Capacity of Primary Healthcare Facilities on Prevention and Management of Cardiovascular Diseases in a Resource-limited Area in Vietnam

by

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A thesis submitted in partial fulfillment of
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ABSTRACT

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Abstract

Background: Vietnam is in the process of an epidemiological transition, with cardiovascular diseases now ranked as the leading cause of death. This study assessed the commune health centers in selected rural and urban communities in Vietnam in terms of their capacity for prevention and management of cardiovascular diseases by using a mixed method approach.

Methods: The study was conducted in July 2016 in Chi Linh district, Hai Duong province – a mountainous area located in northern Vietnam. Structured questionnaire surveys and in-depth interviews were used to collect data on the current capacity of commune health centers in Chi Linh district. The capacity included six aspects: equipment and service availability, medicine, medical record system, service utilization and referral, financing and human resources. Ten facility staff members in the selected commune health centers were surveyed and interviewed. Five policy makers from the local level, the regional level, and the national level were also interviewed.

Results: A description of Chi Linh district's commune health center capacity on CVD prevention and management was reported. (1) Equipment & Service Availability: Not all essential equipment and health services recommended by WHO was available at commune health centers. A few centers owned glucometers and no center had an ECG machine. (2) Medicine: No diabetic medicines were available in the commune health center; the essential medicines for other CVD conditions were inadequate in terms of quantity and diversity. (3) Medical record system: One fifth of the commune health centers had an electronic medical record system, others used a paper-based record. (4) Service Utilization & Referral: On average, each facility admitted 63 CVD out-patients per month (urban 152, rural 29); none of the facilities could provide in-patient service. (5) Financing: Government budget and social health insurance were the main sources of facility revenue. (6) Human resources: The human resources specialized in CVD were inadequate in commune health centers. On average, there were 0.328 medical doctors, 0.182 nurses and midwives and 0.009 pharmaceutical personnel per 1000 population.

Conclusion: The capacity of commune health centers to prevent and manage cardiovascular diseases in Vietnam is inadequate. The results of this study show critical gaps in primary healthcare facilities in Vietnam in six key areas. They include service delivery, health workforce, health information system, access to essential medicine, financing and governance. Thus, there is an urgent need to improve the capacity of commune health centers.

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1. Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally. It was estimated that 17.5 million people died from CVDs in 2012, which was accounted for 31% of all deaths around the world. The annual cardiovascular disease mortality has been projected to increase to 22.2 million deaths in 2030, considering only the population growth factor and the improved longevity factor (WHO, 2014). There are also growing concerns about the large and rising burden of CVDs from an economic perspective. Over the period of 2011-2025, the cumulative output loss associated with CVDs is projected to be more than US$ 3.76 trillion in low- and middle- income countries (LMICs) (Bloom et al., 2011).

Although the rate of deaths from CVDs has declined in most high-income countries due to a combination of improved risk factors prevention and improved treatment (Moran et al., 2014), CVDs have become an increasing threat to most LMICs, where CVDs death rates trends are still increasing (Fuster & Kelly, 2010). According to WHO, over 80% of all cardiovascular deaths occurred in LMICs (WHO, 2014).

To curb the the rising trend and limit the growing burden in LMICs, especially in resource-limited areas, WHO published its "Package of Essential NCD interventions for primary care in low-resource settings" (WHO PEN) to provide a prioritized set of highly cost-effective interventions that are feasible to be implemented at the primary healthcare (PHC) level, even in the resource-constrained settings. This package identifies core technologies, essential medicines and risk-prediction tools for several non-communicable diseases (NCDs) and provides technical and operational guidelines for integration of essential NCD interventions into PHC in low-resource settings.

Admittedly, life-long diseases like CVDs do need long-term, patient-centered, community-oriented and sustainable healthcare and such care could be delivered equitably only through health systems based on PHC (Demaio, Kragelund Nielsen, Pinkowski Tersbøl, Kallestrup, & Meyrowitsch, 2014; Van Lerberghe, 2008). However, as the first contact point of the patients with the national health system, PHC is often the weakest part of the health system in most LMICs. The current capacity of PHC facilities cannot fulfill the essential requirement in providing routine care of CVDs and delivering the essential interventions. An assessment study conducted in 8 LMICs has also demonstrated large gaps in existing capacity of PHC facilities and the WHO PEN standards in terms of health financing, medicines and technologies, health workforce, and health information systems (Mendis et al., 2012).

In addition, as countries vary in terms of health system structure, economic development level and health policies in combating NCDs, there is never a "one size fits all" solution to strengthen the capacity of the primary healthcare in delivering CVDs management and prevention. Therefore, there is a need to understand the gaps of PHC facilities in resource-limited settings in LMICs and explore the feasible and suitable strategies for delivering essential PHC services for the prevention and control of CVDs

1.1 Vietnam

Vietnam is located in Southeast Asia and is bordered by China to the north, Laos to the northwest, and Cambodia to the southwest. With an estimated 94 million inhabitants, it is the world's 15th-most-populous country (CIA, 2016). 70% of the population is aged between 15 to 64, and the dependency ratios (both youth and elderly) are lower than the world averages (World Bank, 2016). There are 55 ethnic groups, but the dominant *Viet* or *Kinh* ethnic group constitutes over 85% of the population (Central Population and Housing Census Steering Committee, 2010). People who live in the Southeast, North Central Coast and Red River Delta areas have better socioeconomic status than those who live in Northeast, Northwest and Central Highlands (Tran Thi Mai Oanh et al., 2009).

Since 1986, the Vietnamese government has been "transitioning from the rigidities of a centrally-planned economy" (CIA, 2016). In 2014, the agriculture sector's share of economic output was 18.1%; the industry sector's share was 38.5%; and the services sector's share was 43.4%, which was largely due to the prosperous tourism business. The GDP per capital in 2014 was US$ 2,052 with an annual growth rate of 6.0% (World Bank, 2016) and the total expenditure on health was 7.1% of the GDP in 2014 (WHO, 2016).

Compared with countries that have the same GDP per capita, Vietnam has relatively good health outcomes. The life expectancy at birth is 73 years (71 years in males; 76 years in females). The maternal mortality rate is 54 deaths per 100,000 live births. The infant mortality rate is 18 deaths per 10,000 live births. Physicians density is 1.19 physicians per 1000 population (CIA, 2016). Among the leading causes of disability-adjusted life years (DALYs), the top three are all non-communicable diseases (NCDs), followed by unintentional injuries and infectious diseases like HIV, TB and malaria, which means that Vietnam is facing a triple-burden situation (WHO, 2016). In the terms of risk factors, dietary risks, high systolic blood pressure, and alcohol and drug use were the leading risk factors in 2013 (IHME, 2016).

1.2 Cardiovascular diseases in Vietnam

Vietnam is in the process of an epidemiological transition, with CVDs now ranked as the leading cause of death. According to Global Burden of Disease (GBD) 2015, CVDs caused the most deaths and the most premature deaths in Vietnam in that year. Compared to the rates of 2005, the deaths caused by cerebrovascular disease have increased 8.1% and the deaths caused by ischemic heart disease have increased 10.4%. If we measure the disease burden by Years of Life Lost (YLL), cerebrovascular disease, ischemic heart disease and diabetes (as CVDs risk factor) were ranked 1st, 2nd and 7th among all causes. Another GBD study conducted in 2008 showed that CVDs caused 24% YLL in men and 31% YLL in women; if the burden is measured by Disability Adjusted Life Years (DALYs), CVDs were responsible for 17% of the total in men and were responsible for 18% in women (T. T. N. Nguyen et al., 2011). Minh et al. set up a

Demographic Surveillance System at Bavi district, a rural community in the northern Vietnam. They found that CVDs, as the leading cause of death, were accounted for 20% and 25.7% of total mortality in 1999 and 2000, respectively. Over the period of 1999 – 2003, 32% of adult deaths were due to CVDs. The burden of CVDs had far exceeded the burden of infectious diseases (Minh, 2006).

CVDs have a group of metabolic risk factors, including high blood pressure and elevated fasting blood glucose. These two factors have also contributed significantly to the CVDs burden. According to a cross-sectional survey conducted in eight Vietnamese provinces and cities, the prevalence of hypertension among those aged 25 years and over was 25.1% (28.3% in men and 23.1% in women). Among all hypertensive patients, only 48.4% were aware of their hypertensive status, only 29.6% were getting treatment and only 10.7 % got their blood pressure well controlled within the safe range (Son et al., 2012). As reported by the Vietnam Noncommunicable Disease Prevention and Control Programme 2002-2010 Implementation Review, the prevalence of diabetes has more than doubled in Vietnam during the last two decades. A survey conducted in 2008 estimated that the prevalence of diabetes was 3.1%. In addition, the number of people with a pre-diabetic condition is three times higher than those with diabetes(Harper, 2011). Without lifestyle changes, this group of people are very likely to progress to type 2 diabetes.

1.3 Structure of the public health system in Vietnam

The health system in Vietnam is a mixed public-private provider system, in which the public system plays important roles, especially in prevention, research and training (Minh, 2006). The public health facilities covered about 96% of inpatient health services, 60% of outpatient health services and 30% of ambulatory services in 2010 (WHO, 2012).

The public health system in Vietnam is now organized in four levels: national level, provincial level, district level and commune level (See figure 1). At the national level, the Ministry of Health is the major governmental institute to mange a variety of health-related issues, including both curative care and preventive medicine. At the provincial level, the Provincial Health Department receives direct technical guidance and supervision from the Ministry of Health and organizational control from the local Provincial People's Committee, including payroll and operations. In the meantime, the Provincial Health Department also advises the local Provincial People's Committee on local health-related issues. At the district level, the District Health Bureau receives direct technical guidance from the Provincial Health Department and organizational control from the local District People's Committee. The District Center for Preventive Medicine is a governmental agency that recently split from the District Health Bureau. The Preventive Center is under direct control from the Provincial Health Department. At the commune level, the Commune Health Center (CHC) is the first contact point of the patients within the public health system. CHC provides a group of basic primary healthcare services, including vaccination, hygiene inspection, family planning and other services. The CHC receives technical guidance from the District Hospital and is under the control of the District Health Bureau and the local Commune People's Committee. Meanwhile, The District Center for Preventive Medicine also provide guidance and help to CHC in terms of healthcare prevention. Each CHC also organizes and trains a group of Village Health Workers who help CHC to complete its duties.

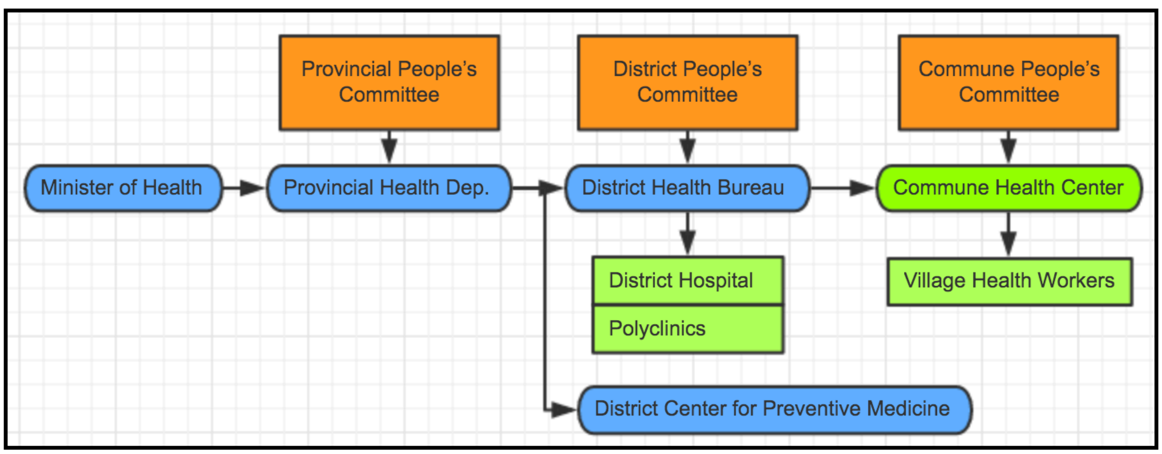

Figure 1: Sketch of the health system structure in Vietnam

1.4 CVDs policy in Vietnam

In 2001, the Prime Minister of Vietnam proposed the 2002-2010 NCD Prevention and Control Program. In the next year, through Decision 77/2002/QD-TTg, this program was officially approved. After Decision 108/2007/QD-TT and Decision 172/2008/QD-TT, four specific diseases, including hypertension, diabetes, cancer and metal disorders, were added to the program as the main targets (Harper, 2011).

The whole program was led by a Steering Committee established in 2002, which was chaired by the Deputy Minister of Health. Four sub-committees were also established to be in charge of the four specific targets. The Cardiology Subcommittee was chaired by the Director of the National Heart Institute and the Diabetes Subcommittee was chaired by the Director of the National Hospital of Endocrinology.

In response to the 2002-2010 NCD Prevention and Control Program, a project management unit was established in each province and city. In addition, at the district level, the District Hospital established a Diabetes Treatment Unit and CVDs Treatment Unit. A variety of hypertension prevention programs and diabetes prevention programs were organized by the District Center of Preventive Medicine. At the commune level, CHC worked closely with the local Commune People's Committee, the Women's Union and the Elderly Union to carry out healthcare programs, under the guidance and help from both the District Hospital and the District Center of Preventive Medicine (See figure 2).

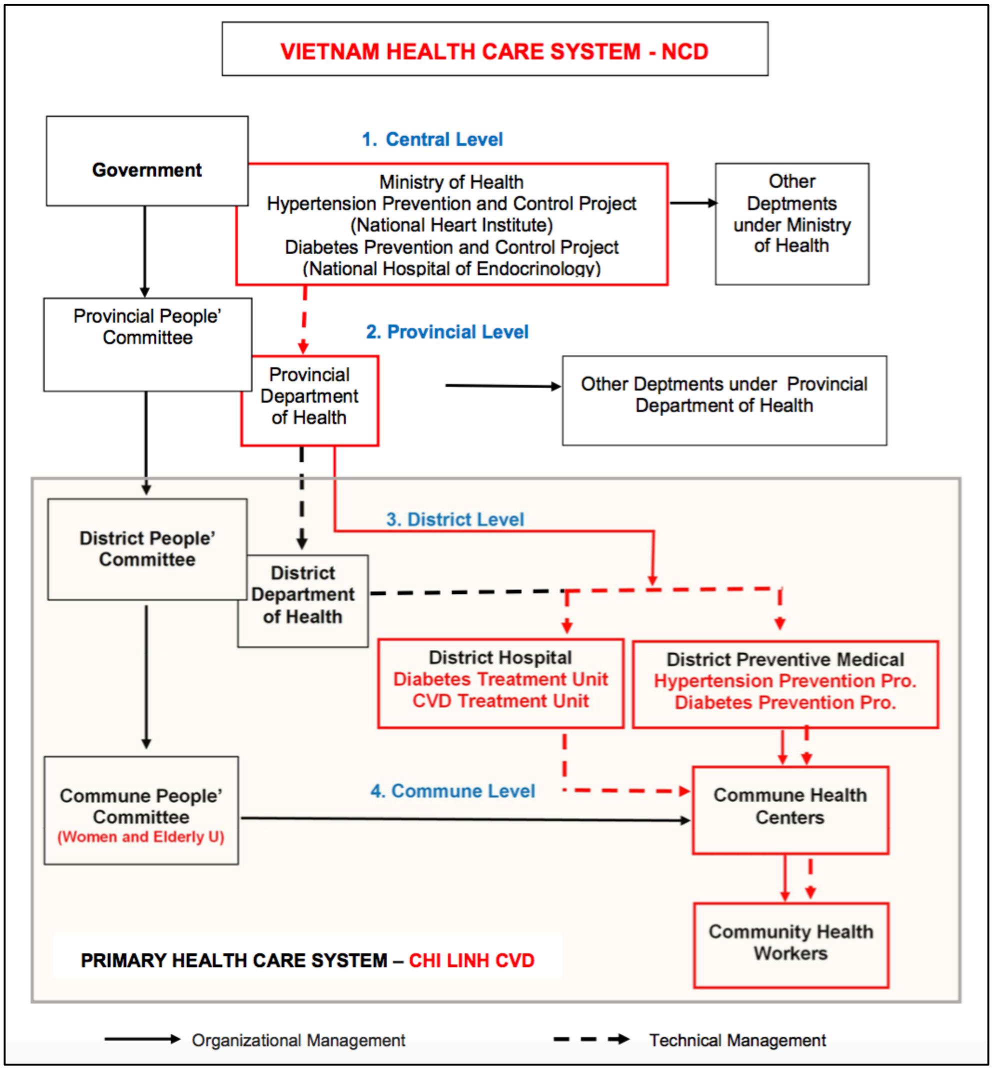

Figure 2: NCD program in Chi Linh District

The main activities in the hypertension program included developing hypertension project management systems, providing training to health professionals, conducting health education in the local community, and conducting pilot hypertension programs at selected areas. Due to limited resources, only about 300 communes from 16 provinces took part in the program in 2009 and 32 provinces took part in the program in 2010. It was estimated that 1.2% of the target age group in the country were covered by the program (Harper, 2011).

The main activities in the diabetes program included establishing a nationwide Endocrinology network, providing training to health professionals, conducting health education in the local community, and conducting screening of the population for early detection. During 2009-2010, a total of 242,295 people from selected communes from 30 provinces were screened, which was less than 1% of the target age group in Vietnam (Harper, 2011).

1.5 Social health insurance in Vietnam

The Vietnamese government is committed to universal health care largely through social health insurance (SHI). SHI in Vietnam provides a generous benefit package for the insured people, and includes four categories of coverage. The first category covers ambulatory, curative and therapeutic services, like renal replacement treatment, organ transplantation and invasive cardiovascular treatment. In order to improve access to health care among poor people, transportation costs for referral are also covered. The second category provides a list of high-tech medical services that are insured, including computerized tomography scan, X-ray and other advanced imaging technology. The third category is the list of reimbursement drugs that are approved by the Ministry of Health. In 2008, the reimbursement drug list for SHI members consisted of 750 western medicines and 237 traditional medicines. Individual hospitals have the right to set their own reimbursement drug list based on the national list. A great number of insured people have to buy their medicine in private pharmacies because the shortage of drug is common in the hospitals. Finally, some traffic accidents are also included in the SHI benefit package, however, the patients an need official statement from the local authorities to get reimbursement from them (Tien, Phuong, Mathauer, & Phuong, 2011).

There are two insurance schemes, including a compulsory scheme and a voluntary scheme. The compulsory scheme consists of two sub-schemes run by Vietnam Social Security. One is a contributory sub-scheme, which covers the formal sector workers and civil servants. They have to contribute 4.5% of their salary as the premium. The other sub-scheme is a non-contributory scheme, which covers the children under six, the poor, and the minority groups. The voluntary scheme targets three groups: full-time students, family members of the mandatory insured people, and others who are not included in the schemes above. The near-poor and school students are subsidized at least 50% and 30% of the premium by the government. Others contribute 4.5% of the minimum salary as the premium. The health insurance coverage rate varies among different subgroups, ranging from 11.4% in the near-poor group to 94.3% in the formal sector worker group (Lieberman & Wagstaff, 2009). As reported by the Vietnam Ministry of Health, the national health insurance coverage rate was nearly 72% in 2015.

However, a study conducted in Cao Lanh District, Dong Thap Province showed that the health insurance coverage rate of the the near-poor was only 20.3% (T. D. Nguyen & Wilson, 2016).

2. Methodology

2.1 Study Design

This was a mixed methods study that incorporated both quantitative and qualitative data collection approaches. A knowledgeable PHC professional from each selected PHC facility was asked to answer the survey questions. In addition, they were also involved in the in-depth interviews, which aimed to further identify gaps and reinforcing factors in delivering the CVD management and prevention at the primary healthcare level. Five policy makers from national (1), regional (2) and local level (2) were also interviewed.

2.2 Study Setting

Chi Linh is a mountainous district of Hai Duong province in northern Vietnam. There are 8 townships (phường) and 12 communes (xã) within this district. The public healthcare system in Chi Linh consists of a district hospital and 20 commune health centers (CHCs), among which we selected 5 CHCs located within the townships (Sao Do, Pha Lai, Chi Minh, Ben Tam, Cong Hoa) and 5 CHCs located within the communes (Hoang Hoa Tham, Co Thanh, Nhan Hue, An Lac, Le Loi) as our study sites. These CHCs are considered typical in terms of urban and rural settings in Vietnam.

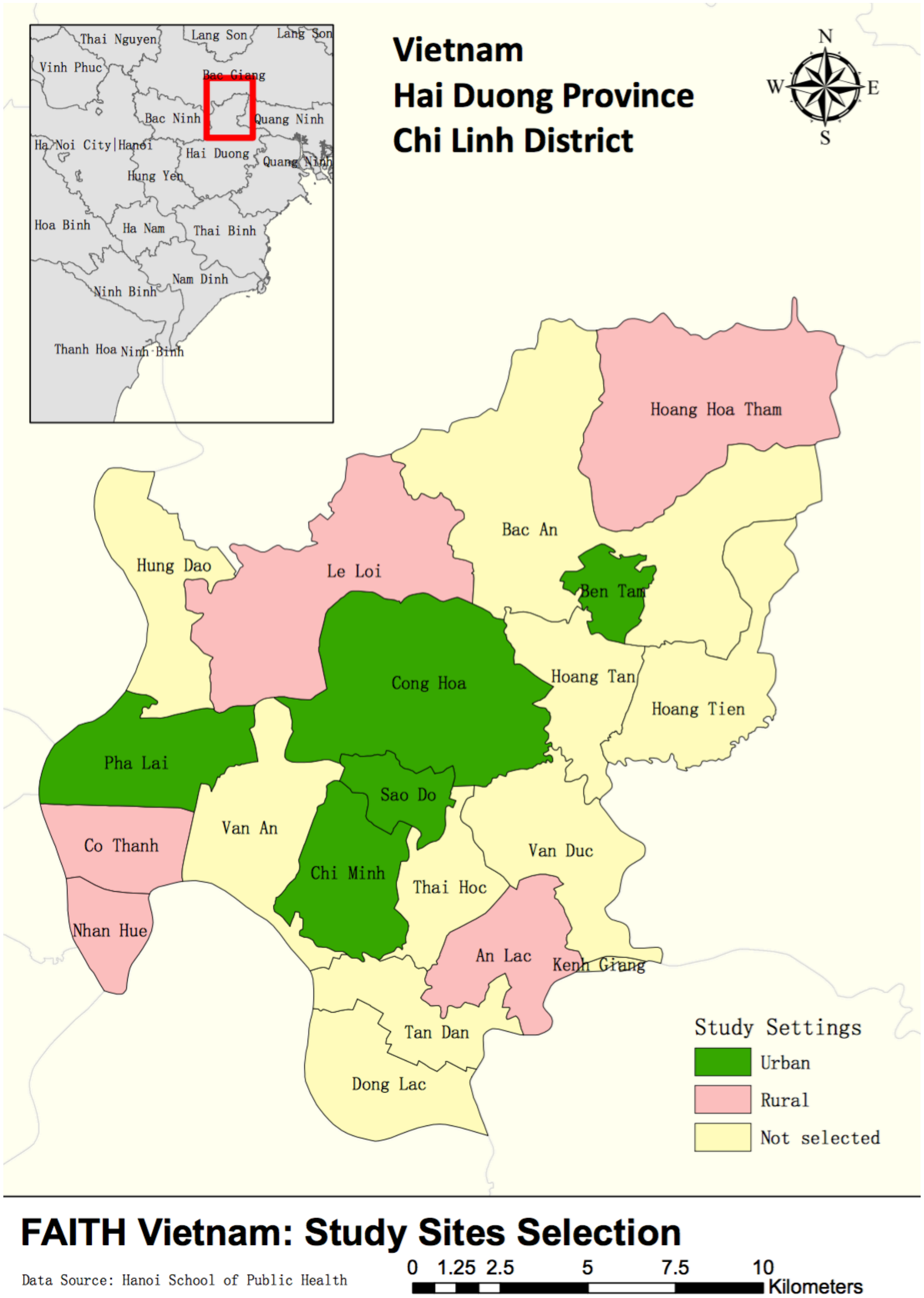

Figure 3: Study sites

2.3 Participants

A knowledgeable health staff from each PHC facility was selected to participate in the Facility Assessment Survey (FAQ) and in-depth interviews. Typically, they were the heads of the CHCs and were qualified as doctors or assistant doctors. The participants met the following criteria: 1) The healthcare staff worked at least 1 year in the facility with good understanding of the capacity of the facility and the CVD related services provided by the facility; and 2) The healthcare staff was willing to participate in the study and was able to provide reliable information.

Policy makers at different levesl were invited to participate the in-depth interviews about the strategy and implementation of NCD related programs. The policy makers were in a position related to PHC and CVDs and were willing to participate in the study.

2.4 Instrument Design

2.4.1 Facility Assessment Questionnaire (FAQ)

The FAQ, administered to knowledgeable PHC providers in the selected PHC facilities, was developed on the basis of the "WHO sample questionnaire for rapid assessment of capacity in primary care facilities" from the WHO PEN, with some revisions to better focus on CVDs prevention (both primary and secondary) and management.

The whole questionnaire required 30 minutes for participants to complete and included 6 sections: A. Equipment & Service Availability; B. Medicine; C. Medical Record System; D. Service Utilization & Referral; E. Financing; and F. Human Resources. (See Appendix A for the Facility Assessment Questionnaire).

Equipment Availability served as one of the most objective indicators for the capacity of healthcare facility. In this section, we investigated the availability of basic equipment for CVDs management, including adult weighing machines, measuring tapes, stethoscopes, glucometers, and ECG machines, with special attention to Blood Pressure Measuring Devices (BPMDs) types and calibrating frequency. To understand the feasibility of implementing potential m-health interventions, we also investigated the availability of information and communication devices, including computer (desktop and laptop), Pad/tablet, cellphone (smart phone and non-smart phone) and internet (Wi-Fi and cable). The m-health part was not designed specifically to CVDs.

Service Availability consisted of two parts in the questionnaire: medical services and educational services. Medical services included injection, IV fluid, blood sugar test and blood cholesterol test. The blood sugar test availability in this section and glucometer availability in the equipment section served as the internal validity test; their answers should be consistent. Educational services included patients counselling for self-management, education on behavioral risk factors to patients and their family members. In addition, we examined the sources of the educational material.

In the **Medicine** Section, we investigated the availability of essential medicine for CVDs, including hypertension and diabetes at PHC level in resource-limited area. The checklist was developed based on the Core list of medicines required for implementing essential NCD interventions in primary care from WHO PEN and the 19th WHO Model List of Essential Medicines.

The **Medical Record System** Section of the FAQ investigated the form of medical record system (paper-based or electronic) and the information being recorded (date, name, symptom, examination results, diagnosis, prescription, etc.). This part was not designed specifically to CVDs.

The **Service Utilization & Referral** Section investigated the total numbers of in-patients, out-patients and home visits in the last month and in the last year. In addition, we excluded other diseases and focused only on CVDs patients. In terms of referral, we investigated the numbers of CVDs patients being referred in the last month and in the last year. We also investigated which institute patients were referred to, the distance of required travel and the means of transportation.

The **Financing** Section examined the composition of the total revenue in the healthcare facility by percentage. This part was not designed specifically to CVDs.

The **Human Resources** Section investigated the formation of human resources in the healthcare facility and the CVDs training (organized by superior institutes) time and CVDs self-study (organized by themselves) time.

2.4.2 PHC provider and policy maker interview guide

The in-depth interview aimed to understand the gaps and reinforcing factors in delivering the CVD management and prevention to patients at the primary healthcare level. The questions focused on the routine prevention and management of CVDs and the six building blocks of the primary healthcare, including health service delivery, health workforce, health information systems, access to essential medicines, health systems financing, and leadership and governance. The interview required approximately 45 minutes for participants to complete. We developed separate guidelines for PHC providers (See Appendix B) and Policy Makers (See Appendix C).

2.5 Data collection

A face-to-face interview approach was adopted for data collection. Researchers asked questions based on the designed questionnaire and interview guide. All data collected were based on self-report.

Quantitative data (FAQ) were collected based on pencil-paper based forms and then entered into the computer by using Epidata software. The in-depth interviews were conducted based on the standardized interview guidelines. Interviews were recorded, transcribed in the local language and then translated into English.

2.6 Procedures

2.6.1 Instrument adaption and local IRB approval

The research team from Hanoi School of Public Health translated the instruments and adapted them into the local context in May, 2016. The medicine checklist in the FAQ was modified based on the Vietnam essential medicine list and the Vietnam health insurance medicine list. All instruments and interview guides were available, and local IRB approval was obtained from Hanoi School of Public Health IRB committee in June 2016.

2.6.2 Pilot study at Sao Do and Hoa Tham

With the support from the head of the Planning Department of Chi Linh Preventative Health Medicine Center, the research team conducted a pilot study on the June 8^{th}, 2016 in the Sao Do ward and Hoa Tham commune, which served as representatives for urban and rural areas. The Facility Assessment Survey and the in-depth interviews were conducted in two healthcare facilities. After the completion of the pilot study, the research team summarized the feedback from the pilot study and made minor revision to the instruments.

2.6.3 Main study data collection

After a training session held on July 7th, six senior students of Hanoi School of Public Health, three master-level researchers (the primary investigator from Duke Kunshan University and two faculties from Hanoi School of Public Health) and a local translator conducted data collection from July 12^{th} to July 22^{nd}. Two research teams were created, each with one master-level researcher from Hanoi School of Public Health and 3 patient interviewers to, independently carry out the study in two different communes each day. The primary investigator and the accompanying translator followed one of the team to supervise. In total, our research team completed 10 FAQs among 10 CHCs and 15 in-depth interviews (including 10 heads of CHCs, 5 policy makers).

2.7 Data management and analysis

After data collection, all data were stored and transferred via Duke Box, a cloud-hosted password-protected platform for storing and sharing files online. Paper files were kept in a locked cabinet and access to the key was limited to relevant researchers.

Since the sample size for the FAQ was small (N=10), the statistical test was not within consideration. Rather, a descriptive analysis was carried out to describe the basic condition and capacity of the primary healthcare facilities on CVD management and control by using Stata version 14.0.

Interview records were transcribed into the local language and then translated into English. The primary investigator reviewed all of the transcriptions and commented on the part that was hard to understand and the Vietnam team further revised the transcriptions based on those comments.

Qualitative data was analyzed by Nvivo and a thematic analysis approach was adopted. There were three stages in this process: text reduction, exploration of text and integration of exploration. First, material was coded, themes were identified and thematic networks were constructed in order to reduce text. Thematic networks were then described and summarized. Finally, the thematic patterns were interpreted.

2.8 Analytic framework

WHO Six Building Blocks is a framework to monitor and evaluate the health system. It consists of six core components or "building blocks": (i) service delivery, (ii) health workforce, (iii) health information systems, (iv) access to essential medicines, (v) financing, and (vi) leadership/governance. We adopted this framework when analyzing both the FAQ results and the qualitative data. Each questionnaire section was classified into one of the six blocks (See Table 1) and the qualitative data was also coded under these six organizing themes.

Table 1: Analytical framework and questionnaire section classification

Six Building Blocks	Related Questionnaire Section
(i) service deliver	A. Equipment & Service Availability
	D. Service Utilization & Referral
(ii) health workforce	F. Human Resources
(iii) health information systems	C. Medical Record System
(iv) access to essential medicine	B. Medicine
(v) financing	E. Financing
(vi) leadership/governance	Qualification of National Standard Question*

2.9 Ethical consideration

We complied with national and international regulations on Institutional Review Board (IRB) review, approval, annual renewal, and reporting of severe adverse events, protocol violation, etc. The central IRB was applied through Duke Kunshan University IRB committee. Local IRB approval was obtained with the support of the Hanoi School of Public Health. All investigators, staff, students or other individuals who worked on the team were trained before their engagement in the study.

Subjects were fully informed that their participations was voluntary and that they had the freedom to decline any question or withdraw at any time. Only after subjects had signed the consent form could the investigators begin to collect information.

We fully respected the privacy of the interview subjects and maintained data confidentiality. Sensitive data collected during this study were thoroughly de-identified. After the data were collected and entered, the identifiable information stored in a separate dataset was password protected. Only relevant researchers could access to this file if there was a research-oriented need. All data were confidentially stored and transferred through Duke Box with password protection and access restriction only to invited necessary personnel. Paper files were kept in a locked cabinet and access to the key was limited to relevant researchers.

3. Results

This chapter details the results obtained from the analysis of quantitative and qualitative data following the six building block framework. We primarily focus on four blocks, including service deliver, health workforce, health information system and human resources; the data for financing and governance are limited. We use WHO PEN standard as the yardstick for medicine section, equipment section and medical service section; others sections are descriptive and are without any specific yardstick.

3.1 Service Delivery

3.1.1 Quantitative Results

As shown in table 2, urban CHCs covered more households and population than CHCs located at rural area. All 10 CHCs were equipped with weighing machines, measuring tapes, stethoscopes and blood pressure measuring devices (BPMDs). Most CHCs used aneroid BPMDs, while only 1 CHC used mercury BPMD. It is important to note that only 3 out of 10 CHCs had glucometers and none of them had ECG machines, which are considered as essential for CVD prevention and management according to WHO. In terms of medical services, all CHCs could conduct injection, 9 could administrate intravenous fluids; while only 3 could conduct blood sugar test and none could conduct blood cholesterol test. All CHCs reported about education or counselling on hypertension and diabetes self-management. The mean monthly managed CVD out-patients of urban CHCs was about three times of the rural CHCs. No CHCs were capable to administrate in-patients. The average distance between CHCs and referral hospital in urban area and in rural area was 5.4 kilometers and 11.4 kilometers respectively. As shown in figure 4, the distances in urban area ranged from 2 to 10 kilometers and the distances in rural area ranged from 8 to 15 kilometers.

As shown in figure 4, most CHCs provided education on four major CVD behavioral risk factors (smoking, abusive drinking, unhealthy diet and physical inactivity) to both patients and their families; however, one urban CHC only educated to patients and one rural CHC only educated on diet and exercise.

Table 2: Service Delivery

	CHCs in urban area (N=5)	CHCs in rural area (N=5)	Total (N=10)
Average population served per facility			
Household	4037	1565	2801
People	15983	6000	10991
Number of facilities with essential equipment for CVD (recommended by WHO)			
Weighing machines	5 (100%)	5 (100%)	10 (100%)
Measuring tape	5 (100%)	5 (100%)	10 (100%)
Stethoscope	5 (100%)	5 (100%)	10 (100%)
Glucometer	2 (40%)	1 (20%)	3 (30%)
ECG machine	0 (0%)	0 (0%)	0 (0%)
Blood pressure measuring device (BPMD)	5 (100%)	5 (100%)	10 (100%)
Mercury BPMD	0 (0%)	1 (20%)	1 (10%)
Aneroid BPMD	5 (100%)	4 (80%)	9 (90%)
Automatic BPMD	0 (0%)	0 (0%)	0 (0%)
Number of facilities with essential medical services for managing CVD			
Injection	5 (100%)	5 (100%)	10 (100%)
IV fluid	4 (80%)	5 (100%)	9 (90%)
Blood sugar test	2 (40%)	1 (20%)	3 (30%)
Blood cholesterol test	0 (0%)	0 (0%)	0 (0%)
Counselling & educational services			
Hypertension and diabetes self-management	5 (100%)	5 (100%)	10 (100%)
Estimated monthly managed CVD patients per facility			
Out-patients	105.2	29.4	67.3
In-patients	0	0	0
Home visits	3.6	1.4	2.5
Patient referrals	0	2.4	1.2
Average distance between the referral hospital and the health facilities in kilometer	5.4	11.4	8.4

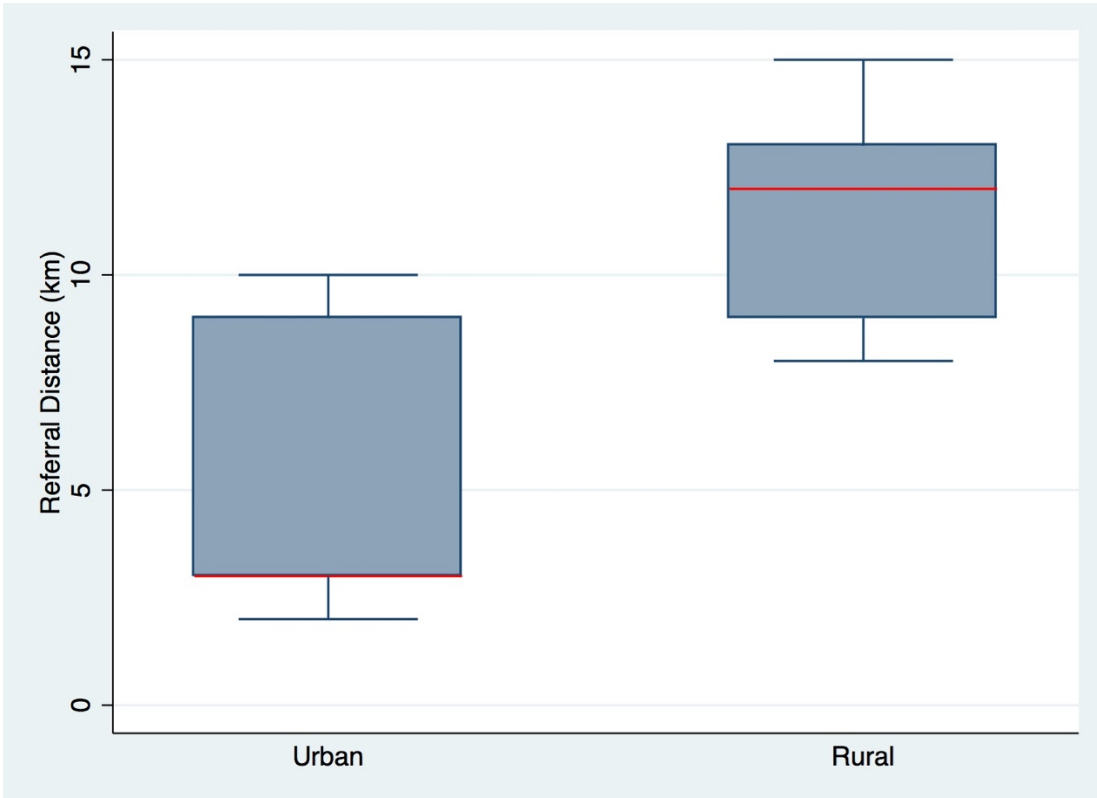

Figure 4: Referral distance

Education / CHC	Smoking	Diet	Alcohol	Exercise
Urban 1	To both patients and family	To both patients and family	To both patients and family	To both patients and family
Urban 2	To both patients and family	To both patients and family	To both patients and family	To both patients and family
Urban 3	Only to patients	Only to patients	Only to patients	Only to patients
Urban 4	To both patients and family	To both patients and family	To both patients and family	To both patients and family
Urban 5	To both patients and family	To both patients and family	To both patients and family	To both patients and family
Rural 1	To none	To both patients and family	To none	Only to patients
Rural 2	To both patients and family	To both patients and family	To both patients and family	To both patients and family
Rural 3	To both patients and family	To both patients and family	To both patients and family	To both patients and family
Rural 4	To both patients and family	To both patients and family	To both patients and family	To both patients and family
Rural 5	To both patients and family	To both patients and family	To both patients and family	To both patients and family

To none Only to patients To both patients and family

Figure 5: Education on four major CVD behavioral risks to patients and families

3.1.2 Qualitative Results

Utilize broadcasting system to conduct health education

All interviewed CHCs mentioned about utilizing broadcasting system to conduct health education programs. Firstly, staff at CHC draft the broadcasting content and sent it to the local authority – usually the People's Committee – to get approval. Then the content would be delivered to the radio station to be further censored, revised and broadcasted. Usually, there will be 1 to 2 talks in each month themed at different diseases or risk factors, like diabetes, stoke, non-smoking day, etc. Seasonal diseases will be prioritized. Staff put great efforts in making the content understandable to the public.

> *"I have to go through all materials and my knowledge so that the talks will be easy to read, to listen to, and to understand."*

However, 2 CHCs reported problems with the limited cover range of the broadcasting system. In rural area, especially the mountainous places, villages are far from each other, while the number of public speaker was limited and the quality of the speaker was not good. So, oftentimes, some villages could not hear voice. 1 CHC reported trouble caused by frequent system breakdown and unstable electricity provision. 2 CHC reported that it was hard to fit into the tight broadcasting schedule, which was usually interrupted by funeral events or broadcasting programs from other sectors. 1 CHC complained about the limited duration time which was usually 3 to 5 minutes.

Collaborate with clubs and unions to conduct hypertension screening activities

Among the 10 surveyed communes, only An Lac Commune was selected by the Preventive Health Center to conduct hypertension screening to all people aged over 40, during which more than 1200 people were screened in 2 days and nearly 300 hypertensive patients were identified and recorded. Other communes did not have such population-wide screening test, but they did collaborate with the Elderly Union to provide health examination service and consultation service at least once per year. However, the age criteria to attend the examination session varied across communes; some said over 60, some said over 80. This event was organized and funded by the People's Committee and District Prevention Health Center which means the staff could get their payment for attending the examination. One CHC suggested that such event was better to be held at non-harvesting time when the elderly would be free of taking care of grandchildren. Three CHCs also mentioned that they provided health consultation services to the Women's Union, the Veteran Union during their regular meetings.

Lack of essential CVD medical equipment, especially glucometer and respirator

All of the surveyed CHCs reported their lack of essential medical equipment to deliver CVD service and testing. 50% mentioned the need of ECG machine for subclinical check, 30% mentioned the need of respirator for emergency cases, 40% mentioned the need of glucometer to identify and manage diabetic patients, 20% mentioned the need of blood lipid measuring device, 20% mentioned the need of ultra-sound machine.

> *"The patients here complain a lot, saying that they have to be in the queue (at district hospital) from 5 am for their waiting numbers. If people come late, they will get checked even later than 12 am."*

The situation for diabetic patients at Chi Linh District was quite hard. None CHC had medicines for diabetes and only 3 CHCs had glucometers to monitor patients' blood sugar level. All the diabetic patients had to go to the district hospital located at Sao Do Commune to be checked and to get medicines only on Thursday. Patients at rural communes had to travel more than 10 kilometers and wait in queue for more than half a day. The elderly could not travel by themselves and had to be accompanied by their descendants, but their descendants may be busy at work. This problem caused lots of inconvenience to the local people. According to the staff at CHCs, many patients said that it would be great if the CHC could check blood sugar level and distribute medicine for diabetic patients. Some CHCs bought the glucometer by their own and charged for using the service. One CHC also said that they should be further trained to use glucometer and certificate must be issued by the People's Committee, otherwise the social health insurance would not pay for such service.

As for respirator, it was regarded by several CHCs as critical when treating acute CVD patients. Though the availability of respirator was not asked in the quantitative questionnaire, several CHCs reported that they were in need of such devices.

Limited capacity to treat acute CVD patients

60% CHCs claimed that it was hard for them to treat acute CVD patients. They were not knowledgeable enough and well equipped enough to deal with complicated cases. What they could do is just to keep patients' vital signs and transfer them away to higher level facility. One CHC mentioned that the transportation time was critical, but for CHC located at countryside, it took about 15 to 20 minutes to call for a cab. Though the district hospital owned 2 ambulance cars, they were always occupied. Additionally, it took about the same time for an ambulance to arrive when compared with the cab.

New policy caused difficulty to manage all patients

Because of the new policy issued in the year of 2016, patients do not need referral letters anymore when seeking health service at higher level facilities. Thus, many patients bypassed the CHCs and went to district hospital directly. 30% CHCs complained about this bypass problem which caused difficulty in managing all patients with CVDs.

3.2 Health Workforce

3.2.1 Quantitative Results

As shown in table 3, all CHCs had doctors without certification, 9 CHCs had nurses and midwives, 7 CHCs had doctor with certification, only 1 had pharmacist and none CHC had administrative staff. There was no apparent difference between urban and rural CHCs in terms of health workforce settings.

Table 3: Number of CHCs with certain type of healthcare provider

	Urban CHCs (N=5)	Rural CHCs (N=5)	Total (N=10)
General doctors	4 (80%)	3 (60%)	7 (70%)
Assistance doctors	5 (100%)	5 (100%)	10 (100%)
Pharmacists	0 (0%)	1 (20%)	1 (10%)
Nurses	5 (100%)	4 (80%)	9 (90%)
Midwives	5 (100%)	4 (80%)	9 (90%)
Administrative staffs	0 (0%)	0 (0%)	0 (0%)

As shown in table 4, the general health workforce pattern for CHCs consists of 1 doctor with certification, 3 doctors without certification, 1 nurse and 1 midwife. No apparent difference was observed between urban and rural CHCs.

Table 4: Average number of certain type of healthcare provider at CHCs

	Urban CHCs	Rural CHCs	Total
General doctors	0.8	0.8	0.8
Assistance doctors	2.8	2.8	2.8
Pharmacists	0	0.2	0.1
Nurses	1	1.2	1.1
Midwives	1	0.8	0.9
Administrative staffs	0	0	0

Table 5 shows that the average CVD-related training rate of urban CHCs (61%) was higher than of rural CHCs (52%). The average training time in 2105 of urban CHCs (5.4 hours) was lower than that of rural CHCs (8.1 hours).

Table 5: CVD training among health staff at CHCs

	Urban CHCs	Rural CHCs	Total
Official Staff Trained	17/ 28 (61%)	15/ 29 (52%)	32/ 57 (56%)
Average training time in the year of 2015 (hour)	5.4	8.1	6.7

3.2.2 Qualitative Results

Limited human resources

> *"Limited human capacity, too many patients, patients are even more knowledgeable than doctors."*

All of the interviewed CHCs talked about their lack of human resources. 70% CHCs complained that the quantity of the staff working at CHCs was not enough and their workload was too much. 60% mentioned that their capacity and knowledge were limited. 20% mentioned that they were in need of doctor with certification which is one of the criteria for CHC to be recognized as meeting the national standard.

Community health workers (CHWs)

CHWs are members of a community who are chosen by the community organizations to provide basic medical services. In Vietnam, after 9 months' health training, community members become community health workers

Every commune organized its own network of CHWs. Usually, there are 5 to 10 wards in each commune, and each ward was assigned 1 to 2 CHWs. CHWs helped CHCs to monitor patients and they reported to CHCs monthly.

Positive aspects about CHWs were: 1. They worked with high enthusiasm (mentioned by 30% CHCs) 2. They helped a lot to monitor and manage patients, and even those who never came to CHC (mentioned by 70% CHCs) 3. They were familiar with the local neighborhoods (mentioned by 10% CHCs).

However, 40% CHCs mentioned that the payment for CHWs was too little, while they had multiple tasks, including vaccination program, the birth and death management and other disease programs. Sometimes, CHWs even had to purchase blood pressure measuring devices on their own.

> *"Now, our CHWs is working without getting paid… no or very small allowance… monthly money paid for them just equal to about 1 working day, only 235,000 dong (about 70 RMB)."*

3.3 Health Information System

3.3.1 Quantitative Results

Table 6 shows the IT equipment owned by CHCs and their medical recording systems. All CHCs were equipped with cable internet, Wi-Fi internet and desk-top computers. No CHC had lap-top. Only 1 CHC at urban area owned Pad/ Tablet. Most CHC staff owned basic phones, while limited CHC staff had smart phones. 80% CHCs used paper-based medical recording system, 20% used electronic medical recording system.

Table 6: Health information system

	CHCs in urban area (N=5)	CHCs in rural area (N=5)	Total (N=10)
Number of facilities with information/ communication devices			
Internet			
Cable	5 (100%)	5 (100%)	10 (100%)
Wi-fi	5 (100%)	5 (100%)	10 (100%)
Computer			
Desk-top	5 (100%)	5 (100%)	10 (100%)
Lap-top	0 (0%)	0 (0%)	0 (0%)
Pad	1 (20%)	0 (0%)	1 (10%)
Mobile phone			
Basic Phone	5 (100%)	4 (80%)	9 (90%)
Smart Phone	2 (40%)	4 (80%)	6 (60%)
Medical record system			
Paper-based medical record system	4 (80%)	4 (80%)	8 (80%)
Electronic medical record system	1 (20%)	1 (20%)	2 (20%)

3.3.2 Qualitative Results

Mixed opinions about M-health interventions

When asked about conducting CVD health interventions through mobile phones, respondents showed mixed opinions. 40% CHCs expressed their worries about the elderly people who were not used to modern technology (weak eyesight, illiteracy). 20% CHCs said that the healthcare staff were not knowledgeable enough to manage the mobile phone system and more training was needed. 20% CHCs said it would be more convenient to manage patients though mobile phone and cellphones were becoming more and more popular.

Recording book and recording software

All CHCs managed hypertension patients through paper-based recording books; however, the content and the format of the recording books varied across CHCs. The books at most CHCs were designed for hypertensive patients' number counting, while the book at An Lac CHC – the CHC selected to conduct hypertension screening – was designed for patients' blood pressure monitoring and treatment tracking; Every patients' information was recorded in separate pages.

Actually, 20% CHCs complained that the current recording books were not detailed enough to manage hypertensive patients. And one CHC said that the format of the notebook has been changed a lot of times.

All CHCs also updated the health records of hypertensive patients to computers and reported to higher level though e-mails quarterly. But 20% CHCs complained that the software was designed for health insurance only, which means, only the prescription had been recorded. When they wanted to look for other information about the patients, they had to refer to the paper-based recording books.

3.4 Access to Essential Medicine

3.4.1 Quantitative Results

Table 7 shows the availability of essential CVD medicines recommended by WHO at CHCs, which are further grouped into 6 categories according to WHO Model List of Essential Medicines by their functions (WHO, 2015). Only 2 urban CHCs owned aspirin. In terms of antihypertensive medicines, all CHCs had calcium channel blocker, but only 1 urban CHC owned ACE inhibitor and only 1 urban CHC owned Beta-blocker. Thus, the antihypertensive medicine types were extremely limited. 1 urban CHC did not have epinephrine for emergency cases. Only 1 urban CHC had Heparin. Very few CHC had Glyceryl trinitrate and Isosorbide dinitrate to treat Angina. In terms of Diuretics, the choices were still limited. All CHCs owned Furosemide, while few CHC had Spironolactone and none had Thiazide Diuretic. It is also important to note that none CHC had medicines for diabetes.

Table 7: Number of CHCs that had access to essential medicines

	CHCs in urban area (N=5)	CHCs in rural area (N=5)	Total (N=10)
Antithrombotic medicines			
Aspirin	2 (40%)	0 (0%)	2 (20%)
Antihypertensive medicines			
ACE inhibitor	1 (20%)	0 (0%)	1 (10%)
Beta-blocker	1 (20%)	0 (0%)	1 (10%)
Calcium channel blocker	3 (60%)	4 (80%)	7 (70%)
Medicines used for acute CVD			
Epinephrine	4 (80%)	5 (100%)	9 (90%)
Heparin	1 (20%)	0 (0%)	1 (10%)
Glyceryl trinitrate	1 (20%)	0 (0%)	1 (10%)
Isosorbide dinitrate	0 (0%)	1 (20%)	1 (10%)
Diuretics			
Furosemide	3 (60%)	2 (40%)	5 (50%)
Spironolactone	0 (0%)	0 (0%)	0 (0%)
Thiazide diuretic	1 (20%)	0 (0%)	1 (10%)
Lipid-lowering agents			
Statin	1 (20%)	0 (0%)	1 (10%)
Medicines used for diabetes			
Insulin	0 (0%)	0 (0%)	0 (0%)
Metformin	0 (0%)	0 (0%)	0 (0%)
Glibenclamide	0 (0%)	0 (0%)	0 (0%)

3.4.2 Qualitative Results

Lack of essential medicine in terms of quantity and diversity

All the 10 interviewed CHCs reported the lack of medicines. 50% CHCs said the shortage of medicines was caused by social health insurance ceiling which was cut by half recently. CHCs were not allowed to exceed the insurance ceiling. 80% CHCs reported that the types of medicine were limited and not enough. There were only 1 to 2 hypertensive medicines that were covered by social health insurance.

> *"There are some difficulties like some patients use the incompatible medicines so some of them have to come to Chi Linh hospital, some even have to come to Bach Mai hospital. Because hypertension medicines are mostly provided by the insurance, so there is only 1 type."*

3.5 Financing

3.5.1 Quantitative Results

As shown in table 8, major revenue of CHCs came from government budget (85.05%) and social health insurance (14.27%). None revenue came from commercial health insurance, very little came from out-of-pocket payment. No differences were observed between urban CHCs and rural CHCs.

Table 8: Total revenue composition of the financial year of 2015

	Urban CHCs (N=5)	Rural CHCs (N=5)	Total (N=10)
Government budget	85.61%	84.48%	85.05%
Social health insurance	13.77%	14.78%	14.27%
Commercial health insurance	0%	0%	0%
Patient out-of-pocket payment	0.48%	0.12%	0.30%
Other sources	0.14%	0.62%	0.38%

3.5.2 Qualitative Results

High coverage rate of social health insurance

Most people in Chi Linh District were covered by social health insurance. The estimated coverage rate according to our respondents was about 75%. If the patient has social health insurance, then he/she could get free hypertensive medicine and free examination at CHC. However, one CHC said it was hard for the poor to purchase social health insurance because they had to buy for the whole family at one time which was not affordable to them.

3.6 Leadership/ Governance

3.6.1 Quantitative Results

In urban area, 4 out of 5 CHCs met the national standard; in rural area, 3 out of 5 CHCs met the national standard.

3.6.2 Qualitative Results

Not all CHCs met the national standard for CHC

The CHC national standard was regulated by the Decision 3447/QĐ-BYT. There are 10 specific criteria in the regulation. They are: 1) Guidance and Management on people's health care; 2) Health Human Resources; 3) CHC Infrastructure; 4) Equipment, drugs and other devices; 5) Planning – Finance; 6) Preventive medicine, sanitation and health national target programs; 7) Examination and Treatment, rehabilitation and traditional medicine; 8) Maternal Health Care – Children; 9) Population - Family Planning; 10) Health Communication and Education.

During our study, most CHCs failed the national standard because they did not have doctor. As reported by a district policy maker, only 14 out of 20 CHCs at Chi Linh have doctors.

Mixed results about CVDs guidelines

Among 7 CHCs being asked about whether they received any guideline on CVDs, 2 answered “No”, 5 answered “Yes”. Among 5 CHCs that reported about receiving CVDs guideline, 1 complained about the guideline was too old; 1 reported that the guideline was for hypertension only; 1 said they received the guideline from the external source rather than the government; 1 reported the guideline was delivered through specialized training and posters only.

4. Discussion

The results of this study show critical gaps in PHC facilities in Vietnam in all the six key areas. They include service delivery, health workforce, health information system, access to essential medicine, financing, leadership and governance. Many results are consistent with Minh et al.'s findings in 2011 at Dong Hy district, Thai Nguyen province—a rural community located in northern Vietnam (Van Minh, Do, Bautista, & Tuan Anh, 2014). They conducted an assessment study to describe Dong Hy district's primary healthcare capacity for NCD prevention and control and they concluded that the capacity of the primary care system in Vietnam is still inadequate to serve the NCD-related health needs of the population.

4.1 Service delivery and access to essential medicine

Ideally, PHC facilities should be equipped with basic medical equipment and adequate drugs to deliver a variety of CVD prevention and management services. However, we found that none CHCs were equipped with ECG machines which are critical for CVD diagnosis and CVD emergency. No blood cholesterol testing machine has been found at PHC level. Only 3 out of 10 CHCs had glucometers, which means the early detection of diabetic patients is missing at most CHCs. Though not surveyed in the FAQ, several CHCs have reported that they were in lack of respirators for emergency cases.

In terms of the medicines, no diabetic medicine has been found at PHC level which caused troubles for the local patients. Diabetic patients have to go to the District Hospital to get health check and drugs. However, the furthest commune is 15 kilometers away from the District Hospital and it is located in the mountainous area. The travel for patients is hard, especially for those who are old and disabled. In addition, the District Hospital only check diabetic patients on one day during the week, so the waiting line is usually long and the waiting time is ridiculous. As for anti-hypertension drugs, both the quantity and the diversity were inadequate. The inadequate quantity was due to the limited reimbursement ceiling from the SHI which was cut nearly 50% recently. According to the regulations, CHCs could not spend over the ceiling. During the study, we also found that each CHC had only 1 to 2 types of anti-hypertension drugs. The limited options caused low efficacy.

4.2 Health workforce

The health workforce is inadequate in terms of both capacity and quantity. According to the national standard for CHC, each facility should have at least one doctor with board certification. However, we found that only 7 out of 10 CHCs had doctor with board certification. The most common health professional at PHC level was "assistant doctor" who receives only 2 years training and study in vocational school. They are certified to practice at PHC level, but it is difficult for them to diagnose and treat patients with severe symptoms independently. 7 out of 10 CHCs have reported that the workload was too much and they needed more staff. It is true that CHCs are in charge of various duties, including hygiene inspection, family planning, vaccination, health education, detection of new epidemics and so on. They have to write all kinds of reports and fill in several designated recording list. The tasks are overwhelming for a CHC with 5 to 6 staff. Actually, according to Ostbye et al., even in the U.S., the current practice guidelines for only 10 chronic illnesses require more time than primary care physicians have available for patient care overall and alternative methods of service delivery are needed to meet recommended standards for quality health care (Østbye et al., 2005).

4.3 Health information system

In terms of the health information system, though every CHC was equipped with computers and internet, the electric recording and surveillance system has yet to be well developed. The current recording software was designed by the insurance company and the only purpose is to record prescriptions without the details of complaint or diagnosis.

4.4 Financing

Vietnamese government is committed to achieve universal health coverage. Though the coverage rate of SHI is high at Chi Linh district, the benefit package of SHI is far from enough, especially for CVDs management. The nearly 50% reimbursement ceiling cut at PHC level was irrational and trouble-making. The cut caused shortage of anti-hypertensive medicine at PHC level. In addition, SHI does not cover reimbursement of diabetic medicine at PHC level. This causes bypass problems.

In addition, the payment issue for CHWs should also be noted. Incentive for CHWs should be created.

4.5 Governance

The clinical guideline for CVDs prevention and management has yet to be delivered to all CHCs. The government, especially the steering committees for hypertension and diabetes should develop appropriate clinical guidelines for PHC facilities based the pilot studies. CVD-related training should also be organized.

In conclusion, the capacity of commune health centers to prevent and manage cardiovascular diseases in Vietnam is inadequate. There is an urgent need to improve the capacity of commune health centers.

4.6 Suggestions

At resource-limited area, it is important to strike a balance between cost and effectiveness when implementing health interventions. High cost causes low feasibility and low sustainability; whereas, effective health outcome is the ultimate goal. So, we need to choose the most cost-effective intervention to curb the increasing CVD burdens at resource-limited area. Ha and Chisholm conducted a cost-effectiveness analysis of interventions to prevent cardiovascular disease in Vietnam. This study concluded that when resources are scare, a health education program to reduce salt intake and a combined mass media program (on salt, tobacco and cholesterol) are the most cost-effective measures and should be purchased first. If the resource is more, then, individual treatment of systolic blood pressure >160 mmHg and combination treatment based on absolute risks of a cardiovascular event of 25%, 15% and 5% in the next 10 years could then be potentially implemented in Vietnam (Ha & Chisholm, 2011).

Based on our findings, the broadcasting system was available at all CHCs and it served as a reinforcing factor for various health education activities. Thus, our first suggestion to Chi Linh District is to increase the utilization of broadcasting system to help to conduct health education programs on four major behavioral risk factors. Nguyen et al. conducted a a quasi-experimental study about health promotion campaigns focused on smoking cessation, reducing alcohol consumption, encouraging physical activity and reducing salty diets. Though the impact on the prevalence of daily smoking or heavy alcohol consumption were insignificant, health promotion reduced levels of salty diets and both systolic and diastolic blood pressure were reduced significantly at the intervention group (Q. N. Nguyen et al., 2012). As for individual treatment, we recommend the anti-hypertension treatment to the patient whose systolic blood pressure is over 140 mmHg. Though the combination treatment based on absolute risks of a cardiovascular event was also highly recommended by WHO, the capacity of CHCs in Chi Linh district was not adequate to provide such service. To be more specific, few CHCs could conduct blood glucose test or blood cholesterol test and few CHCs had medicine for diabetes or lipid-lowering medicine.

The second suggestion for Chi Linh District is to simplify the CVDs clinical guideline based on scientific evidence and the current limited capacity at PHC facilities, especially the limited medicine and the limited medical equipment. Clinical guidance is important for primary healthcare level. However, we found that not all staff in CHCs reported the availability of CVD clinical guideline.

The third suggestion is to engage CHWs in the routine CVDs prevention and management activities. After all, reliance on the overburdened and relatively small number of specialists to implement CVD interventions is not feasible or sustainable. During our study, we found that every CHC organized its own network of CHWs who helped to conduct multiple tasks, including vaccination program, the birth and death management and other disease programs. Though the CHWs only received little payment, they worked with high enthusiasm. In addition, previous studies have shown that there are significant improvements in accessing healthcare facilities, disease screening and monitoring, and patients' adherence to treatment by engaging community healthcare workers (Allen et al., 2011; Chatterjee et al., 2014; Dye, Williams, & Evatt, 2015; Jafar et al., 2009). Thus, we recommend Chi Linh district to conduct pilot study on engaging community healthcare workers to provide CVDs prevention and management services.

4.7 Study Strength and Limitations

The major strength of this study is that the triangulation of both quantitative data and qualitative data. First, the data from in-depth interviews help to validate the answers from FAQ. For example, there was one CHC reported in FAQ that they did not provide any health education on four main CVDs behavioral risk factors to patients' family members which was unusual compared with the answers from other CHCs. In the in-depth interview, the head of the CHC explained that they only focused on "knowledge, causes, and symptoms for CVDs" rather than smoking, diet, exercise and alcohol for the broadcasting programs. But, these four CVDs behavioral risk factors are actually causes for many CVD conditions. This information from the in-depth interview validates the FAQ question and demonstrates the CHC head's limited CVDs knowledge. Second, the data from in-depth interviews further identify gaps and reinforcing factors in delivering the CVD management and prevention at the PHC level and give us a deeper understanding of the local situation.

However, this study also has several limitations. First limitation is the study sites proximity. This study was conducted in one district in northern Vietnam; hence, the generalizability of the findings is limited. However, Chi Linh district is undergoing urbanization. According to Tran et al, the socio-economic and cultural development and the patterns of urbanization and geographic structure present in Chi Linh district, and the resultant health problems, are considered to be representative of all of Vietnam (Tran et al., 2013). When compared with other studies, same gaps have been reported by Minh et al. They conducted the assessment study on the primary healthcare system capacity for the prevention and management of non-communicable diseases in Dong Hy district, Thai Nguyen province in 2011 and they also found gaps in all six building blocks (Van Minh, Do, Bautista, & Tuan Anh, 2014).

Second, all the data were self-reported. Thus, Reporting Bias and Social Desirability Bias are inevitable. Responds may exaggerate the problems hoping gain more benefits or they may cover up some problems to avoid conflict with the upper level government.

Third, the quantitative data were transcribed in Vietnamese, and then translated to English. This process may cause unfavorable bias due to the language fluency of the translators and their personnel ideology. Some information may also lose due to the relatively lengthy transcriptions. Furthermore, the qualitative results were coded, organized and interpreted by the primary investigator only. Without the comparison to another independent reviewer, the results may be biased.

Appendix A - Facility Assessment Questionnaire

昆山杜克大学 DUKE KUNSHAN UNIVERSITY

FAITH study

FAITH Facility Assessment Questionnaire (2016)

Country: ______________
Interviewer: ________________
Date: _____/_____/_____ (MM/DD/YY)
Facility name: ____
Facility code: _______________________
Facility setting type: ☐1 Urban ☐2 Peri-urban ☐3Rural
GPS Info: _______________/___________________
[Latitude] [Longitude]

A. General Information

Respondent name： ____________
Respondent job title： ____________
Respondent phone number: office phone ___________________; cellphone _________________
Does this facility meet the national standards? ☐1Yes ☐2No (*This question is only for Vietnam)
This facility serves: ___________________/___________________/___________________/_________________
[province/ municipality] [provincial municipality] [town/ district] [commune/ ward]
How many primary health care facilities serve this area? _________ public facility _________ general private facility
How many population this facility serves? _________ households _________ people

B. Equipment & Service Availability

Availability of basic equipment for CVDs management (number of **functional** devices available)
*Note: fill in "0" if there is none (this note applies to all the following questions involved with numbers)

Equipment	Weighing machines (for adults only)	Measuring tape	Stethoscope	Glucometer	ECG machines
Number	________	________	________	________	________

Availability of Blood Pressure Measuring Devices (BPMDs):

Type	Number	How often are BPMDs calibrated for accuracy?
Mercury	________	☐1Once a year or more ☐2Less than once a year ☐3Never ☐4Don't know
Aneroid	________	☐1Once a year or more ☐2Less than once a year ☐3Never ☐4Don't know
Automatic (non-portable)	________	☐1Once a year or more ☐2Less than once a year ☐3Never ☐4Don't know
Automatic (portable & wrist cuff)	________	☐1Once a year or more ☐2Less than once a year ☐3Never ☐4Don't know
Automatic (portable & upper arm)	________	☐1Once a year or more ☐2Less than once a year ☐3Never ☐4Don't know

Availability of information/ communication devices (facility owned or personally owned):

Device	Classification	Availability
Internet	Cable	☐1Yes, stable ☐2Yes, but not stable ☐3No
	Wifi	☐1Yes, stable ☐2Yes, but not stable ☐3No
Computer	Desktop	☐1Yes ☐2No
	Laptop	☐1Yes ☐2No
Pad/ Tablet		☐1Yes ☐2No; If yes, they are mainly based on: ☐1Android ☐2IOS ☐3Window ☐4Don't know
Cellphone	Basic phone	☐1Yes ☐2No
	Smart phone	☐1Yes ☐2No; If yes, they are mainly based on: ☐1Android ☐2IOS ☐3Window ☐4Don't know

Availability of medical procedures and laboratory tests:

Injection	IV fluid	Blood sugar test	Blood cholesterol test
☐1Yes ☐2No	☐1Yes ☐2No	Finger tip ☐1Yes ☐2No Venipuncture ☐1Yes ☐2No	Finger tip ☐1Yes ☐2No Venipuncture ☐1Yes ☐2No

Availability of counselling & educational services (if yes, tick on the box):

Patient counselling for:	☐1Hypertension self-management ☐2Diabetes self-management ☐3Neither ☐4Don't know
Patient counselling and education on:	☐1 Smoking ☐2 Diet ☐3Alcohol ☐4Physical activity ☐5 None ☐6 Don't know
Counselling and education of family members on:	☐1 Smoking ☐2 Diet ☐3Alcohol ☐4Physical activity ☐5 None ☐6 Don't know

Is there educational material for CVDs? If yes, who provide those materials?

☐1 No ☐2Yes, by central government ☐3Yes, by local government ☐4Yes, by CDC ☐5Yes, by private company
☐6 Yes, by NGOs ☐7 Yes, self-made ☐8 Yes, other (specify: ___________) ☐9 Don't know

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C. Medicine

Medicine	**Availability**	**Prescription right**
Acetylsalicylic acid (aspirin)	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
ACE inhibitor (enalapril)	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
Beta-blocker (atenolol, bisoprolol, metoprolol or carvedilol)	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
Calcium channel blocker (amlodipine or verapamil)	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
Epinephrine	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
Furosemide	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
Glyceryl trinitrate	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
Heparin	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No
Isosorbide dinitrate	☐1Always ☐2Sometimes ☐3No	☐1Yes ☐2No

Medicine	Availability			Prescription right	
Spironolactone	☐1Always	☐2Sometimes	☐3No	☐1Yes	☐2No
Statin (simvastatin)	☐1Always	☐2Sometimes	☐3No	☐1Yes	☐2No
Thiazide diuretic	☐1Always	☐2Sometimes	☐3No	☐1Yes	☐2No
Insulin	☐1Always	☐2Sometimes	☐3No	☐1Yes	☐2No
Metformin	☐1Always	☐2Sometimes	☐3No	☐1Yes	☐2No
Glibenclamide	☐1Always	☐2Sometimes	☐3No	☐1Yes	☐2No

D. Medical record system

Does the facility keep a record of patient visit?

☐1Yes, records kept for all visits

☐2Yes, records kept for certain types of visit; specify: ____________________

☐3No records kept

How is record kept?

☐1Paper based files

☐2Electronic health record

☐3Other; specify: __________________

What information will be recorded (if yes, tick on the box):

☐1 Date ☐2 Name ☐3 Symptom ☐4 Examination results (☐5 Blood Pressure) ☐6 Diagnosis ☐7 Prescription

☐8 Others; specify: _______________________________________

E. Service utilization & Referral

	Number of patient visit in last month	Source		Number of patient visit in last year	Source	
Total Patients						
In-patients	__________	☐1Record	☐2Estimation	__________	☐1Record	☐2Estimation
Out-patients	__________	☐1Record	☐2Estimation	__________	☐1Record	☐2Estimation
Home visit	__________	☐1Record	☐2Estimation	__________	☐1Record	☐2Estimation
CVD patients						
In-patients	__________	☐1Record	☐2Estimation	__________	☐1Record	☐2Estimation
Out-patients	__________	☐1Record	☐2Estimation	__________	☐1Record	☐2Estimation
Home visit	__________	☐1Record	☐2Estimation	__________	☐1Record	☐2Estimation
CVD patients referrals	__________	☐1Record	☐2Estimation	__________	☐1Record	☐2Estimation

*Note: Patients who stay at the facility over night are in-patients.

Can you refer patients to another facility due to CVDs in the following situations?

	Referral		Distance (in kilometer)	Referral institute name
Emergency	☐1Yes	☐2No	If yes _________________	_______________________
Additional test	☐1Yes	☐2No	If yes _________________	_______________________
Specialist consultation	☐1Yes	☐2No	If yes _________________	_______________________

What means of transport is most frequently used to transfer emergency patients at your facility (check only one)?

☐1Ambulance ☐2 Commercial vehicle (e.g. taxi) ☐3 Private vehicle ☐4 Public transportation

☐6Motorbike ☐7Bike ☐8Other; specify: ___________________

F. Financing

Total revenue composition of last financial year:

	Percentage
Government budget	________________%
Social health insurance	________________%
Commercial health insurance	________________%
Patient out-of-pocket payment	________________%
Others, specify________________	________________%

This total revenue composition is based on: ☐1Record ☐2Estimation

G. Human resources

	Number present today	Total Number	How many of them received CVD training (in the past year)	How long is the average CVD training time per person (in the past year)
Doctors with board certification				
Specialists	________	________	________	________hours
Non-specialists	________	________	________	________hours
Doctors without board certification				
Specialists	________	________	________	________hours
Non-specialists	________	________	________	________hours
Pharmacists	________	________	________	________hours
Nurses	________	________	________	________hours
Midwives	________	________	________	________hours
Commune Health Volunteer with honorarium	________	________	________	________hours
Commune Health Volunteer without honorarium	________	________	________	________hours
Administrative staffs	________	________	________	________hours

That's end. Thanks for your participation!

Appendix B – Interview Guideline for PHC Providers

Step 0: Fill in the information below

Date: _____/_____/_____ (MM/DD/YY)

Facility name: ____

Facility code: ______________________

Name of interviewer: _______________

Interviewee Information:

Name: _______________

Age: _________________________

Job title: _____________________________

The job is: 1 Full-time job 2. Part-time job

Education background: ___________________________________

Hong long has the interviewee been worked in this facility: ____________ years

Step 1: Read out relevant sections in Consent Form to interview participants

Step 2: Consenting participants to sign the Consent Form

Step 3: Casually chat with the participant to establish rapport

Step 4: Ask the questions below:

1. CVD prevention

1.1 Population approach

Please describe how does your facility participate in CVD-related population approaches (smoking cessation campaign, healthy diet campaign, alcohol abstinence campaign, exercising campaign)? Has your facility ever met any problem or difficulty? What are some internal and external enabling factors? Probe: enabling factors could come from the facility itself (e.g. skilled & experienced specialist, payment incentive, passion among health workers…) or from the outside of the facility (e.g. national policy, government earmarked subsidy, NGO campaign…)

1.2 Opportunistic high risk screening & high-risk patient management

Please describe how does your facility provide CVD opportunistic high-risk screening and CVD high-risk patient management. Has your facility ever met any problem or difficulty? What are some internal and external enabling factors?

2. CVD management

2.1 Regular follow-up

Please describe how does your facility follow up CVD patients? Has your facility ever met any problem or difficulty when following up CVD patients? What are some internal and external enabling factors that help you to follow up CVD patients?

2.2 Referral

In what situation will your facility refer CVD patients to another facility? Describe the referral process. Has your facility ever met any problem or difficulty when referring CVD patients? What are some internal and external enabling factors that help you to refer CVD patients?

2.3 Acute CVD

Please describe how does your facility manage acute CVD patients. Has your facility ever met any problem or difficulty when managing acute CVD patients? What are some enabling factors that help you to manage acute CVD patients? If the interviewer think he/she is still not getting enough information, the interviewer should ask the following questions.

3. SIX BUILDING BLOCKS

3.1 Health service delivery

What services about CVD are available at your facility (population based health promotion program/ early detection of people at high risks/ early treatment of high risk patients/ rehabilitative care)? Who are responsible for delivering each service (the number and mix of staff, and how they work together)?

3.2 Health workforce

Do you think you have enough workforce in your facility to manage CVD patients? How do you think about your work load every day?

3.3 Health information system

Are you satisfied with the medical recording system now? Especially when manage CVD patients. If no – Why not? Any suggestions to improve? If yes – What are the satisfactory factors? What do you think about the feasibility of future implementation of M-health to help prevent and manage CVD patients? What are the possible barriers?

3.4 Access to essential medicines

Have you experienced shortage of medicine in your facility? Do you think the medical equipment in your facility is enough to provide primary healthcare of CVDs?

3.5 Health system financing

What is your opinion on financing related with CVD prevention and management? It could be government budget/ social health insurance/ commercial health insurance/ out-of-pocket payment.

3.6 Leadership and Governance

Is there any CVD (especially hypertension) management and prevention guideline available in your facility? If yes – Who provide the guideline? Can you show us the protocol/ guideline? If no – Do you think your facility need such protocol/ guideline? Are you aware of any CVD related policy from the government? What is your opinion? Which department is in charge of CVD management and prevention of your facility? Do you think they are doing a good job? Do you have any suggestions?

4. Others

Do you have anything else to share with us about CVD issues in your facility?

Appendix C – Interview Guideline for Policy Makers

Step 0: Fill in the information below

Date: _____/_____/_____ (MM/DD/YY)

Name of interviewer: ________________

Name of interviewee: ________________

Job title of interviewee: ____

Step 1: Read out relevant sections in Consent Form to interview participants

Step 2: Consenting participants to sign the Consent Form

Step 3: Casually chat with the participant to establish rapport

Step 4: Ask the questions below:

1. Policy

Is there national policy/ strategy/ action plan for CVDs?

Are the roles and responsibilities of PHC highlighted in the policy? Specify if any.

2. Governance

Which departments/ units/ groups are responsible for planning, implementing, supervising and managing CVDs related interventions? What is their roles and responsibilities? Are there any collaborations between multiple departments?

Is there any guideline available in the primary healthcare level in terms of CVD patients (especially hypertensive patients) management and prevention? Can you show us the guideline?

3. Health Financing

Who are responsible for financing CVD related interventions implemented at PHC level (state budget, health insurance, foreign aids, out-of-pocket payment, others)? What is the trend of changes overtime?

Role of state budget: From central and local government? What cost items are covered by the state budget? How is the budget estimated? How is the budget allocated?

Role of health Insurance: Provider payment mechanism?

Role of foreign aids: Sustainability?

Role of out-of-pocket payment: How user fee is set and collected? How the facilities utilize the fee collected? Regulation to control irrational care?

4. Human resources

What do you think of the current situation of CVD management and prevention in terms of human resources in primary healthcare level? Is there enough specialist working on this area? Is the training to health providers in terms of CVD management and prevention enough?

5. Health information system

What is the current health information system in primary healthcare level? Do you think the current health information system in primary healthcare level is enough for prevent and manage CVD patients? What do you think is the priority in terms of improving health information system in primary healthcare level?

What do you think about the feasibility of future implementation of M-health to help prevent and manage CVDs? What are the possible barriers?

6. Service Delivery

What services about CVD are available at primary healthcare level (population based health promotion program/ early detection of people at high risks/ early treatment of high risk patients/ rehabilitative care)?

Is there any issue related to access, utilization, quality, equity?

7. Others

What do you think about the current situation of primary healthcare in terms of providing CVD prevention and management to general population?

What do you think about the future of primary healthcare in terms of providing CVD prevention and management to general population? Step 5: Thank the interviewee for their time and hand over small gift.

Step 5: Thank the interviewee for their time and hand over small gift.

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