautious to generalize the findings in this study. As FCHVs are the frontline voluntary health workers in Nepal, most FCHVs did not receive secondary education. Some of them could not even read or write. According to the data from the National FCHV Survey Report 2014, only 21% of FCHVs completed high school or a higher level of education, and 55% of FCHVs reportedly were not able to read or could only could partially read (Advancing Partners & Communities, 2015). Therefore, we must be careful in generalizing the findings from this study to FCHVs overall, or to the FCHVs in other areas or with a lower education level, even though the participants in this study performed well in conducting community-based CVD risk screening.

#### ***4.2 FCHVs' attitude towards community-based NCD programs***

The FCHV program in Nepal is a prominent exemplar of engaging lay people to improve public health in low-resource settings. Compared with other similar CHW delivered program in LMICs, the FCHV program stands out for its low attrition rate, low education requirement, and low payment. After 30 years' development, the FCHV program has become the trusted and accessible source of basic health services in Nepal.

Although FCHVs are voluntary health workers, they are very eager to learn and highly motivated to improve health conditions in their communities.

In this study, FCHVs explicated the growing number of people with chronic conditions in their community. Through focus group discussions, FCHVs expressed their enthusiasm for performing NCD prevention and management tasks in their catchment area and were willing to receive more training regarding NCD prevention and control. All the findings prove that FCHVs are highly motivated to perform NCD prevention and control in their community. This finding concurs with previous evidence (Neupane et al., 2015). In Neupane's study, FCHVs from the Kaski district expressed a strong willingness to engage in the prevention and control of hypertension, and were confident of their capability (Neupane et al., 2015).

Coupled with the findings of capacity assessment in this study, the positive experience of FCHVs in implementing the community level CVD risk assessment program confirms the feasibility of a larger study in this area.

### ***4.3 Cardiovascular risk among the study population***

Another major finding from this study is the distribution of cardiovascular risk among the study population. According to the screening results by the medical doctor, about 13% of participants in this study had a risk greater than 10% of developing CVDs in the following 10 years. This percentage of people with elevated cardiovascular risk is lower than the findings from similar studies conducted in other LMICs. A CHW-led

CVD risk screening study in Bangladesh, Guatemala, Mexico, and South Africa reported that 22.4% of participants had a 5-year cardiovascular risk greater than 10% (Gaziano et al., 2015). The difference might be caused by the different risk scoring tools used in the Gaziano study. In this study, we used the 10-year CVD risk scoring chart developed by the WHO, while the Gaziano study used a self-developed 5-year CVD risk scoring chart (Gaziano et al., 2015).

Identifying populations at high risk of developing CVDs has proven to be a cost-effective measure for reducing the mortality and disability related to it (Lim et al., 2007). Unfortunately, a CVD risk screening tool specially designed for the Nepalese population has not been developed yet. The tool used in this study was adopted from the WHO PEN package, which was designed for the WHO Southeast Asia region, including Nepal (WHO, 2010a). Although this tool was not specially designed for the Nepalese population, it is the only validated CVD risk scoring chart applicable for the Nepalese context when the study was conducted. However, a more contextualized tool would be useful for future use to better assess the CVD risk of the Nepalese population.

#### ***4.4 Strengths and Limitations***

This study is the first to examine the training of FCHVs in Nepal for cardiovascular risk screening. The exploration and findings in this study provide valuable information to support further investigations involving FCHVs in Nepal for more tasks related to the prevention and control of NCDs.

A mixed methods approach was employed in this study. The quantitative component provides measurable indicators to assess FCHVs' capability for community-based cardiovascular risk scoring. The qualitative component explores FCHVs' attitudes towards their potential involvement in NCD-related tasks, as well as their experience during the study. This research approach makes this study more thorough and scientific.

However, there are several limitations of this study.

First, the sample size of FCHVs in this study was relatively small and not representative compared to the general FCHV profile in Nepal. FCHV participants in this study have a relatively high education level (80% attained school leaving certificates) compared to the general profile of FCHVs in Nepal, which might limit the generalizability of this study to the entire FCHV program. According to the data from the National FCHV Survey Report 2014, only 21% of FCHVs completed high school or a higher level of education, and 55% of FCHVs reportedly were not able to read or could only read partially (Advancing Partners & Communities, 2015). Further research is needed to examine whether FCHVs of lower education could be trained to perform CVD risk screening or other tasks in relation to the prevention and control of NCDs in their communities.

Second, a person with diabetes is defined as "someone taking insulin or oral hypoglycaemic drugs, or with a fasting plasma glucose concentration above 7.0 mmol/l or postprandial plasma glucose concentration above 11.0 mmol/l" (World Health

Organization, 2010). To determine the presence or absence of diabetes for CVD risk scoring, a urine sugar test is suggested to replace the plasma glucose test in the WHO PEN package for assessing cardiovascular risk in very low resource settings (World Health Organization, 2010). However, this study used self-reported diabetes status for CVD risk scoring due to the cost of glucose testing. This method might make the CVD risk scores less reliable due to recall bias and a low awareness rate of diabetes.

Third, FCHVs were compensated for their participation in this study at a relatively higher amount of payment compared to what they usually get from the government for their daily FCHV work. Such a high compensation may not be sustainable by the government-led programs, which might limit the generalizability of this program to the national level.

#### ***4.5 Implications for policy and practices***

This study provided promising evidence that FCHVs are prepared and enthusiastic to get more training regarding NCDs. Given the findings of this study and previous evidence of engaging FCHVs in NCD prevention and control (Neupane et al., 2015), we suggest the Nepalese Ministry of Health incorporate NCD contents into the FCHV pre-training package and refresher training sessions. The potential for the FCHV program to tackle NCDs should be addressed and utilized properly.

However, there are many challenges lying ahead. The greatest challenges for scaling such an FCHV-led program are the capacity for FCHVs, sustainability,

affordability, collaboration between FCHVs and health systems, and integration of FCHV-led NCD management intervention into the existing health system. National efforts are called on to build a sustainable model of involving FCHVs for managing chronic conditions. Payers, including international donors, and decision makers should pay more attention to the surging burden of NCDs in Nepal and the possibility of involving FCHVs to combat the battle against NCDs.

#### ***4.6 Implications for further research***

In the study, FCHVs were trained as an independent unit to screen community members for high risk of developing CVDs. However, NCD prevention and management is a complicated task that requires cooperation from multiple sectors, including FCHVs, health posts, higher-level health facilities, and the health Ministry. Therefore, more research is needed to better coordinate the collaborations among the various layers of the health system.

Besides, following-up with a high-risk population with the appropriate management plan is as important as identifying them. Without proper prevention and management strategies, it is useless and even harmful to identify high cardiovascular disease risk populations. Due to time and budget limitations in the current study, we were not able to train FCHVs to perform community-based lifestyle interventions for reducing CVD risk or to evaluate the long-term impact of this program. Future studies should assess FCHVs' capacity for performing community-based lifestyle interventions

and the long-term impact of these interventions to manage patients with chronic diseases in their communities.

What's more, while the findings have demonstrated that FCHVs with a secondary level education can perform CVD risk screening after training, the literacy and education level of FCHVs throughout Nepal is not uniform. Therefore, more studies are needed to determine whether and how FCHVs with no or low education levels can be engaged in CVD risk screening.

## 5. Conclusion

The study has highlighted the potential of FCHVs in the prevention and management of NCDs in Nepal. The findings proved that FCHVs with secondary level educations could properly perform community-based CVD risk screening upon receiving training. After the three-day training, FCHVs were able to accurately identify people with a high risk of developing CVDs in the following 10 years using the non-invasive cardiovascular risk scoring chart.

Nonetheless, cardiovascular risk screening is only one small part of community-based NCD interventions. More research is needed to explore the possibility of engaging FCHVs in NCD interventions more effectively and efficiently. What's more, identifying high cardiovascular risk populations is only the first step of preventing CVDs. It is more important to help those populations at high-risk to reduce and control their risk factors. The prevention and control of NCDs requires the cooperation of whole health system, including but not limited to hospitals, community health centers, health posts, and FCHVs. Obviously, the FCHV program is only a small part of this whole system. How to integrate FCHVs in the health system for the prevention and control of NCDs would require further research.

## Appendix A Data Collection Tool in English and Nepali

### CVD Related Health Information Survey

Participant's Name	FCHV ID	
<b>Self-report health information</b>		
1. Gender: ____Male ____Female ____Other		
2. Age (If the subject could not remember his/her age, proceed to question 3) <input type="checkbox"/> <input type="checkbox"/>		
3. Birth year (Nepali Calendar) <input type="checkbox"/> <input type="checkbox"/> /20 <input type="checkbox"/> <input type="checkbox"/>		
4. Have you ever been told by a doctor that you have type 1 or type 2 diabetes?	____Yes ____No	
5. Have you ever been told by a doctor that you have cardiovascular diseases, including heart attack, stroke, and other established coronary heart disease, cerebrovascular disease and peripheral vascular disease?	____Yes ____No	
<b>Now I am going to ask you some questions about smoking.</b> (This component is adopted from WHO STEPS NCD risk factor surveillance instrument. )		
6. Did you smoke any tobacco products, such as cigarettes, cigars or pipes during past 30 days?	____Yes ____No	
7. Did you smoke any tobacco products, such as cigarettes, cigars or pipes during past 1 year?	____Yes ____No	
<b>Blood pressure</b> (The mean of the two systolic blood pressure readings will be used for CVD risk scoring.)		
Reading 1	Systolic: mmHg Diastolic: mmHg	
Reading 2	Systolic: mmHg Diastolic: mmHg	

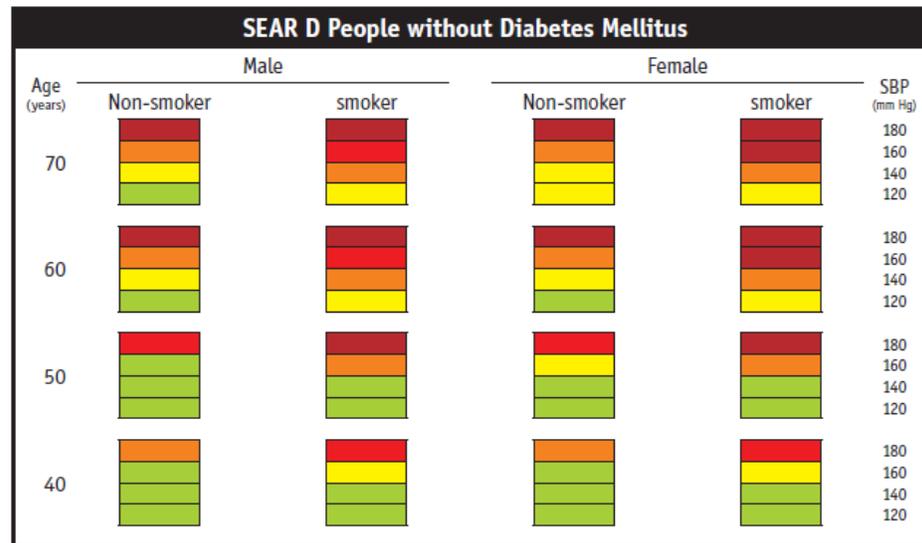
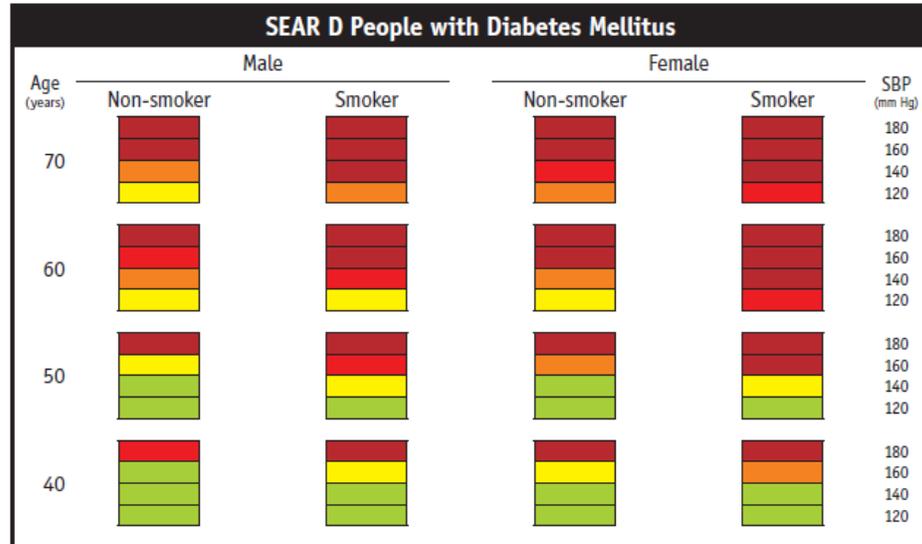
## हृदय तथा रक्त नलीका रोग सम्बन्धि स्वास्थ्य जानकारी सर्वेक्षण

सहभागीको नाम:	म.स्वा.स्व.से. पहिचान नम्बर:	
<b>सहभागीद्वारा आफ्नो स्वास्थ्यबारे दिईएको जानकारी</b>		
१ लिंगः ___पुरुष ___महिला ___ अन्य		
२. उमेर (यदि सहभागीलाई आफ्नो उमेर याद छैन भने, प्र.न. ३ मा जानुहोस्) <input type="checkbox"/> <input type="checkbox"/> पूरा वर्ष)		
३. जन्म मिति (वि.स.): <input type="checkbox"/> <input type="checkbox"/> / <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> महिना साल		
४. तपाईंलाई मधुमेह भएको छ भनेर कहिल्यै कुनै डाक्टरले भन्नु भएको छ?	___छ ___छैन	
५. तपाईंलाई हृदय वा रक्त सम्बन्धि रोग (हृदयघात, मस्तिस्कघात तथा अन्य ) लागेको छ भनेर कहिल्यै कुनै डाक्टरले भन्नु भएको छ?	___छ ___छैन	
<b>अब म तपाईंलाई सुर्तीजन्य वस्तुको प्रयोगबारे केही प्रश्नहरू सोध्दैछु।</b>		
६. विगतका ३० दिनमा तपाईंले कुनै सुर्तीजन्य पदार्थ जस्तै चुरोट, सिगार वा पाइपको सेवन गर्नुभएको थियो ?	___छ ___छैन	
७. विगतको १ वर्षमा तपाईंले कुनै सुर्तीजन्य पदार्थ जस्तै चुरोट, सिगार वा पाइपको सेवन गर्नुभएको थियो ?	___छ ___छैन	
<b>रक्तचाप</b> (जोखिम मापनको लागि पहिलो र दोस्रो परिक्षणको औसत रक्तचाप लिईनेछ ।)		
पहिलो परिक्षण	सिस्टोलिक (SYS) ____mmHg डाएस्टोलिक (DIA) ____mmHg	
दोस्रो परिक्षण	सिस्टोलिक (SYS) ____mmHg डाएस्टोलिक (DIA) ____mmHg	

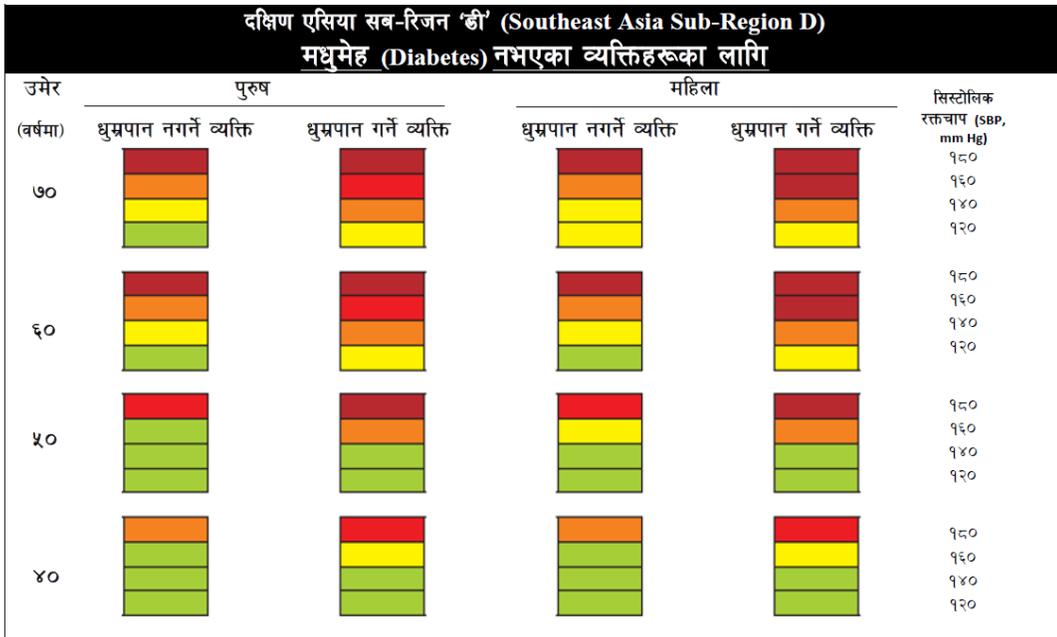
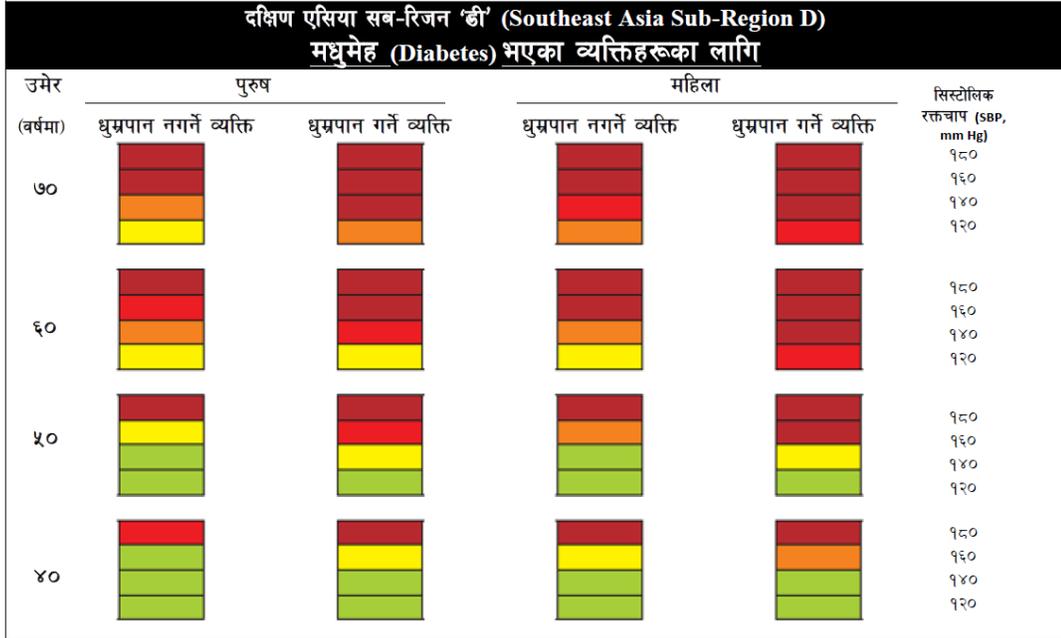
# Appendix B Cardiovascular risk scoring chart in English and Nepali

## WHO/ISH CVDs risk prediction chart for Southeast Asia Sub-Region D (SEAR D)

Risk Level ■ <10% ■ 10% to <20% ■ 20% to <30% ■ 30% to <40% ■ ≥40%



दक्षिण एसिया सब-रिजन 'डी' (Southeast Asia Sub-Region D) का लागि विश्व स्वास्थ्य संघ/इन्टरनेशनल सोसाइटी अफ हाइपरटेन्सनको (WHO/ISH) हृदय तथा नसा सम्बन्धि रोगहरूको जोखिम मापन चार्ट



## Appendix C Focus Group Discussion Guide

### Consent Process

Consent forms for focus group participants are completed in advance by all those seeking to participate. Below is a summary of the information in the consent form that focus group organizers and facilitators should use to make sure participants understand the information in the consent form.

*Thank you for agreeing to participate. We are very interested to hear your valuable opinion on how FCHVs can be mobilized for CVD risk screening.*

- *The purpose of this focus group is to learn how FCHVs view the training and tasks regarding CVD risk screening.*
- *The information you give us is completely confidential, and we will not associate your name with anything you say in the focus group.*
- *We would like to record the focus groups so that we can make sure to capture the thoughts, opinions, and ideas we hear from the group. No names will be attached to the focus groups and the recording will be destroyed as soon as they are transcribed and analyzed.*
- *You may refuse to answer any question or withdraw from the study at any time.*
- *We understand how important it is that this information is kept private and confidential. We will ask participants to respect each other's confidentiality, however this cannot be assured.*
- *If you have any questions now or after this discussion, you can always contact a study team member.*

### Process of Focus group discussion

1. Welcome

Introduce yourself and the notetaker and send the Sign-In Sheet around to the group while you are introducing the focus group.

*Review the following:*

- Who we are and what we're trying to do
- What will be done with this information
- Why we asked you to participate

2. Explanation of the process

Ask the group if anyone has participated in a focus group before. Explain that focus groups are being used more and more often in health and human services research.

*About focus groups*

- We learn from you (positive and negative)
- Not trying to achieve consensus, we're gathering information
- In this project, we are doing focus group discussions to get more in-depth information from participants. This allows us to understand the context behind the data we get from the quantitative research and helps us explore topics in more detail.

*Logistics*

- Focus group will last about one hour to one and a half hours
- Feel free to move around
- Help yourself to refreshments

### 3. Ground Rules

- Everyone should participate.
- Information provided in the focus group must be kept confidential
- Stay with the group and please don't have side conversations
- Turn off cell phones if possible

4. Turn on Recorder if all participants agree to be audiotaped.

5. Ask the group if there are any questions before we get started and address those questions.

### 6. Introductions

- Go around table: job here, where you were born

### 7. Discussion Questions:

- Let's do a quick round of introduction. Can each of you tell the group your name, your age, how many household you serve as a FCHV, and how long you have been working as a FCHV.
- What do you know about CVD, and other NCDs including hypertension, diabetes, cancer, etc. before this study?
- How long do you work per week as a FCHV?
  - a. Probe: Do you feel overloaded with your daily tasks?
  - b. Probe: Will you be able to manage your time if some NDC-related work is assigned to you by the government?
- What are the motivations for you to work as a FCHV?

- a. Probe: What is the most important motivation?
- b. Probe: Do you think financial compensation will motivate you for your work?
- c. Probe: If the government wants to allocate some NCD-related task to you, would you need more financial or nonfinancial compensations as motivation?
- What is your opinion of the burden of CVD in your community?
  - a. Probe: As the burden of CVD in Nepal is increasing, are you willing to be trained about CVD and do some work related with CVD?
- Are you interested in the training we provided?
  - a. Probe: If yes, why are you interested in such training?
  - b. Probe: What kind of training do you want to have in the future?
- Do you think the training in this study is adequate enough for you to perform the required tasks?
  - a. Probe: If not adequate, what training is further needed?
  - b. Probe: Which part of the training should be further strengthened?
- What are the challenges or difficulties you encountered when you perform CVD risk scoring?
  - a. Probe: Did you have any difficulties related with blood pressure measurement?
  - b. Probe: Did you have any difficulties in using the CVD risk scoring chart?

- c. Probe: Did you have any difficulties in answering community member's questions?
- What are the resources you need to better help you to perform CVD risk scoring?
  - a. Probe: This can be a wide range of resources – equipment, portable CVD training material, refresh training etc. You can name anything that can help you better do your job.

## 8. Concluding

Thank you so much for coming and sharing your thoughts and opinions with us. We have a short evaluation form that we would like you to fill out if you time. If you have additional information that you did not get to say in the focus group, please feel free to write it on this evaluation form.

## Appendix D Training Schedule

Time	Sessions	Methods
<b>July 19<sup>th</sup>/Day 1</b>		
9:00 am to 9:15 am	Registration	
<b>Theme 1 Greetings and opening</b>		
9:20 am to 10:00 am	1.1 Greeting and opening remarks 1.2 Ice-breaker	Participatory
10:00 am to 10:30 am	1.3 Brief introduction of the study <ul style="list-style-type: none"> <li>• Background, rationale of the study</li> <li>• Objectives</li> <li>• FCHV's role in this study</li> </ul>	- Power point presentation - Q&A
10:30 am to 10:40 am	Tea Break	
<b>Theme 2 CVD knowledge</b>		
10:40 am to 11:10 am	2.1 What are CVDs? Focusing on heart attack and stroke	- Power point presentation
11:10 am to 11:40 am	2.2 CVD risk factors	- Power point presentation
11:40 am to 12:30 pm	2.3 Evidence-based strategies to reduce CVD risk	- Power point presentation - Plenary discussion
12:30 pm to 1:30 pm	Lunch Break	
1:30 pm to 2:30 pm	2.4 Didactic training assessment	- Knowledge quiz
<b>Theme 3 WHO/ISH CVD risk scoring chart</b>		
2:30 pm to 3:30 pm	3.1 What is CVD risk scoring chart; why is it useful?	- Power point presentation - Q&A
3:30 pm to 4:00 pm	3.2 How to use the CVD risk scoring chart	- Power point presentation
4:00 pm to 4:10 pm	Tea Break	
4:10 pm to 4:40 pm	3.3 Case study	
4:40 pm to 4:50 pm	Feedback	- Anonymous card
<b>July 20<sup>th</sup>/Day 2</b>		

<b>Theme 4 Practical training</b>		
9:30 am to 10:00 am	Recap	
10:00 am to 10:40 am	4.1 Ethical protocol	- Power point presentation - Plenary discussion
10:40 am to 11:30 am	4.2 Data collection	- Power point presentation - Mock interview
11:30 am to 11:40 am	Tea Break	
11:40 am to 12:30 pm	4.3 Blood pressure measurement	- Practicum
12:30 pm to 1:30 pm	Lunch Break	
<b>Theme 5 Practicum</b>		
1:30 pm to 2:30 pm	5.1 Paired exercise	- Exercise
2:30 pm to 3:00 pm	5.2 Feedback and group discussion for paired exercise	- Plenary discussion
3:00 pm to 3:10 pm	Tea Break	
3:10 pm to 4:00 pm	5.3 Recap	
<b>July 21<sup>st</sup>/ Day 3</b>		
<b>Theme 6 Training assessment</b>		
9:30 am to 11:30 am	6.1 Mock Session (training assessment)	
11:30 am to 11:40 am	Tea Break	
11:40 am to 12:10 pm	6.2 Feedback for mock sessions	
12:10pm to 1:30 pm	Lunch Break	
<b>Theme 7 Summary and conclusion</b>		
1:30 pm to 2:30 pm	7.1 Concluding discussion Results of training assessment, financial details, communication arrangements, contract signing, arrangement for data collection	- Plenary discussion
2:30 pm to 3:00 pm	7.2 Closing remarks	

## References

- Advancing Partners & Communities. (2015). *Female community health volunteer (FCHV) national survey report*.
- Alleyne, G., Binagwaho, A., Haines, A., Jahan, S., Nugent, R., Rojhani, A., . . . Group, L. N. A. (2013). Embedding non-communicable diseases in the post-2015 development agenda. *The Lancet*, 381(9866), 566-574.
- Aryal, K. K. (2014). *Non communicable diseases risk factors: STEPS survey Nepal 2013*: Nepal Health Research Council (NHRC).
- Babamoto, K. S., Sey, K. A., Camilleri, A. J., Karlan, V. J., Catalasan, J., & Morisky, D. E. (2009). Improving diabetes care and health measures among hispanics using community health workers: Results from a randomized controlled trial. *Health education & behavior*, 36(1), 113-126.
- Balagopal, P., Kamalamma, N., Patel, T. G., & Misra, R. (2012). A community-based participatory diabetes prevention and management intervention in rural India using community health workers. *The Diabetes Educator*, 38(6), 822-834.
- Brownstein, J. N., Chowdhury, F. M., Norris, S. L., Horsley, T., Jack, L., Zhang, X., & Satterfield, D. (2007). Effectiveness of community health workers in the care of people with hypertension. *American journal of preventive medicine*, 32(5), 435-447.
- Bygbjerg, I. (2012). Double burden of noncommunicable and infectious diseases in developing countries. *Science*, 337(6101), 1499-1501.
- Center for Disease Control and Prevention. (1994). *Community health advisors: Models, research and practice selected annotations-United States*. U.S. Department of Health and Human Services.
- Department of Health Services. (2015). *Annual Report 2014/2015*. Retrieved from [http://dohs.gov.np/wp-content/uploads/2016/06/Annual\\_Report\\_FY\\_2071\\_72.pdf](http://dohs.gov.np/wp-content/uploads/2016/06/Annual_Report_FY_2071_72.pdf)
- Dhitali, S. M., & Karkiii, A. (2013). *Dealing with the burden of hypertension in Nepal: Current status, challenges and health system issues*. Paper presented at the Regional Health Forum.
- Dhungana, R. R., Pandey, A. R., Bista, B., Joshi, S., & Devkota, S. (2016). Prevalence and associated factors of hypertension: A community-based cross-sectional study in municipalities of Kathmandu, Nepal. *International Journal of Hypertension*, 2016.

- Di Cesare, M., Khang, Y.-H., Asaria, P., Blakely, T., Cowan, M. J., Farzadfar, F., . . . Msyamboza, K. P. (2013). Inequalities in non-communicable diseases and effective responses. *The Lancet*, *381*(9866), 585-597.
- Gautam, R. (2013). NCDs in Nepal: Burgeoning burden amid low priority and the ways forward. *Health Prospect*, *11*.
- Gaziano, T. A., Abrahams-Gessel, S., Denman, C. A., Montano, C. M., Khanam, M., Puoane, T., & Levitt, N. S. (2015). An assessment of community health workers' ability to screen for cardiovascular disease risk with a simple, non-invasive risk assessment instrument in Bangladesh, Guatemala, Mexico, and South Africa: An observational study. *The Lancet Global Health*, *3*(9), e556-e563.
- Ghaffar, A., Reddy, K. S., & Singhi, M. (2004). Burden of non-communicable diseases in South Asia. *BMJ: British Medical Journal*, *328*(7443), 807.
- Glenton, C., Scheel, I. B., Pradhan, S., Lewin, S., Hodgins, S., & Shrestha, V. (2010). The female community health volunteer programme in Nepal: Decision makers' perceptions of volunteerism, payment and other incentives. *Social Science & Medicine*, *70*(12), 1920-1927.
- Global Burden of Disease Collaborative Network. (2017). *Global burden of disease study 2016 (GBD 2016) results*. Retrieved from <http://ghdx.healthdata.org/gbd-results-tool>
- Government of Nepal. (2014). Multisectoral action plan for the prevention and control of non-communicable diseases (2014-2020). Retrieved from <https://extranet.who.int/nutrition/gina/sites/default/files/NPL%202014%20NCD%20Multisectoral%20Action%20Plan.pdf>
- Gyawali, B., Sharma, R., Neupane, D., Mishra, S. R., Van Teijlingen, E., & Kallestrup, P. (2015). Prevalence of type 2 diabetes in Nepal: A systematic review and meta-analysis from 2000 to 2014. *Global Health Action*, *8*(1), 29088.
- Hunter, D. J., & Reddy, K. S. (2013). Noncommunicable diseases. *New England Journal of Medicine*, *369*(14), 1336-1343.
- Joshi, R., Alim, M., Kengne, A. P., Jan, S., Maulik, P. K., Peiris, D., & Patel, A. A. (2014). Task shifting for non-communicable disease management in low and middle income countries—A systematic review. *PLOS ONE*, *9*(8), e103754.
- Khatri, R. B., Mishra, S. R., & Khanal, V. (2017). Female community health volunteers in

- community-based health programs of Nepal: Future Perspective. *Frontiers in public health*, 5, 181.
- Koniak-Griffin, D., Brecht, M.-L., Takayanagi, S., Villegas, J., Melendrez, M., & Balcázar, H. (2015). A community health worker-led lifestyle behavior intervention for Latina (Hispanic) women: Feasibility and outcomes of a randomized controlled trial. *International journal of nursing studies*, 52(1), 75-87.
- Lim, S. S., Gaziano, T. A., Gakidou, E., Reddy, K. S., Farzadfar, F., Lozano, R., & Rodgers, A. (2007). Prevention of cardiovascular disease in high-risk individuals in low-income and middle-income countries: Health effects and costs. *The Lancet*, 370(9604), 2054-2062.
- Ministry of Health. (2017). Nepal Health Sector Strategy Implementation Plan 2016-2021. Retrieved from [http://nepalphysio.org.np/wp-content/uploads/2017/04/NHSS\\_implementation\\_plan\\_2016\\_2021.pdf](http://nepalphysio.org.np/wp-content/uploads/2017/04/NHSS_implementation_plan_2016_2021.pdf)
- Ministry of Health - MOH/Nepal, New ERA/Nepal, & ICF. (2017). *Nepal demographic and health survey 2016*. Retrieved from Kathmandu, Nepal: <http://dhsprogram.com/pubs/pdf/FR336/FR336.pdf>
- Maher, D., Ford, N., & Unwin, N. (2012). Priorities for developing countries in the global response to non-communicable diseases. *Globalization and Health*, 8(1), 14.
- Maher, D., Harries, A. D., Zachariah, R., & Enarson, D. (2009). A global framework for action to improve the primary care response to chronic non-communicable diseases: A solution to a neglected problem. *BMC Public Health*, 9(1), 355.
- McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia medica*, 22(3), 276-282.
- Mendis, S., Al Bashir, I., Dissanayake, L., Varghese, C., Fadhil, I., Marhe, E., . . . Sow, I. (2012). Gaps in capacity in primary care in low-resource settings for implementation of essential noncommunicable disease interventions. *International Journal of Hypertension*, 2012.
- Ministry of Health - MOH/Nepal, New ERA/Nepal, & ICF. (2017). *Nepal demographic and health survey 2016*. Retrieved from Kathmandu, Nepal: <http://dhsprogram.com/pubs/pdf/FR336/FR336.pdf>
- Mishra, S. R., Kallestrup, P., & Neupane, D. (2016). Country in Focus: Confronting the challenge of NCDs in Nepal. *The Lancet Diabetes & Endocrinology*, 4(12), 979-980.

- Mishra, S. R., Neupane, D., Preen, D., Kallestrup, P., & Perry, H. B. (2015). Mitigation of non-communicable diseases in developing countries with community health workers. *Globalization and Health*, 11(1), 43.
- Murray, C. J., Vos, T., Lozano, R., Naghavi, M., Flaxman, A. D., Michaud, C., . . . Abdalla, S. (2013). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. *The Lancet*, 380(9859), 2197-2223.
- Neupane, D., Kallestrup, P., McLachlan, C. S., & Perry, H. (2014). Community health workers for non-communicable diseases. *The Lancet Global Health*, 2(10), e567.
- Neupane, D., McLachlan, C. S., Gautam, R., Mishra, S. R., Thorlund, M., Schlütter, M., & Kallestrup, P. (2015). Literacy and motivation for the prevention and control of hypertension among female community health volunteers: A qualitative study from Nepal. *Global Health Action*, 8, 10.3402/gha.v3408.28254. doi:10.3402/gha.v8.28254
- Neupane, D., McLachlan, C. S., Mishra, S. R., Olsen, M. H., Perry, H. B., Karki, A., & Kallestrup, P. (2018). Effectiveness of a lifestyle intervention led by female community health volunteers versus usual care in blood pressure reduction (COBIN): An open-label, cluster-randomised trial. *The Lancet Global Health*, 6(1), e66-e73.
- Norris, S. L., Chowdhury, F. M., Van Le, K., Horsley, T., Brownstein, J. N., Zhang, X., . . . Satterfield, D. W. (2006). Effectiveness of community health workers in the care of persons with diabetes. *Diabetic Medicine*, 23(5), 544-556.
- Pastakia, S. D., Ali, S. M., Kamano, J. H., Akwanalo, C. O., Ndege, S. K., Buckwalter, V. L., . . . Bloomfield, G. S. (2013). Screening for diabetes and hypertension in a rural low income setting in western Kenya utilizing home-based and community-based strategies. *Globalization and Health*, 9(1), 21.
- Panday, S., Bissell, P., Teijlingen, E., & Simkhada, P. (2017). The contribution of female community health volunteers (FCHVs) to maternity care in Nepal: A qualitative study. *BMC Health Services Research*, 17(1), 623.
- Samb, B., Desai, N., Nishtar, S., Mendis, S., Bekedam, H., Wright, A., . . . Patel, K. (2010). Prevention and management of chronic disease: A litmus test for health-systems strengthening in low-income and middle-income countries. *The Lancet*, 376(9754), 1785-1797.

- Sharma, S. K., Ghimire, A., Radhakrishnan, J., Thapa, L., Shrestha, N. R., Paudel, N., . . . Brodie, D. (2011). Prevalence of hypertension, obesity, diabetes, and metabolic syndrome in Nepal. *International Journal of Hypertension*, 2011.
- The World Bank, World Development Indicators. (2016). *GDP per capita (Current US\$)*. Retrieved from <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD>
- Upreti, S. R., Lohani, G. R., Magtymova, A., & Dixit, L. P. (2016). Strengthening policy and governance to address the growing burden of diabetes in Nepal.
- Vaidya, A., Pathak, R. P., & Pandey, M. R. (2012). Prevalence of hypertension in Nepalese community triples in 25 years: A repeat cross-sectional study in rural Kathmandu. *Indian heart journal*, 64(Sullivan et al.), 128-131.
- Whiting, D. R., Guariguata, L., Weil, C., & Shaw, J. (2011). IDF diabetes atlas: Global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract*, 94(3), 311-321.
- WHO, UNICEF, UNFPA, World Bank, & United Nations Population Division. (2015). *Trends in Maternal Mortality: 1990 to 2015*. Retrieved from Geneva, World Health Organization World Health Organization. (2002). Innovative care for chronic conditions: building blocks for actions: Global report.
- World Health Organization. (2010a). *Package of essential noncommunicable (PEN) disease interventions for primary health care in low-resource settings*.
- World Health Organization. (2010b). *Package of essential noncommunicable (PEN) disease interventions for primary health care in low-resource settings (9241598999)*. Retrieved from
- World Health Organization. (2013). Global action plan for the prevention and control of noncommunicable diseases 2013-2020.
- World Health Organization. (2014). Noncommunicable diseases (Alleyne et al.) country profiles 2014. *Geneva: WHO*.
- Xavier, D., Gupta, R., Kamath, D., Sigamani, A., Devereaux, P., George, N., . . . Yusuf, S. (2016). Community health worker-based intervention for adherence to drugs and lifestyle change after acute coronary syndrome: A multicentre, open, randomised controlled trial. *The Lancet Diabetes & Endocrinology*, 4(3), 244-253.