Epidemiology of cardiovascular disease in rural Vietnam

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ABSTRACT

In the context of transitional Vietnam, although cardiovascular disease (CVD) has been shown to cause a large burden of mortality and morbidity in hospitals, little is known about the magnitude of its burden, risk factor levels and its relationship with socio-demographic status in the overall population. This thesis provides a preliminary insight into population-based knowledge of the CVD epidemiology in rural Vietnam and contributes to the development of methodologies for monitoring it. The ultimate goal of the work is to facilitate the formulation of evidence-based health interventions for reducing the burden of the CVD epidemic in Vietnam and elsewhere.

This work was located in Bavi district, a rural community in the north of Vietnam. Studies on cause-specific mortality and risk factors were conducted within the framework of an ongoing Demographic Surveillance System (DSS) (called FilaBavi). The cause-specific mortality study used a verbal autopsy (VA) approach to identify causes of death in FilaBavi during 1999-2003. The risk factor study, conducted in 2002, employed the WHO STEPwise approach to surveillance of non-communicable disease (NCD) risk factors (WHO STEPS).

Findings indicated that Bavi district, as an example of rural Vietnam, was already experiencing high rates of CVD mortality and associated risk factors. Mortality results indicated a substantial proportion of deaths due to CVD, which was the leading cause of death (20% and 25.7% of total mortality in 1999 and 2000, respectively and 32% of adult deaths during 1999-2003), exceeding infectious diseases. Hypertension was found to be a serious problem in terms both of its magnitude (14% of the population) and widespread unawareness (82% of the hypertensives). Smoking prevalence was very high among men (58% current daily smokers) and might be expected to cause a considerable number of future deaths without urgent action. CVD mortality and some risk factors seemed to be rising among disadvantaged groups (women, less educated people and the poor). The combination of DSS and WHO STEPS methodologies was shown to have potential for addressing basic epidemiological questions as to how NCD and CVD mortality and associated risk factors are distributed in populations.

Given this evidence, actions to prevent CVD in Bavi and similar settings are clearly urgent. Interventions should be comprehensive and integrated, including both primary and secondary approaches, as well as policy-level involvement. Further studies, continuing on similar lines, plus qualitative approaches and deeper cross-site comparisons, are also needed to give further insights into CVD epidemiology in this type of setting.

Key words: Cardiovascular disease, epidemiology, risk factors, rural Vietnam
ABBREVIATIONS

AIDS   Acquired Immunodeficiency Syndrome
CHC    Commune Health Center
CI     Confidence Interval
CVD    Cardiovascular Disease
DALY   Disability Adjusted Life Year
DBP    Diastolic Blood Pressure
DSS    Demographic Surveillance System
FilaBavi Epidemiological Field Laboratory in Bavi District
GDP    Gross Domestic Product
HIV    Human Immunodeficiency Virus
ICD    International Statistical Classification of Diseases and Related Health Problems
IMR    Infant Mortality Rate
INDEPTH International Network of field sites for continuous Demographic Evaluation of Populations and Their Health in developing countries
JNC    Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure
MOH    Ministry of Health
MONICA Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases
NCD    Non-communicable disease
OR     Odds Ratio
P      P-value
PPP    Purchasing Power Parity
RR     Relative Risk
SAREC  Swedish Agency for Research Co-operation with Developing countries
SBP    Systolic Blood Pressure
SES    Socio-Economic Status
Sida   Swedish International Development Agency
STEPS  Stepwise approach to surveillance of non-communicable risk factors
TB     Tuberculosis
U5MR   Under Five Mortality Rate
UNDP   United Nations Development Programmes
US$    US Dollars
VA     Verbal Autopsy
VND    Vietnamese currency (1 US$ = 15,900 VND approximately)
WHO    World Health Organization
This thesis is based on the following original papers:


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INTRODUCTION

What is cardiovascular disease?
Cardiovascular disease (CVD) is the term used by the scientific community to embrace not just conditions of the heart (coronary artery, valvular, muscular, and congenital disease), but also hypertension and conditions involving the cerebral, carotid and peripheral circulation [1].

According to the International Statistical Classification of Diseases and Related Health Problem 10th revision (ICD 10) [2], CVD comprises many conditions including the following:

- (I00-I02) Acute rheumatic fever
- (I05-I09) Chronic rheumatic heart diseases
- (I10-I15) Hypertensive diseases
- (I20-I25) Ischaemic heart diseases
- (I26-I28) Pulmonary heart disease and diseases of pulmonary circulation
- (I30-I52) Other forms of heart disease (pericardium, endocardium including heart valves, myocardium/ cardiomyopathy, electrical conduction system of the heart, other)
- (I60-I69) Cerebrovascular diseases
- (I70-I79) Diseases of arteries, arterioles and capillaries
- (I80-I89) Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified
- (I95-I99) Other and unspecified disorders of the circulatory system

CVDs vary in the extent to which they compromise normal circulation; some CVD events such as heart attacks or strokes may be rapidly fatal, while people with rheumatic heart disease and other chronic CVD often survive for long periods along with heart attack and stroke survivors, leading to a considerable burden of prolonged illness and disability.
INTRODUCTION

**Cardiovascular disease: an emerging public health problem in developing countries**

CVD has been an important health issue in developed countries for some decades, while in developing countries it has often not been seen as a major problem compared with communicable diseases and malnutrition [3]. However, current trends in the CVD epidemic show diversification into two contrasting directions. In at least some developed countries, the CVD epidemic is decreasing as a result of major efforts to identify risk factors and implement interventions [4]. Meanwhile, in many developing countries, CVD and related risk factors are emerging as increasingly important public health problems [5-14].

In fact, twice as many deaths from CVD have occurred in developing countries as in developed countries [15]. CVD accounts for a huge proportion of human illness and death, estimated to cause about 17.5 million deaths worldwide annually (30% of total deaths), with low and middle-income countries carrying 80% of the CVD mortality burden. CVD is killing more middle-aged people in poorer countries than in wealthier ones and affecting five times as many people as HIV/AIDS in developing nations [16].

According to the Global Burden of Disease Study, CVD is expected to cause more than 19 million deaths annually in developing countries by 2020 [4]. There will be a 55% rise would occur in DALY (Disability Adjusted Life Years) lost attributable to CVD between 1990 and 2020 in developing countries [4]. CVD will affect all socio-economic groups and inflict major economic and human cost. Clinical care of CVD is costly and prolonged. These direct costs divert scarce family and societal resources to medical care. CVD often affects individuals in their peak mid-life years, disrupting the future of the families dependent on them and undermining national development by depleting valuable human resources in the most productive years [17].

Not only is the burden of CVD in developing countries increasing, but the burden of its risk factors is also increasing [18]. A few major risk factors, such as tobacco use [18,
19], elevated blood pressure [18, 20], imbalance diet [18, 21], physical activity [18, 22, 23] and alcohol consumption [18, 24], etc, explain a large proportion of new cases of CVD. It has been estimated that among people aged 30 years old and over, 50% of CVD is related to elevated blood pressure, 31% to high cholesterol and 14% to tobacco use [18].

The rising burden of CVD and its risk factors will have health, social and economic consequences, and will have an impact on national development. As health care systems in developing countries are usually designed to deal with acute communicable diseases, a growing CVD burden will be a major challenge in these countries today and in the future [12, 16, 25-28].

**Epidemiological transition**

The theoretical basis for explaining the emerging CVD epidemic in developing countries is that of the “epidemiological transition” formulated by Abdel Omran [29, 30]. The epidemiological transition theory is the framework for describing and explaining “a characteristic shift in the disease pattern of a population as mortality falls during the demographic transition: acute, infectious diseases are reduced, while chronic, degenerative diseases increase in prominence, causing a gradual shift in the age pattern of mortality from younger to older ages” [29].

Omran originally defined three stages of epidemiological transition: 1 - the “age of pestilence and famine”, 2 - the “age of receding pandemics”, 3 - the “age of degenerative and manmade disease [29]. Thirty years later, Omran proposed two more stages for the western model: 4 - the “age of declining CVD mortality, ageing, life style modification, emerging and resurgent diseases” and 5- the “age of aspired quality of life, with paradoxical longevity and persistent inequities” [30]. Omran also proposed a different third stage for non-western countries, “the age of triple health burden”, i.e. the unfinished old set of health problems, a rising new set of health
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problems, and the ill-prepared health systems to cope with the prevention and care of chronic diseases [30].

While the epidemiological transition progressed slowly over a century in the developed world, it appears to be accelerating faster in some developing countries. The epidemiological transitions in “non-western societies” occur with different acceleration, timing and magnitude of changes; thus it can be differentiated into rapid, intermediate and slow transition models [30].

Even though the epidemiological transition theory was said to have some drawbacks [31, 32], it offered a useful insight into how CVD is emerging as the predominant global cause of morbidity and mortality. During the transition from one stage to another, both characteristic and total rate of CVD mortality change (Table 1) [33-35]. In stage one, the predominant circulatory diseases are rheumatic heart diseases, those due to other infections, and nutritional deficiency–related disorders of the heart muscle. In the second stage, as infectious disease reduces and nutritional status improves, diseases related to hypertension, such as haemorrhagic stroke and hypertensive heart disease, become more common. In the third stage, which has the highest CVD mortality, atherosclerotic processes lead to a high incidence of ischaemic heart disease and atherothrombotic stroke, especially at ages below 50 years. During the fourth stage, increased efforts to prevent, diagnose, and treat ischaemic heart disease and stroke typically delay these diseases to more advanced ages.

The pace and process of CVD epidemic also varies across countries, mostly reflecting levels of socio-economic development but also influenced by equity and access to health care. In most developed countries, the CVD epidemic has already advanced into the third or fourth stages. Developing countries, however, are usually in the first or the second stages. It is a challenge for these countries is to alter the natural history of the CVD epidemic [30, 35, 36].
INTRODUCTION

The diversity of current CVD profiles in developing countries can be explained largely by changes in demography, lifestyle and foetal nutrition. The first change is typically an overall increase in population. Secondly, as life expectancy rises sharply in a fairly compressed time period, large segments of the population come into the middle age of life and beyond, resulting in longer periods of lifetime exposure to CVD risk factors and hence making them more vulnerable to developing the diseases and suffering their consequences. Thirdly, as developing countries undergo economic transition, the forces of urbanization, industrialization and globalization often propel lifestyle alterations that promote risky behaviour and elevate risk factor levels in the population (tobacco smoking, alcohol use, physical inactivity, etc). Exposure to higher levels of risk over more years of life leads to augmented CVD lifetime risks. Fourthly, there is also growing evidence that inadequate nutrition during pregnancy is associated with higher risk of CVD in adult life [12, 29, 30, 35, 36].

Table 1: The epidemiological transition with reference to the pattern of cardiovascular disease mortality

<table>
<thead>
<tr>
<th>Stage</th>
<th>CVD death (% of total death)</th>
<th>Major CVD conditions</th>
<th>Risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - The age of pestilence and famine</td>
<td>5-10</td>
<td>Rheumatic heart disease; infectious and deficiency-induced cardiomyopathies</td>
<td>Uncontrolled infection; deficiency conditions</td>
</tr>
<tr>
<td>2 - The age of receding pandemics</td>
<td>10-35</td>
<td>As above plus hypertensive heart disease and haemorrhagic stroke</td>
<td>High-salt diet leading to hypertension, increased smoking</td>
</tr>
<tr>
<td>3 - The age of degenerative and manmade disease</td>
<td>35-55</td>
<td>All forms of stroke, ischaemic heart disease</td>
<td>Arteriosclerosis from fatty diets; sedentary lifestyle, smoking</td>
</tr>
<tr>
<td>4 - The age of delayed degenerative diseases</td>
<td>Probably less than 50</td>
<td>Stroke and ischaemic heart disease</td>
<td>Educational and behavioural changes leading to lower levels of risk factors</td>
</tr>
</tbody>
</table>

Source: Disease Control Priorities in Developing Countries. Oxford: Oxford University Press; 1993
The case of Vietnam

General description

Vietnam is a socialist republic and one-party state, governed by the Communist Party of Vietnam. The National Assembly is designated as the highest representative body of the people and is the only organ with constitutional and legislative power. The country has a long and narrow shape with an area of 331,000 km². It is located in Southeast Asia and shares borders with China to the north and Laos and Cambodia to the west. The climate is dominated by wet and dry seasons, with slightly greater seasonal temperature variations in northern areas.

The population of Vietnam in 2005 was about 83 million, with 51.5% of the population estimated to be women and 48.5% men. Seventy six percent of the population live in rural areas. There are 54 ethnic groups, among which the Kinh tribe are the majority (87%).

In 1986, the Vietnamese Government initiated a wide-ranging economic reform programme known as doi moi (renovation). The programme put Vietnam firmly on the path to transforming itself from a planned economy to a market economy. Under the positive effects of doi moi, Vietnam has made progress in improving economic conditions. In general, in urban as well as rural areas, people’s livelihood has improved. The percentage of the population living on less than 2100 calories per day fell from 58% to 29% between 1993 and 2002 [37]. GDP per capita increased from US$156 in 1992 to US$514 in 2004, corresponding to a high average growth rate (7%) as compared with other countries in the Southeast Asia such as Cambodia, Indonesia, Laos and Thailand [38, 39].
**Health care system**

The health system in Vietnam is a mixed public-private provider system, in which the public system still plays a key role in health care, especially in prevention, research and training. The private sector has grown steadily since 1989, but is mainly active in outpatient care. Only 26% of private health facilities participate in primary health care activities.

<table>
<thead>
<tr>
<th>Administrative Authorities</th>
<th>Health Authorities</th>
<th>Main Health Facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Government</td>
<td>Ministry of Health</td>
<td>- Departments in the MOH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- National medicine/pharmacy training colleges</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Central hospitals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Central research/professional institutions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Central pharmaceutical companies/factories</td>
</tr>
<tr>
<td>Provinicial People’s Committee</td>
<td>Provincial Health Bureau</td>
<td>- Provincial health office</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Provincial hospitals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Provincial preventive health centre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Provincial pharmaceutical companies/factories</td>
</tr>
<tr>
<td>District People’s Committee</td>
<td>District Health Centre</td>
<td>- District health centre office</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- District hospitals/polyclinics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- District preventive health team</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Public pharmacies</td>
</tr>
<tr>
<td>Commune People’s Committee</td>
<td>Commune Health Centre</td>
<td>- Commune health centre</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Drug outlets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Village health workers</td>
</tr>
</tbody>
</table>

**Figure 1: Vietnam public health care system**

The public health care system in Vietnam is now organized in four levels (Figure 1). At the top is the Ministry of Health. The Ministry, consisting of different departments, is ultimately responsible for the provision of almost all preventive and a large part of the curative health services in the country. At the second level are the 64 Provincial Health Bureaux which manage different health facilities within the province such as General or Specialized Hospitals, Preventive Medicine Centres, Centre for Maternal and Child Health Care and Family Planning and Provincial Pharmaceutical...
Companies. District Health Centres are at the third level. They administer District General Hospitals, Brigades of Hygiene and Epidemiology, Inter-communal Polyclinics and Commune Health Centres in the district. At the bottom are the Commune Health Centres which are responsible for providing primary health care, including preventive, ambulatory and outpatient services and for referring complicated cases to upper levels of care. They are expected to implement national health programmes, such as family planning (FP), acute respiratory infection (ARI) and the Expanded Program of Immunization (EPI) and are generally responsible for the management of all health services at the commune level. Village Health Workers, who are recruited locally and trained on a number of basic medical topics, are supposed to mobilize and assist with immunization, antenatal care, and family planning programs, advise about clean water and sanitation, and offer simple treatments to people in remote villages.

Total health expenditure in 2003 was about 4 - 5% of GDP. Government expenditure accounts for only about one-fourth, the majority being allocated to treatment, which increased from 71% in 1991 to 85% in 2000. Budget allocations for prevention remain low and continue to decrease. Health insurance policies have not been implemented in the private sector. Pro-poor policies, such as providing health insurance cards for the poor, direct exemption from hospitalization fees, and the establishment of health care funds for the poor, are being actively implemented, but with limited coverage because of budget shortages [40].

The current, most pressing issues are improving the quality of care, rationalizing and training health staff, and increasing public funding for health care through extension of health insurance coverage. Inequity is highest in outpatient and rehabilitation services. A large disparity in access to health care facilities exists across regions and population groups, particularly in mountainous areas and among minority ethnic groups and the poor [40].
Health trends: double burden of disease with an increased burden of CVD

Even though it has been one of the poorest countries in the world, Vietnam’s health indicators are better than might be expected for a country at its stage of overall development. During the past few decades, Vietnam has made impressive progress relating to health status of the people (Table 2), and the rates of improvement are equal or surpass those in most neighbouring countries [37]. The incidence of communicable diseases has also fallen in recent decades, represented in decreased shares of total morbidity and mortality from 55.5% and 53.0% in 1976 to 27.4% and 17.4% in 2003, respectively. These facts reflect the success of communicable disease control programmes, especially the Expanded Program of Immunization, which has dramatically reduced the incidence of vaccine-preventable diseases in the country.

### Table 2: Trends in main health indicators for Vietnam

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population (million)</td>
<td>53.7</td>
<td>66.2</td>
<td>78.5</td>
<td>81.0</td>
</tr>
<tr>
<td>Infant mortality rate (per 1,000 live births)</td>
<td>57.0</td>
<td>40.0</td>
<td>36.7</td>
<td>21.0</td>
</tr>
<tr>
<td>Under five mortality rate (per 1,000 live births)</td>
<td>105.0</td>
<td>81.0</td>
<td>42.0</td>
<td>32.8</td>
</tr>
<tr>
<td>Maternal mortality ratio (per 100,000 live births)</td>
<td>-</td>
<td>200.0</td>
<td>95.0</td>
<td>94.2</td>
</tr>
<tr>
<td>Birth weight &lt; 2500g (%)</td>
<td>25.0</td>
<td>15.0</td>
<td>7.3</td>
<td>7.1</td>
</tr>
<tr>
<td>Life expectancy (years)</td>
<td>63.0</td>
<td>67.0</td>
<td>67.8</td>
<td>71.3</td>
</tr>
</tbody>
</table>

Source: Ministry of Health of Vietnam, 2003

Despite the decline in their incidence, communicable diseases continue to be major public health problems in the country. Acute respiratory infections (ARI), diarrhoea and gastroenteritis with presumed infectious origin, and parasitic diseases were among leading causes of morbidity in 2003, while new or re-emerging diseases, such as tuberculosis (TB), HIV/AIDS, dengue fever and Japanese encephalitis, are increasing. On average, there are more than 68,500 new TB patients every year. In 2003, 4.3% of TB patients were HIV-positive [40]. By the end of May 2005, there had been 95,871 cases of HIV infection detected, among whom 15,618 cases had
INTRODUCTION

progressed to AIDS, and 8,975 people had died [41]. Severe acute respiratory syndrome (SARS) was detected in its early stages in Vietnam in 2003 with five deaths out of 63 reported cases. The avian influenza H5N1 virus causing poultry outbreaks led to the death of 29 out of 37 reported cases of infected persons by February 2005 [40].

While Vietnam continues to struggle with communicable diseases, nutritional deprivation, and reproductive health risks among children and women, non-communicable disease (NCD) are becoming more and more prevalent and cause a heavy burden of morbidity and mortality. According to national hospital statistics, NCD admissions increased from 39% in 1986 to 65% in 1997 and NCD deaths rose from 42% in 1986 to 62% in 1997 [42]. In 1998, hospital data showed that CVD deaths were very common: stroke, acute myocardial infarction, hypertension and heart failure were responsible for numbers one, four, five and seven among the leading causes of death, respectively [43]. In 2002, intracerebral haemorrhage, hypertension related diseases, heart failure and malignant neoplasms were among the ten leading causes of morbidity and mortality in hospitals [44]. According to WHO estimates, CVD was the first leading cause of DALY lost in Vietnam in 2002, with the number of fatalities from myocardial infarction, stroke and rheumatic heart disease were 66,200, 58,300 and 4,200, respectively [45].

CVD control in Vietnam and the need for information on the epidemiology of CVD

In Vietnam, control of NCD in general, and CVD in particular, has received recent attention. The Government’s readiness to fight these diseases was well reflected in the Prime Minister’s Decision No 35/2001/QD-TTg on Ratification of National Strategy for People’s Health Care for the Period 2001–2010 [46] and No 77/2002/QD-TTg on Ratification of Programme of Prevention and Control of Certain Non-communicable Diseases for the Period 2002–2010 [47] as well as the Government Resolution No 12/2000/NQ-CP on National Tobacco Control Policy 2000 – 2010 [48]. In those
documents, a number of ambitious targets for the reduction of NCD and CVD morbidity, mortality and risk factors have been set out. Of the proposed solutions for achieving the targets, conducting research, surveillance and sharing information on epidemiological aspects of NCD and CVD are considered as urgently needed actions. Evidence on CVD epidemiology is believed to be a firm background for the formulation of appropriate policies as well as for cost-effective interventions to control NCD and CVD in Vietnam.

Vietnam however continues to have a weak health information system. Even though there have been some cross-sectional surveys, the system mainly relies on hospital-based statistics which usually represent only part of health situation and do not give insights into epidemiological aspects of disease patterns such as gender, socio-demographic determinants, etc. There remains a lack of population-based data which are much more useful for policy makers and health managers.

In terms of information on the CVD epidemic, the overall magnitude of the burden of CVD would be clearer and possibly greater if data from the community level were added. Unfortunately, as a result of the weaknesses of the health information system as a whole, population-based data on CVD morbidity, mortality, risk factors and their determinants remain very scanty.

Reliable and more complete data on the extent of CVD and related risk factors are urgently needed by those with responsibility for health planning and health decision-making as well as for society in general. Analysis of mortality and risk factor patterns and the socio-economic situation at the present time in Vietnam will provide important information related to the burden of disease, risk factors and determinants. It will help health officials apply existing knowledge to formulate appropriate interventions and policy for CVD control.
Potential role of a demographic surveillance system (DSS) for assessing CVD epidemiology in Vietnam

Despite the impossibility of having immediately reliable and complete information about CVD epidemiology in the whole country, some sources of information are useful for outlining part of the picture. Among them, a demographic surveillance system (DSS), defined as a geographically defined population, under continuous demographic monitoring, with timely production of data on all births, deaths, and migrations, is known as one of the most effective approaches [49-51].

In 1999, in Bavi district, Hatay province (a rural community in the North of Vietnam), a Demographic Surveillance System called FilaBavi (the Epidemiological Field Laboratory of Bavi), was established, supported by Sida/SAREC within the framework of Vietnamese - Swedish co-operation. The general objectives of FilaBavi were to 1 - generate basic health data, 2 - supply information for health planning, 3 - serve as a background and sampling frame for specific studies, especially intervention studies, and 4 - constitute a setting for epidemiological training for research students.

FilaBavi is a member of INDEPTH (an International Network of field sites for continuous Demographic Evaluation of Populations and Their Health in developing countries) (www.indepth-network.org) which was founded to facilitate linkage of existing demographic field sites through a focused network [50].

Since its establishment, FilaBavi has been running well under the leadership of a coordinating Board which includes many experts from Sweden and Vietnam, together with efforts by skilled and enthusiastic staff, and encouragement and attention from health authorities. Based on the activities within FilaBavi, there is a real chance to outline the picture of CVD in the location. This first step in identifying the burden of CVD in the community can then be the basis for further research and appropriate interventions.
OBJECTIVES

STUDY OBJECTIVES

Overall objective

The overall objective of this study is to investigate the pattern of cardiovascular mortality and risk factors in a rural community in the North of Vietnam. The ultimate goal of the study is to contribute to the development of evidence-based health interventions to reduce the burden of the CVD epidemic in Vietnam and elsewhere.

Specific objectives

1. To examine the potential of the Demographic Surveillance System model and the WHO STEPS methodology for assessing NCD/CVD epidemiology in developing countries generally and in Bavi district particularly. (I, II)

2. To describe the burden of CVD mortality in Bavi district. (II, III)

3. To estimate the magnitude of selected CVD risk factors (blood pressure and tobacco use) among adults in Bavi district. (IV, V)

4. To identify the association of CVD mortality and selected risk factors with some socio-demographic factors in Bavi district. (III, IV, V)

5. To compare CVD risk factor profiles among adults in Bavi district with those in communities in other countries at different stages of the epidemiological transition. (I, V)
MATERIALS AND METHODS

Study setting
The study setting was Bavi district, Hatay province, Vietnam. Bavi is a rural area which is located in northern Vietnam, 60 km west of Hanoi. The district has a population of about 238,000 and covers an area of 410 km², including lowland, highland and mountainous areas. The temperate climate is typical of northern Vietnam. It is predominantly a monsoon tropical climate with two main seasons. The wet season is from July to October with hot temperature, heavy rainfalls and storms. The dry season is from November to June with cooler weather.

Agricultural production and livestock breeding are the main economic activities of the local people (81%), with major products of wet rice, cassava, corn, green beans and some fruits (e.g. pineapple, mandarin, papaya). Other economic activities are forestry (8%), fishing (1%), small trade (3%), handicraft (6%) and transport (1%). The average income per person per year in 1996 was 290 kg rice (about VND600,000 ≈ US$48) [52].
There are 32 Commune Health Centres (CHC) in Bavi district, one in each commune. Twenty-one of these CHCs are under the direct supervision of the Bavi District Health Centre, while eleven CHCs are supervised and supported by three polyclinics. Private sector activities are not common so far in Bavi District. There are only three private pharmacies (with licenses), and a few private practitioners.

Bavi District was selected for the epidemiological field laboratory since it contained different geographical characteristics, was considered typical of northern Vietnam in socioeconomic and health status, had local authorities and health leaders strongly committed to the project, and was a reasonable distance away from Hanoi.

Daily life in Bavi
MATERIALS AND METHODS

Study base
This work was carried out within the Epidemiological Field Laboratory of Bavi (FilaBavi). FilaBavi was set up in Bavi district as part of the Health Systems Research Cooperation Programme between Sweden and Vietnam.

As a basis for sampling, an estimated infant mortality rate (IMR) of 45 per 1,000 live births and an under five mortality ratio (U5MR) of 60/1,000 were used, aiming to assess IMR after three years of study, and show differences in IMR between equally sized groups in the magnitude of 15 per 1,000. This could be achieved with approximately 20% of the total population. A random sampling of villages, with probability proportional to population size in each unit, was performed, and 67 population clusters were selected with a reported population size of about 51,000 inhabitants in about 11,300 households (Figure 2).

Figure 2: FilaBavi sample size

The overall design was to create a study base representative of the population in the district, through a baseline household survey, and quarterly demographic surveillance of vital events among the study population subsequently, with a complete re-census every two years. The household baseline survey was carried out at the beginning of 1999, collecting information at household and individual levels. Re-censuses were conducted in 2001, 2003 and 2005. At the household level, information
was collected on housing conditions, water resources, latrines, expenditure, income, agricultural land, access to the nearest commune health centre and hospital, and an assessment by the local authorities of the economic status of each household. For each household member, information on age, gender, ethnicity, religion, occupation, education, marital status, etc. was collected. Following the baseline survey, quarterly surveys have been carried out including data on marital status changes, migrations, pregnancy follow-ups, births, and deaths.

The organization of FilaBavi includes steering committees, the project manager, research students, surveyors, field surveyors, the field manager, and computer staff. The central steering committee is mainly responsible for technical and policy guidance of the field laboratory. In addition, this committee serves as a link between Swedish collaborators, the Ministry of Health in Vietnam, and Bavi District in discussions regarding collaborative research in the field laboratory. The members of the committee are representatives of the Ministry of Health; Health Strategy and Policy Institute; Hanoi Medical College and Bavi District People’s Committee. The District steering committee is mainly responsible for supporting practical management and implementation of the field laboratory in the District. Members of this committee include Bavi District People’s Committee; Bavi District Health Centre; Health Strategy and Policy Institute; and research students.

The project manager is very important for the whole field laboratory system, being responsible for coordinating and integrating activities, gathering information from different sources, and then achieving consensus between students and supervisors in Vietnam and in Sweden; and managing the field resources.

Research students also play important roles in supervising fieldwork. Coming from participating Vietnamese institutions, they are not only responsible for conducting specific studies but also for general fieldwork, to which each is expected to devote at
MATERIALS AND METHODS

least two weeks per year. They are the link persons between coordinators, students’ supervisors, surveyors, and field supervisors.

Surveyors are responsible for collecting field data in household interviews. They are all secondary school graduates, and each is in charge of about 300 – 400 households. All of them are trained and frequently updated, since the quality of surveys depends on their work. Supervisors are each responsible for seven surveyors, and mostly have some medical background. They receive forms, discuss difficulties, perform re-interviews for quality control purposes, collect forms from surveyors and pass them on to the manager, and meet surveyors’ teams and the manager in the FilaBavi office every week.

Three computer staffs and one supervisor work in the FilaBavi office, located at the District headquarter. They have high school education, basic computer skills, and relevant training. The field manager is mainly responsible for coordinating activities in the field and the office, and reports frequently to the project manager.

Data collection methods and procedures have been developed collaboratively by Vietnamese and Swedish experts, and training courses given before each survey. Data quality is assured by all forms being re-checked by field supervisors before submission to the office; the subjects of 10% of forms are re-interviewed by field supervisors, and 5% are re-interviewed by research students; 20% of collected questionnaires are desk-checked before computer entry.

A database system using Microsoft Access was developed locally to handle the data. Data files are frequently backed up onto zip disks and CD-ROMs, and completed forms are filed systematically in the office. Data processing and analysis has been done jointly by Vietnamese and Swedish experts, and research students have linked field lab results with their own specific studies [53].
Study design
Two main studies were designed and conducted for fulfilling the objectives of this thesis: one on cause-specific mortality and the other on risk factors (Figure 3). As compared to direct measures of disease occurrence, mortality and risk factor studies are simpler and less resource-intensive. Mortality reflects consequences and past patterns of diseases while risk factors are predictors of disease and indicate preventive utility.

![Diagram of study design]

Figure 3: Overall design of the thesis

The cause-specific mortality study
This was a retrospective study employing a verbal autopsy (VA) approach to identify causes of death in FilaBavi during 1999-2003. Verbal autopsy is an indirect method for estimating cause-specific mortality. The method uses information obtained from close relatives or caretakers of a deceased person about the circumstances, signs and symptoms during the terminal illness in order to assign the most likely cause of death [54]. The VA method was pilot tested in FilaBavi in 1999 and has since been used as a routine procedure to derive causes of death across all ages in the setting.
The current VA procedure involves 42 DSS surveyors registering deaths during their routine quarterly visits to households; 6 field supervisors (with medical background) for conducting interviews at households using VA questionnaires; two physicians for making diagnoses; and a group of investigators for comparing the two diagnoses, seeking more reference information (if needed) and drawing conclusions on cause of death (Figure 4). The VA questionnaire used in this study was developed from the WHO and INDEPTH standard verbal autopsy questionnaires, some Vietnamese medical textbooks and expert opinions. It has also been revised according to field experiences.

**Figure 4: Verbal autopsy procedure**
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The risk factor study

The risk factor study had a cross-sectional design which used the WHO STEPwise approach to surveillance of NCD risk factors (WHO STEPS) [55]. STEPS is composed of three steps, a structured-questionnaire to assess self-reported behaviour/lifestyle risk factors (Step 1), measurement of blood pressure and anthropometrical parameters (Step 2), and biochemical analysis of blood samples (Step 3) (Table 4). Within each step, different modules - core, expanded, and optional or built-in modules - have also been developed to allow collection of information with different complexity and levels of risk factor data assessment, depending on resource availability and information needs in different settings.

The pilot study was conducted in FilaBavi in 2001 to evaluate the methodological and logistical feasibility of the WHO STEPS in the setting (number and qualification of interviewers, questionnaire, blood pressure instruments, response rate, etc). A total of 600 adults aged 25-64 years were surveyed. Six field surveyors and six supervisors working for FilaBavi were selected to administer the adapted and translated STEPS questionnaire and to take blood pressure. Both field surveyors and field supervisors did separate interviews as well as separate BP measurements on selected individuals. They recorded all difficulties or practical problems encountered in undertaking these interviews in a working diary including the extent of re-visiting required to trace selected people and any reluctance to respond to any element of the survey.

Based on experiences gained from the pilot study, the main study was carried out in 2002 in a representative sample of 1000 men and 1000 women aged 25-64 years, randomly selected from FilaBavi study base, to measure the prevalence of major CVD risk factors. The step 1 of the WHO STEPS plus blood pressure was applied. Twelve field surveyors were selected as interviewers and the investigators were responsible for supervising the field procedure as well as other technical issues. The STEPS
questionnaire was revised to adapt to the local circumstances. Digital blood pressure devices (OMRON, as recommended by the WHO) were used.

Table 4: The WHO STEPS approach for NCD risk factor assessment

<table>
<thead>
<tr>
<th>Measures</th>
<th>Level</th>
<th>Core</th>
<th>Expanded</th>
<th>Optional (Examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Step 1 (Self Report)</td>
<td>Socio-economic and demographic variables, years of education, tobacco and alcohol use, physical inactivity, intake of fruit and vegetable</td>
<td>Ethnicity, education, occupation, income. Smokeless tobacco, fat consumption, types of physical activity</td>
<td>Other health-related behaviours; mental health, disability, injury</td>
</tr>
<tr>
<td></td>
<td>Step 2 (Physical)</td>
<td>Measured weight and height, waist circumference, blood pressure</td>
<td>Hip circumference, pulse rate, history of blood pressure</td>
<td>Objective measure of physical activity behaviour (e.g. timed walk, pedometer), skin fold thickness</td>
</tr>
<tr>
<td></td>
<td>Step 3 (Biochemical)</td>
<td>Fasting blood sugar, total cholesterol</td>
<td>History of diabetes, treatment for diabetes, fasting HDL-cholesterol and triglycerides</td>
<td>Oral glucose tolerance test, urine examination</td>
</tr>
</tbody>
</table>

Source: Bonita R, et al. 2002

Design of the thesis

Using data from the two above-mentioned original studies, five papers, as listed in page iii, have been written for inclusion in this thesis. While paper I and II are mainly descriptive and addressed methodological issues, paper III, IV and V employed both descriptive and analytical designs. Analytical designs were used to examine the association between outcome variables (CVD mortality, “hypertension” and tobacco use) and explanatory factors (gender, age, education, occupation, economic status). An overview of the five papers in terms of study objectives that they addressed, data sources, study sample, main variables and statistical methods is given in table 5.
Table 5: Overview of the designs of the five papers

<table>
<thead>
<tr>
<th>Paper</th>
<th>Specific objective*</th>
<th>Data source</th>
<th>Study subjects/ Sample size</th>
<th>Focus/ Main variables</th>
<th>Statistical methods**</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1, 5</td>
<td>FilaBavi database, risk factor study and comparable data from Indonesia and Ethiopia</td>
<td>1000 men and 1000 aged 25-64 years old in each study site</td>
<td>Methodology/ Blood pressure, smoking status, age, gender</td>
<td>Mainly descriptive: mean, proportion and corresponding 95% CI</td>
</tr>
<tr>
<td>II</td>
<td>1, 2</td>
<td>FilaBavi database and mortality study</td>
<td>189 cases of death occurring during January 01, 1999 to December 31, 1999</td>
<td>Methodology/ Cause of death, age, gender</td>
<td>Descriptive: Frequency, proportion of death by cause</td>
</tr>
<tr>
<td>III</td>
<td>2, 4</td>
<td>FilaBavi database and mortality study</td>
<td>1,067 cases of death occurring among adults aged 20 years and over during January 01, 1999 to December 31, 2003</td>
<td>Cause of death, age, gender, education, economic status</td>
<td>Descriptive and analytical: Mortality rates, crude and adjusted (Mantel-Haenszel) mortality rate ratios, multivariate Cox regression</td>
</tr>
<tr>
<td>IV</td>
<td>3, 4</td>
<td>FilaBavi database and risk factor study</td>
<td>1000 men and 1000 aged 25-64 years old</td>
<td>Blood pressure, age, gender, education, occupation, economic status</td>
<td>Descriptive and analytical: Prevalence of hypertension, multivariate logistic regression</td>
</tr>
<tr>
<td>V</td>
<td>3, 4, 5</td>
<td>FilaBavi database, risk factor study and comparable data from Indonesia</td>
<td>1000 men and 1000 aged 25-64 years old in each study site</td>
<td>Smoking status, geographical area, age, gender, education, occupation, economic status</td>
<td>Descriptive and analytical: Prevalence of different smoking categories, Kaplan-Meier survival curves, multivariate Cox regression</td>
</tr>
</tbody>
</table>

* Refer to specific objectives of the thesis

** Statistical tests were carried out using Stata8 software (Stata Corporation, College Station, TX, USA), p values of 0.05 were used
Main definitions

This study uses the following main definitions:

- Underlying cause of death was reached when there was consensus between two VA physicians (II, III).

- "Hypertension" was defined as systolic blood pressure (SBP) equal to or more than 140 mmHg or diastolic blood pressure (DBP) equal to or more than 90 mmHg (adapted from JNC 7) [56] or being treated for hypertension (I, IV).

- Smoking status was classified, based on the WHO STEPS smoking questions, as current daily smoker, ex-daily smoker, smoker but not daily, and non-smoker (Figure 5) [57] (I, V). For measuring dynamic changes in smoking status, study subjects were categorized as in regular use (the change in smoking status from non-daily smoking to daily smoking) or cessation (the change in smoking status from a daily smoking to non-daily smoking) (V).

Figure 5: The WHO STEPS smoking questions and definitions of smoking status
MATERIALS AND METHODS

- Socio-economic status of the study subjects was estimated by assessing their educational level, occupational status and the present economic condition of their household.
  o Educational level was classified as two groups in paper III (1 - no formal education, including illiteracy, 2 – formal education: completion of any level of schooling) and as three groups in paper IV (1 - less than secondary school: completion of any school level from the first to the sixth class, or none), 2 - secondary school: completion of school level from the seventh to the ninth class, 3 - high school and higher).
  o Occupational status (main occupation of the study subjects) was grouped as: 1 - government staff, 2 - farmer, 3 - other jobs (housewives, small traders, construction workers, handicraft makers and jobless, etc) (IV).
  o Economic condition of households was described as two groups in paper III (1 - poor, and 2 - non-poor) and three groups in paper IV (1 - poor, 2 - average and 3 - fair and rich) (according to local authorities’s assessment).
  o For comparability with Indonesian data, study subjects were dichotomized into those who were educated to less than high school level and those who had completed at least 9th grade (educational level); farmers and non-farmers (occupational status). The economic condition of the household was categorized into low, average and high based on the household average annual income (V).

Ethical considerations
The protocol of this study was approved by the Scientific and Ethical Committee in Biomedical Research, Hanoi Medical University. All human subjects in the study were asked for their consent before collecting data, and all had complete rights to withdraw from the study at any time without any threats or disadvantages. The Research Ethics Committee at Umeå University has given ethical approval for the FilaBavi household surveillance system, including data collection on vital statistics (reference number 02 – 420).
MAIN FINDINGS

Applying VA and the WHO STEPS methods in FilaBavi (I, II)

VA method for identifying causes of death

The VA method was pilot tested as a method of determining cause of death across all ages in FilaBavi in 1999. The method involved a total of 39 lay interviewers to carry out the VAs using a questionnaire adapted from WHO and some Vietnamese medical textbooks. The questionnaire is a combination of open-ended questions and checklists of signs and symptoms.

During 1999, there were 221 deaths occurring in FilaBavi but VA interviews were successfully completed for only 189 (86.0%). Of the total interviews, 10 (5.3%) were re-interviewed by field supervisors, 12 (6.3%) by researchers randomly, and another 15 (7.9%) required re-interview because of insufficient information. There were 165 cases (87.3%) in which respondents were close caretakers, and 13 cases (6.8%) where they were not (excluding 11 deaths caused by accidents at which no one was present).

The study was carried out in 1999 and early 2000, collecting information on deaths that occurred in 1999, so that the recall period (time between death and VA interview) ranged from one month to 12 months with a mode of seven months (22.8%).

Physician review approach was used to derive causes of death. The diagnoses of cause of death were made by two physicians separately and then compared. The kappa test was used to measure agreement between the two physicians, $\kappa = 0.84$ (95% CI 0.8 - 0.9), indicating a very good agreement [58].

The WHO STEPS approach to surveillance of NCD risk factors

The methodological and logistical feasibilities of the WHO STEPS were assessed in 2001. The pilot study revealed that either field surveyors or field supervisors of FilaBavi were appropriate for administering the WHO STEPS questionnaire as well
as measuring blood pressure using an automatic digital BP measuring device. In general, most of questions in the STEPS instruments were understandable to both the surveyors and the respondents, and each interview could be completed in 20-30 minutes. However, there were some difficulties when collecting information such as how to convert quantity of alcohol used into a standard drink; on the method for standardizing servings of vegetable and fruit; and the difficulties of questions on physical activities, etc. The digital BP measuring device OMRON, as recommended by the WHO, was convenient for use in the field and suitable for use by laypersons. There was no logistical problem found and the study subjects were pleased to collaborate, resulting in a response rate of 97.5% [59].

Burden of mortality from CVD in Bavi (II, III)

An initial idea about the burden of mortality from CVD in Bavi was obtained from analysing 189 verbal autopsy interviews in 1999. Mortality figures indicated that a substantial proportion of deaths were due to CVD (20% of all deaths), which was the leading cause of death, exceeding even infectious diseases (Figure 6).

![Figure 6: Distribution of causes of death in FilaBavi in 1999](image)

The same was true for the mortality pattern in Bavi in 2000. Of a total of 249 deaths, CVD ranked number one with 64 cases, accounting for 25.7% of total mortality. There were 35 cases (26.5%) among men and 29 cases (24.8%) among women [60].
The burden of mortality from CVD in Bavi was more evident from an analysis of 5-year data. CVD was shown to be the most common cause of death among adults, as well as being the largest component of NCD mortality. Out of 1,067 deaths which occurred among people aged 20 years old and over during the period January 01, 1999 to December 31, 2003 in FilaBavi, there were 334 cases who died of CVD (32.2% of all deaths), a rate of 2.6 per 1,000 person-years. Burden of CVD mortality was higher among men than among women. CVD deaths accounted for 33.2% of all deaths among men (190 cases, 3.0 per 1,000 person-years) and 31.1% (154 cases, 2.1 per 1,000 person-years) among women (Table 6).

Table 6: Distribution of causes of death among adults aged 20 years and over, Bavi district, Vietnam, 1999-2003

<table>
<thead>
<tr>
<th>Broad causes</th>
<th>Men</th>
<th>Women</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>% of total death</td>
<td>Rate/1000 p-yrs</td>
</tr>
<tr>
<td>CVD</td>
<td>190</td>
<td>33.2</td>
<td>3.0</td>
</tr>
<tr>
<td>Cancer</td>
<td>95</td>
<td>16.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Other NCD*</td>
<td>96</td>
<td>16.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Infectious</td>
<td>68</td>
<td>11.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Injuries</td>
<td>48</td>
<td>8.4</td>
<td>0.8</td>
</tr>
<tr>
<td>Others**</td>
<td>75</td>
<td>13.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Total</td>
<td>572</td>
<td>100</td>
<td>9.2</td>
</tr>
</tbody>
</table>

* Including digestive, genito-urinary, nervous, respiratory disease, etc
** Including old age and inconclusive causes
p-yrs: person-years

Among CVD deaths, stroke was the predominant cause (113 cases, accounting for 59% among men and 99 cases, accounting for 64% among women). Heart failure was the second ranked CVD cause (37 cases, 19% among men and 29 cases, 19% women) and the remaining CVD causes of death were coronary heart disease, pulmonary heart disease, etc (40 cases, 21% in men and 26 cases, 17% in women) (Figure 7).
Figure 7: Distribution of CVD causes of death among adults aged 20 years and over, Bavi district, Vietnam, 1999-2003

Magnitude of selected CVD risk factors among adults in Bavi (I, IV, V)
For the risk factor study, out of the 2000 subjects randomly selected from the FilaBavi study base, 1996 people (997 men and 999 women) responded (response rate 99%). In this thesis, only data on blood pressure and tobacco use have been analyzed.

Blood pressure and “hypertension”
As shown in table 7, both the mean SBP and mean DBP were significantly higher in men than women (mean SBP and DBP were 124.9 and 76.9 mmHg in men and 117.7 and 72.0 mmHg in women). Taking the previously-mentioned definition of hypertension, men had more hypertension than women (18.1% vs. 10.1%, respectively). The overall prevalence of hypertension was 14.1% (281/1996).

Among people who had hypertension, only 49 cases (17.4% of the hypertensives), 25 men (13.8% of the hypertensive men) and 24 women (23.8% of the hypertensive women), were aware of their hypertensive status and the remaining 232 (82.6%) were unaware. Of the hypertensives who were aware of their condition, only 18 cases (36.7% of the aware hypertensives), 10 men (40% of the aware hypertensive men) and 8 women (33.3% of the aware hypertensive women), were being treated
with drugs. Among those who were treated with drugs, 13 cases (72% of the treated hypertensives), 7 men (70% of the treated hypertensive men) and 6 women (75% of the treated hypertensive women), had blood pressure below 140/90 mmHg.

*Tobacco use*
Smoking was the main form of tobacco use and it was very common among men in Bavi. About 58% of men (aged 25-64 years) reported that they currently smoked daily and only 15% of men had never smoked (non-smokers). The median age of becoming a daily smoker was 20. Manufactured cigarettes were more often used by daily smokers compared to other forms of tobacco. The average daily number of cigarettes consumed by daily smokers was 9.8. The mean duration from the age of starting daily smoking to the age at cessation (among those who had quit daily smoking) was 21 years. Tobacco was rarely used by women in Bavi, with a low prevalence of current smokers (0.1%).

**Table 7: Pattern of selected CVD risk factors among adults in Bavi district**

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of subjects in the analysis</strong></td>
<td>997</td>
<td>999</td>
</tr>
<tr>
<td><strong>Blood pressure</strong>: mmHg (95% CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mean systolic blood pressure</td>
<td>124.4 (123.9-125.5)</td>
<td>117.7 (116.1-118.9)</td>
</tr>
<tr>
<td>- Mean diastolic blood pressure</td>
<td>76.9 (76.2-77.6)</td>
<td>72.0 (71.4-72.7)</td>
</tr>
<tr>
<td><strong>Hypertension</strong>: prevalence (95% CI)</td>
<td>18.1 (15.8-20.5)</td>
<td>10.1 (08.2-11.9)</td>
</tr>
<tr>
<td><strong>Aware of hypertension</strong>: n (% of the hypertensives)</td>
<td>25 (13.8)</td>
<td>24(23.8)</td>
</tr>
<tr>
<td><strong>Treated for hypertension</strong>: n (% of the aware hypertensives)</td>
<td>10 (40.0)</td>
<td>8(33.3)</td>
</tr>
<tr>
<td><strong>Tobacco use</strong>: % (95% CI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Current daily smokers</td>
<td>57.5 (51.0–63.8)</td>
<td>0.1 (0.0- 0.4)</td>
</tr>
<tr>
<td>- Ex-daily smokers</td>
<td>16.3 (13.2–20.5)</td>
<td>0.3(0.0 -1.0)</td>
</tr>
<tr>
<td>- Never daily smokers</td>
<td>10.5 (07.4-14.7)</td>
<td>1.3 (0.6-3.0)</td>
</tr>
<tr>
<td>- Non smokers</td>
<td>15.4 (10.0-22.9)</td>
<td>98.4 (96.4-99.1)</td>
</tr>
<tr>
<td><strong>Age at start of daily smoking</strong>: median (min-max)</td>
<td>20.0 (8.0-40.0)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Cigarettes/day used by daily smoker</strong>: mean (min-max)</td>
<td>9.8 (1.0-20.0)</td>
<td>-</td>
</tr>
<tr>
<td><strong>Duration of daily smoking (years)</strong>: mean (min-max)</td>
<td>21.0 (2.5-40.0)</td>
<td>-</td>
</tr>
</tbody>
</table>
Social patterning of CVD mortality and risk factors in Bavi (III, IV, V)

A graphical representation of adjusted RR/ORs, and corresponding 95% CIs, showing the association of CVD mortality, hypertension and tobacco use with some socio-demographic indicators is presented in Figure 8. In terms of tobacco use, changes in smoking status were of particular interest. Due to the low prevalence of smoking among women, analyses of the association between changes in smoking status and socio-demographic status were done for men only. The socio-demographic indicators included gender, age, education, occupation and economic status.

Gender and age

Figure 8 indicates that CVD mortality was significantly associated with gender and age. CVD mortality risks were higher for men than women (bar 1, RR=3.3) and increased significantly with age (bar 3, RR=13.3). It was found that CVD mortality in Bavi was more strongly associated with gender, age and education than were other NCD causes [61].

Hypertension was also shown to be gender and age related. The prevalence of hypertension was significantly higher among men than among women (bar 2, RR=1.8). It increased with age and was statistically different among people aged 35-44, 45-54 and 55-64 years as compared with the 25-34 year age group (bar 4 to bar 9).

Regarding changes in smoking status among men, age was not found to be an independent determinant of becoming regular smoker (bar 10-12) but it was significantly associated with the chance of smoking cessation (bar 13-15). The younger birth cohorts were more likely to cease smoking and those who started to adopt daily smoking later in life had a slightly higher chance of ceasing smoking (bar 16, RR=1.1).
**Figure 8: Summary of the analyses of socio-demographic determinants of CVD mortality, hypertension and smoking status**
MAIN FINDINGS

**Education**

Educational status was found to be strongly associated with both CVD mortality and hypertension. The risk of dying from CVD among people without formal education was 4.5 times higher than that of those with primary and higher education (bar 17).

Men and women with the lowest educational levels were more likely to be hypertensive than the two higher education categories. However, the difference in hypertension between low and high educational groups was only significant in men (bar 18, OR=2.8).

Even though bivariate analyses showed that the proportion of current daily smokers among men was significantly higher among those with lower education [62], multivariate Cox regression revealed that education was not a significant predictor of either becoming a daily smoker or of cessation (bar 22, 23).

**Occupation.**

As mortality data included all people aged 20 years and over, information on occupational status was missing for many elderly who had stopped working for a long time. Occupational status was not captured in the mortality analysis.

Occupation was shown to be related to hypertension. For both genders, people doing other jobs had a significantly higher prevalence of hypertension compared with farmers (bar 25, OR=2.2, among men and bar 27, OR=5.0, among women). Like education, occupation was not a significant predictor of either becoming a daily smoker or of cessation.

**Economic status**

In this study, economic status was not shown to be significantly associated with CVD mortality (bar 30). However, it seemed to be an important predictor of hypertension and of changes in smoking status.
The patterns of hypertension according to economic status in Bavi varied and were inconsistent by gender. Affluent men and poor women had the highest prevalences of hypertension as compared with other economic groups of the same gender. While affluent men had a significantly higher prevalence of hypertension as compared to poor men (bar 32, OR=1.8), women in the average living standard group were less likely to be hypertensive than poor women (bar 33, OR=0.4).

Income was also shown to be a significant predictor of both becoming a regular smoker and of smoking cessation among men in Bavi. Men in the low income group were 1.4 times more likely to smoke daily than those in the high income group (bar 35). Daily smokers in the highest income group had a greater chance of smoking cessation than those with low income (bar 38, RR=2.8).

Comparing risk factors profile among adults in 3 INDEPTH sites (I, V)

This section provides some preliminary comparisons of risk factor profiles among adults in three INDEPTH sites: FilaBavi (Vietnam), Purworejo (Indonesia) and Butajira (Ethiopia) (Figure 9). These three sites are involved in a collaborative project on characterizing the epidemiological transition, initiated by the Umeå International School of Public Health.

Figure 9: INDEPTH member sites in 2004 (shaded) and the three project areas
Demographic surveillance project in the three study bases within this collaboration have generated an extensive longitudinal database amounting to about 1.5 million person-years. Each of the three DSS sites has its own unique empirical study base, culture and setting and they differ from each other remarkably on all main demographic and epidemiological indicators [63].

Preliminary analysis showed that most NCD risk factors were more prevalent in Indonesia, compared with Vietnam and Ethiopia. In all three sites, mean systolic and diastolic blood pressures were significantly higher among men compared to women, and the blood pressure distributions showed a transitional pattern when comparing Ethiopia, Vietnam and Indonesia (Figure 10).

![Figure 10: Systolic and diastolic blood pressure distribution in 3 sites](image)

The age-standardized prevalence of smoking among men and women was 62.6% and 1.6%, respectively, in Indonesia compared to Vietnam (57.1% and 0.1%) and Ethiopia (7.7% and 0%). Among men, the age-standardized prevalence of elevated blood pressure varied from 11.8% in Ethiopia to 18.0% in Vietnam and 22.7% in Indonesia. A similar pattern was observed among women in all sites (7.1%, 9.8% and 18.8%, respectively). Compared with Ethiopia, both Indonesia and Vietnam had higher prevalence of risk factor clustering (smoking and elevated blood pressure combined) (Figure 11).
As it was not so common in Ethiopia, smoking status was further compared between Vietnam and Indonesia. Kaplan-Meier survival curves were plotted to examine probabilities of not starting and not quitting daily smoking among men (Figure 12).

Figure 11: Profile of selected risk factor in 3 INDEPTH sites

Figure 12: Kaplan-Meier survival curves showing the probability of not starting and not quitting daily smoking, among men aged 25-64 years
**Figure 12** shows that, in both study areas, the median age of becoming a daily smoker was 20. However, relatively more Indonesian men had started to smoke very early. More than 28% of Indonesian men had smoked daily by the age of 15 while only about 11% Vietnamese men had done so. Indonesian men continued taking up daily smoking even after the age of 40 while the Vietnamese did not. More Vietnamese men quit being a daily smoker than did Indonesian men. In 20 years after initiating daily smoking, 15% of Vietnamese and 10% of Indonesian daily smokers had quit smoking. The quitting gap became wider and by the age of 35, the number of Vietnamese men who quit daily smoking was twice that of Indonesian men. The velocity of quitting smoking was also faster in Vietnam compared with Indonesia.

**Figure 13** shows the relative risk of becoming a regular smoker and the relative chance of cessation among men in the two study populations according to socio-demographic factors using a Cox proportional hazards model. While only income was found to be a significant predictor of becoming a regular smoker in Vietnam, birth cohort and education significantly increased the probability of becoming a regular smoker in Indonesia. Men in the low income group in Vietnam were 1.4 times more likely to smoke daily than those in the high income group. Indonesian men aged 55-64 years old and having lower education had a significantly increased risk of adopting daily smoking, by 1.3 times and 1.5 times respectively.

In both study areas, birth cohort was found to be significantly associated with the chance of smoking cessation. The younger birth cohorts were more likely to give up smoking. Age at start of daily smoking had a slight effect on cessation, indicating that those who adopted daily smoking later in life had a slightly higher chance of ceasing smoking. Educational level and occupation were also found to be significant predictors of smoking cessation in Indonesia while economic status played an important role in Vietnam. The chance of cessation among Indonesian daily smokers was lower among those with low education (RR=0.4) and among
farmers (RR=0.6). Vietnamese daily smokers in the highest income group had a greater chance of smoking cessation than those with low income (RR=2.8).

Figure 13: Relative risks of becoming regular smokers and relative chance of smoking cessation among men in Vietnam and Indonesia according to socio-demographic characteristics, based on a Cox proportional hazards model.
DISCUSSIONS

Potential of combining the DSS and the WHO STEPS methodologies

Discussions about how to measure population health have raised concerns over the low priority given to disease surveillance in national health systems. Surveillance is “the tool underpinning health promotion and disease prevention efforts and it is a fundamental, but often neglected, component of public health practice” [49]. For epidemiologists working in the world’s poorest communities, this means that vital registration often has to be implemented as a starting point in fieldwork [49, 64]. DSSs have thus been established in different countries as platforms to monitor population dynamics. An initial census defines and registers the target population. Regular subsequent rounds of data collection are done to register all new individuals, households and residential units and to update key variables and attributes of existing subjects.

Surveillance of NCD/CVD risk factors is less technologically and logistically demanding as compared with surveillance of a disease itself. From the public health perspective, a focus on the risk factors is more promising. “The major risk factors of today will be the disease of tomorrow” [55]; therefore information on NCD/CVD risk factors will contribute to efforts to control of future NCD/CVD epidemics. The STEPS approach is the WHO-recommended NCD/CVD surveillance tool which is based on the view that small amounts of good quality data on a few key modifiable NCD/CVD risk factors which may predict most future NCD are more valuable than large amounts of poor quality data [65]. STEPS is constructed in a flexible way and allows add-on modules which can be simply built into the information package to capture, on a population basis, emerging NCD/CVD risk factor patterns.

Figure 14 illustrates the relationship between DSS, risk factor surveillance and hypothesis-driven research. Risk factor surveillance and mortality assessment will enable a DSS to monitor changes over time and thus characterize the epidemiological transition alongside demographic and economic transitions. The
application of the VA method within DSS enables the assessment of cause-specific mortality [58].

DSS also provide suitable sampling frames for analytical studies, e.g. for cohort studies on morbidity, and can be the basis for selecting cases for case-control studies, and for studying risk factor changes through risk factor surveillance. Risk factor surveillance provides distribution of risk factor levels in a population, and changes can be assessed through repeated cross-sectional studies or in panels. Observed patterns over time may raise questions on causes of risky behaviour, enable analyses of their consequences and suggest interventions. Implementation of risk factor surveillance based on STEPS allows us to answer some basic epidemiological questions on ‘who, where, when?’ [49] such as: how are risk factors distributed in the population?; who within the population are more affected by the risk factor burden?; are the poorest more burdened by NCD risk factors compared to the richer?; how do risk factor patterns change over time?

**Figure 14: The triangulation between DSS, risk factor surveillance and hypothesis-driven research [63]**
DSSs as well as risk factor surveillance data may potentially be a lever for hypothesis driven research. Different research designs may be used to address specific *a priori* hypotheses or research questions brought up from DSS or risk factor surveillance data. While such analytical studies can enable the assessment of potential risk factors, qualitative approaches may explore observed phenomena in greater depth. Both can provide a basis for designing population interventions. The availability of a surveillance system permits evaluations of these interventions.

**Burden of CVD mortality and its risk factors in Bavi**

We have shown a substantial proportion of deaths due to CVD, which was the leading cause of death in Bavi district. Thus the so-called “double burden of mortality” in our setting is now dominated by NCD, and mostly due to CVD. Referring to characteristics of the epidemiological transition pertaining to CVD epidemics ([Table 1](#)) [35], our results suggest that rural Vietnam, of which Bavi district is an example, is in the second stage of the CVD epidemic. This stage would also include China and other Asian countries. India is already progressing to stage three of the CVD epidemic, while developed countries are typically in stage four [35].

The heavy burden of mortality from CVD in Bavi could partly be explained by the aging of the population in the setting. The proportion of people aged 50 years and over rose from 16.1% (13.4% of men and 18.7% of women) in 1999 to 16.9% (14.2% of men and 19.5% of women) in 2001 and to 17.9% (15.0% of men and 20.5% of women) in 2003. Other explanations, as evident from this study, could involve the magnitude of established risk factors such as hypertension and tobacco use in the setting.

Hypertension is an established and important risk factor for CVD and has been observed to be a leading contributor to burdens of mortality and morbidity both in developed and developing countries [66-69]. The relationship between blood pressure and risk of CVD events is continuous, consistent, and independent of other risk factors. The higher the blood pressure, the greater the chance of heart
Discussion

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The overall 14.1% prevalence of hypertension found in this study indicates that the condition already affects a sizeable proportion of the adult population in Bavi district. This figure was lower than the prevalence of 16.8% found in a study by the Vietnam National Heart Institute in 2001 for both urban and rural areas in some provinces in the North of Vietnam [70] and of 16.9% among people age 25-64 years in all Vietnam reported by the Vietnam National Health Survey 2002 [71].

The findings of this study indicate that the prevalence of hypertension seemed to be increasing in rural communities of Vietnam as compared with the figure of 11.7% in 1996 [70]. This tendency was consistent with hospital based figures for all Vietnam: hypertension-related diseases were the fifth leading cause of death and the sixth leading cause of disease in hospitals in 1998 [43] and were the third leading cause of death and the sixth leading cause of disease in hospitals in 2002 [44]. A recent NCD survey in FilaBavi has also shown an increased prevalence of hypertension in the setting (16.9% among people aged 25-64 years) (unpublished data).

The prevalence of hypertension in Bavi was low compared to national figures in developed countries like the United States of America, Australia and the United Kingdom, as well as other developing countries like Thailand, Indonesia and China [63, 72, 73]. The hypertension prevalence in FilaBavi was slightly lower than that revealed in a rural community of India (17.3% among people aged 25-64 years) [74] and the figures of 15% in remote rural region of Pakistan [75], but higher than the 10% reported in rural communities of Iran [76].

This study also revealed an extremely high percentage of hypertensives (83%) who were not aware of their high blood pressure. This was much higher than the figure
of 55.3% reported in China in 2000 [77], of 75.7% in Korea in 2001 [78], and of 49% in a community of India in 2003 [79]. Urgent strategies and measures for prevention and control of hypertension are needed in this setting.

Tobacco use is another established risk factor for CVD [80-88]. Smoking is the main form of using tobacco and its epidemic follows a four-stage transition characterized by the different levels of smoking prevalence and tobacco-related morbidity among men and women. Stage 1 is described by a low prevalence (below 20%) of cigarette smoking, principally limited to males. Stage 2 is characterized by an increase in smoking prevalence to above 50% in men, early increases in cigarette smoking among women, a shift towards smoking initiation at younger ages. In stage 3, there is a decrease in smoking prevalence among men, a more gradual decline in women, and convergence of male and female smoking prevalence. Stage 4 of the epidemic is characterized by a marked downturn in smoking prevalence in both men and women [89]. Vietnam was classified by the World Health Organization to be at the first stage of the smoking epidemic in 2000 [89].

Tobacco use has also been identified as a big problem in Bavi, especially among men. The prevalence of current daily smoking of 58% among men, as revealed from this study, together with national figure of 51.0% among men and 3.5% among women in 2002 [71], indicate that Vietnam is no longer at the first stage of the smoking epidemic, as previously classified by WHO.

Given the high prevalence of daily smoking among men in the setting, a considerable number of deaths attributable to smoking will occur in the future. Using the smoking attributable fraction approach, adapted from Wen et al. [90],

\[ SAF_{10} = \frac{P(RR-1)(1+P(RR-1))}{(RR-1)(1+P(RR-1))} \]

(where \( SAF_{10} \) is the smoking attributable mortality fraction in 10 years; \( P \) is the daily smoking prevalence; \( RR \) is the relative risk of smoking related diseases: assumed to be 1.5), then the proportion of deaths attributable to smoking among men in Bavi in 10 years would be 23.7%.
National data on morbidity and mortality from tobacco-related diseases also support the mode and speed of the smoking epidemic in Vietnam. It was reported that the number of hospital admissions and the number of deaths from non-communicable diseases rose 1.5 times between 1986 and 2002 [42, 44].

Despite the low percentage of daily smoking among women, the problems with female smoking in communities must not be underestimated. Concerns about smoking among women have also been raised by anti-tobacco activists in Vietnam [91, 92]. The well-known natural history of smoking epidemics characterized by increasing smoking rates among women in developed countries could spread to developing countries, and thus preventive actions need to be taken.

Social patterning of CVD mortality and risk factors in Bavi
Of particular interest in this thesis are the differences in CVD mortality and its risk factors by socio-demographic conditions (gender, age, education, occupation and economic status) as, according to transition theory, subsets of populations may be at different stages of the CVD epidemic [29, 30, 33-35].

Gender and age are fundamental characteristics of individuals that are almost always included in epidemiological studies. Even though sex and age are considered not “modifiable”, they serve as markers for underlying behaviours, exposures related to disease outcomes. The term “gender” was used to infer the modifiable differences between men and women.

Our results show that CVD has already affected both genders and this refutes the misperception that CVD is not a real problem for women. However, CVD mortality rates were significantly higher for men than women and the differences in mortality by gender were larger for CVD than for other NCD causes.

The excess risk of dying from CVD in men can be partially explained by the differences in risk factor profiles between men and women. In fact, in Bavi, men
experienced more hypertension than women (18% vs. 10%). This pattern was consistent with Vietnamese findings in 1996 and 2002 but the gender difference in hypertension found in this study was wider [70, 71]. This pattern was also comparable to other studies carried out in both developed and developing countries [69, 93-95]. However, this finding was contrary to a study in Indonesia in 2000 which reported that women suffered from hypertension more than men [63]. Similarly, largely due to cultural factors, men in Bavi used tobacco considerably more than women did (Table 7).

In this study, age was proven to be more strongly associated with CVD mortality than with other NCD causes. Age was also a key predictor of blood pressure level and hypertension. This is in accordance with many other studies worldwide [5, 67, 69-71, 96-99].

For tobacco use, birth cohort was found to be significantly associated with the chance of smoking cessation. The younger birth cohorts were more likely to cease smoking. This implies that tobacco cessation programs are likely to be more effective in younger generations.

Education was an important factor for health, both among men and among women, particularly in the rural areas. This probably reflects higher education being associated with increased knowledge about health matters, leading to consequent reductions in risky health behaviours, etc.

We found that CVD mortality rates were substantially lower among the higher educated, even after adjusting for other independent variables such as gender, age and economic status. This is similar to the findings of a number of studies that showed inverse socio-economic gradients in CVD mortality in developed [100-103] and developing countries [104]. CVD was found to be the greatest contributor to differentials in NCD mortality by education in both genders. This is similar to findings from studies in England [105], Israel [106] and Korea [107].
DISCUSSIONS

The educational differences in CVD mortality could be partly explained by the relationship between education and hypertension. An inverse significant association was found when comparing the risk of being hypertensive between men at the lowest educational level (less than secondary school) and the highest one (high school and higher). This inverse association was also found in almost all studies carried out in developed countries such as the United States of America, Canada, Australia, Sweden and the Netherlands [96]. In developing countries, the pattern of association varied, while hypertension was found to be inversely associated with educational levels in some studies, for example, in Brazil [99] and China [108], while a direct association was observed in others, for example in India [109, 110].

Regarding the association between education and changes in smoking status, education was not shown to be a significantly independent predictor of changes in smoking status, neither for becoming a regular smoker nor for smoking cessation. These non-significant results might also be due to the small sample size in this study. The importance of education for anti-smoking campaigns should not be undervalued.

In this study, farmers were shown to be less likely to suffer from hypertension as compared with people doing other jobs. In fact, farmers may be less exposed to lifestyle risk factors as they have little sedentary time due to hard agricultural work, and their living standard tends to be too low for excessive consumption of saturated fat [59]. On the contrary, people doing other jobs (traders, construction workers, handicraft makers etc) might be more at risk of hypertension, possibly because of unhealthy lifestyles (heavy drinking, smoking) and job pressure.

Like education, occupation was not shown to be a significant independent predictor of becoming a regular smoker or of smoking cessation in the setting.
CVD mortality differences between rich and poor were not pronounced in this study. Contrary to the old concept that “only the rich develop CVD”, these results showed a possibly rising burden of CVD mortality among the poor which demonstrates the shift from “early to later adopter” of a CVD epidemic [12].

In this study, hypertension was found to have a complex association with economic status. Richer men and poorer women had increased risks of being hypertensive as compared with people of the same gender in the average living standard group. This is supported by a Jamaican study [111] and may imply a diverse range of factors associated with hypertension in particular and cardiovascular diseases in general. High risks of hypertension among the richer men of Bavi may reflect the adoption of western lifestyles such as high-fat diets, less physical activity, higher alcohol consumption and job stress, etc. A relatively higher prevalence of hypertension among poor women may reflect alternative risk factors in this setting, such as early under-nutrition (the Barker’s hypothesis [112-114]). Another Jamaican study [115] confirmed that growth retardation in infancy was associated with higher blood pressure in later life.

The complex relationships between hypertension and economic status found in this study were different from those reported elsewhere: some studies in the United States of America found an inverse association between hypertension and economic status but a study from a rural area of India found a direct association [96].

Regarding tobacco use, this study showed a significantly lower risk of becoming a regular smoker and the higher chance for cessation among the high income group compared to lower income group implying that improvements in living standards are likely to reduce tobacco use. This is consistent with the findings from a study in Vietnam which also showed that income appears to exert strong effect on the decision to both initiate and to cease smoking [91, 116].
DISCUSSIONS

Risk factors transition in three transitional societies
The risk factor profiles of FilaBavi, Purworejo and Butajira indicated that these three DSS sites are burdened by NCD risk factors to varying extents, and further illuminate different stages of the epidemiological transition. Indonesia is undergoing rapid epidemiological transition, while Ethiopia is at an earlier stage of the transition, often characterized as a delayed model, and Vietnam lies in between the two extremes. Initial information on socio-demographic characteristics in the three respective sites seem to support this statement [63], as do national data on economic development: GDP per capita in Indonesia, Vietnam and Ethiopia in 2005 were 3,700, 3,000 and 800 PPP US$, respectively [117].

Comparing the smoking epidemics of Vietnam and Indonesia showed that both countries have already moved into the second stage of the smoking epidemic with high rates of smoking in men, especially Indonesia. The higher prevalence of daily smokers among men and women in Indonesia compared to Vietnam is consistent with the WHO’s figures [88] and other studies in these countries respectively [71, 91, 118].

In both Vietnam and Indonesia, men with lower SES were more likely to become regular smokers but less likely to cease. These findings are consistent with prior analyses of individual stages of cigarette use [116, 118-123]. However, the SES determinants of changes in smoking status (i.e. of becoming a regular user and quitting) were different between the two study areas suggesting the importance of comprehensive tobacco interventions. While, as stated earlier, improvement in living standards in Vietnam has had strong impact on tobacco control in Vietnam, education played an important role in the anti-tobacco in Indonesia.

Tobacco control activity in Indonesia is currently at an early stage with inadequate tobacco control measures [88] while the influence of tobacco industry has been growing [122]. Actions against tobacco in Vietnam appear to be better
implemented [91, 92] and have been further improved by signing and ratifying the Framework Convention on Tobacco Control.

**Methodological considerations**

As important as the main findings, some methodological issues of this study must be taken into consideration. There are a number of issues related to the method used and possible factors which may have influenced the results.

For mortality analysis, the validity of VA methods is a major concern. Working in a setting without medical death certification, our mortality pattern depends critically on the quality of the verbal autopsy approach but the method has not been extensively validated in Vietnam. The VA process is difficult to validate rigorously, particularly for detailed differentiation between different types of CVD. Based on experiences with VA in 1999 [58], we chose interviewers with more appropriate qualifications (medical background, field experience), carefully organized the prior training, designed a detailed questionnaire and involved one local clinical physician as an assessor of the questionnaire instrument. We are currently working on the development of a probabilistic model for interpreting verbal autopsy which may lead to a more objective assessment of cause of death [124, 125].

For assessing blood pressure, even though recognizing that blood pressure affects cardiovascular health on a continuous scale rather than categorically [18, 126], we used the JNC 7 definition of hypertension after consulting with cardiologists in Vietnam about the threshold of blood pressure that leads to high risk of cardiovascular complications and to ensure comparability with other studies in Vietnam as well as internationally. We are currently working on another paper which examines the level of blood pressure in population as the whole.

There were also several limitations to our analyses on smoking status in this study. Firstly, even though we recognized that smoking could be harmful at any dose, we were only able to analyze the daily smokers from information that could be
extracted from the smoking module of the WHO STEPS questionnaire. The WHO STEPS is a surveillance tool more than a survey tool and its emphasis is placed on daily smoking as the most risky level of smoking and so most important to study. Secondly, our results relied on the accuracy of self-reported smoking status among the population in which validity (both influenced by recall bias and under reporting) has to be considered. This applied especially among women as female smoking is not culturally appropriate in either Vietnam or Indonesia. However, the validity of self-reported smoking status has been confirmed elsewhere[127, 128].

Thirdly, even though our surveys were carried out using the standardized protocol of the WHO STEPS which facilitated comparisons, a minor concern related to difference in the timing of data collection and the slightly different sampling methods undertaken in both countries. We addressed the problems by introducing sampling weights and by standardizing the figures to the WHO global population structure.

In this study, education was used as a main indicator of socio-economic position, which had several advantages. It is causally prior to occupation and is usually stable throughout life after young adulthood. Unlike occupational class, education allows classification of individuals who do not work, including, for instance, most of the elderly cases in our setting. Educational status is an individual measure of socioeconomic position which may be a better indicator than those based on household measures, such as household income, which are difficult to measure in our setting. Economic status was also used as another dimension of effect of socioeconomic status on CVD profiles.

When comparing the findings from this study with those from other studies, other factors that might contribute to any observed differences should be taken into consideration, such as: differences in age structure between studied subjects, variability in definition of variables of interest (for example: definition of hypertension and smoking status, etc), timing and standardization of data collection, measuring instruments and procedures, etc.
DISCUSSIONS

It would be more informative in this thesis if the classifications of socio-demographic status were available in greater details (i.e. have more categories of age, education, occupation and economic status) and consistent across all the papers. However, due to small sample size in some categories and in order to get clear results, we had to redefine socio-demographic status for different papers.

Regarding risk factors for CVD, this thesis only focuses on blood pressure and tobacco use for several reasons. Firstly, high blood pressure and tobacco have been shown to cause a large proportion of mortality in middle-income countries (respectively accounting for as much as 5% and 4% of the total mortality, and higher than that of 2.7% by obesity and of 2.1% by high cholesterol) [18]. Secondly, they have also been identified as research priorities in Vietnam as a consequence of their considerable impacts on CVD mortality and morbidity [37, 47, 48, 97]. Thirdly, there is evidence that their modification is possible and effective in primary prevention [12, 16, 55, 129, 130]. Fourthly, in FilaBavi, the questions on tobacco use as well as blood pressure measurements have been well validated. The patterns of other risk factors for CVD, such as alcohol consumption, fruit and vegetable intakes and physical activities, were not assessed because of the difficulties in standardizing instruments (e.g. how to convert quantities of alcohol consumed into standard drinks; how to standardize servings of vegetables and fruit; and how to capture farming and non-farming components of physical activity) as well as in analysing the data (especially data on alcohol consumption and physical activities). There are currently other investigations about alcohol use was well as nutritional patterns being implemented in FilaBavi. At the time of the study, due to time and budget constraints, only Step 1 of WHO STEPS plus blood pressure measurements were carried out, and so physical and biochemical measures were not evaluated.
CONCLUSIONS AND POLICY IMPLICATIONS

In the context of transitional Vietnam, although CVD has been shown to cause a large burden of mortality and morbidity in hospitals, little is known about the magnitude of its burden, levels of its risk factors and its relationship with socio-economic status in the population as a whole. This study has provided a preliminary insight into the epidemiology of CVD in rural Vietnam as well as contributed to the development of methodologies for monitoring it.

The findings from this study indicate that rural Vietnam, of which Bavi district is an example, is already suffering a heavy burden of CVD mortality and risk factors. Mortality figures indicated that a substantial proportion of deaths were due to CVD, which was the leading cause of death, exceeding infectious diseases. Thus the so-called “double burden of mortality” in our setting is now dominated by NCD, and mostly due to CVD.

Similarly, the risk factor data clearly demonstrated that rural Vietnam is burdened by NCD/CVD risk factors. Hypertension was proven to be a serious problem which should no longer be ignored, both because of its magnitude and the high unawareness rate in the population. Smoking prevalence was also high in the setting and will lead to a considerable number of future deaths attributable to smoking occurring if urgent action is not taken.

The findings of this study also showed a possibly rising burden of CVD mortality and risk factors among women and the disadvantaged groups. It seems to correspond with the early stages of the so-called “shift from early to later adopter” of a CVD epidemic.

We have also shown that combining DSS and the WHO STEPS methodologies can potentially address basic epidemiological questions on how NCD/CVD mortality and its risk factors are distributed in populations. Epidemiological results from the STEPS implementation are also a powerful advocacy tool for public health
decision-making, especially for allocating resources for future NCD/CVD prevention. DSSs are uniquely positioned to elucidate these issues and to chart the potentially rapid shifts in population risk profiles. In turn, this will clarify the epidemiological transition in poorer countries and better inform public policy.

Given the evidence from this study, actions to prevent CVD in the setting are clearly urgent. This is in line with and, further, will strengthen the Programme of Prevention and Control of Certain Non-communicable Diseases for the Period 2002–2010 in Vietnam.

Available evidence shows that a large proportion of CVD is preventable. The major causes of CVD are known, and if these risk factors were eliminated, up to 80% of all heart disease could be prevented. In reality, experiences from previous interventions in developed countries show that there is a full range of cost-effective interventions against CVD. Many of these solutions are also feasible and affordable to implement elsewhere [12, 16, 129, 130].

Suggested interventions in Bavi district, based on the evidence from this study, are outlined in figure 15. Interventions should be comprehensive and integrated, including both primary and secondary approaches, as well as policy-level involvements.

Available evidence supports the feasibility and effectiveness of primary prevention directed toward increasing the population proportion at low risk of developing CVD (population-wide approach) [12, 16, 129-131]. The aim should be to make small improvements in a large proportion of the population. The highest priorities should be put on control of hypertension and tobacco as they are shown to be problems here. Integrated strategies (covering major risk factors, integrations with other health promotion initiatives and with well-established primary health care structure) are especially relevant for this purpose. Health education to improve public awareness on issues related to blood pressure, tobacco smoking, diet and
CONCLUSIONS AND POLICY IMPLICATIONS

Physical exercise should be implemented as soon as possible. Health education message need to be tailored to cater to the lower socioeconomic strata of the community. Health education programs should be addressed in schools as part of training curriculum. The programs should also be integrated with activities of different social and community organizations (community empowerment) such as Youth Union, Women Union, Farmer Association, Veteran Association, etc.

Individual approach is also very important for those who are at high risk of developing CVD. The WHO CVD-risk management package for low-and medium-resource settings is particularly appropriate for this purpose. It has been designed for assessment and management of individuals with elevated blood pressure but can also be applied for smoking [132].

Figure 15: Outline of suggested interventions in the setting
1: Policy level, 2: Primary prevention, 3: Secondary prevention
Secondary prevention for early treatment of individuals with established CVD is also a key component of public health strategy to reduce the rising burden of CVD. This will help to reduce complication rates and improve their quality of life. Cost-effective medication (aspirin, low cost diuretics and beta-blockers, etc) need to be available for use at all health care levels [117].

Policy-level interventions have a crucial role in the prevention and control of CVD in any country. In Vietnam, concrete policy frameworks should be put in place to strengthen the National Programme of Prevention and Control of Certain Non-communicable Diseases. The programme should be integrated into the primary health care system and other existing well-established health programmes such as the Primary Health Care Programme and Nutrition Programme, etc. This will help reduce costs of prevention as well as taking full advantage of existing capacity. Importantly, central and local Governments and Health Authorities should provide timely special protection for vulnerable groups. These include children, women, less educated people and the poor who usually have limited choices about the food they eat, their living conditions, and access to education and health care. There is also a need to increase the share of financial resources for prevention, which is currently very limited. The Framework Convention on Tobacco Control, which was ratified in Vietnam, should be further promoted by passing laws against smoking.

Capacity building in NCD/CVD prevention is also necessary for the success of prevention programmes. Technical expertise, management skills and information systems all need to be strengthened.

The scope and intensity of the CVD epidemic requires an enhanced international partnership. This could help to effectively control global threats such as tobacco marketing and to share experiences in controlling CVD. Every country, regardless of the level of its resources, has the potential to make significant improvements in CVD prevention and control, and to take STEPS towards achieving the global goal
of a 2% reduction in mortality each year over the next decade [16]. Developing and strengthening national institutions for CVD prevention and control is an important first step.

This is a preliminary study of CVD epidemiology in a rural setting in a transitional country. Further studies over longer periods of time are required to give greater insights into the burdens as well as the trends of CVD epidemics. Continuing the study, as part of the surveillance system, will also help to provide good quality and timely data to further increase effectiveness of interventions to reduce burden of CVD. Mortality studies using the VA approach should be regularly implemented to record all cases of death in the setting over time and the WHO STEPS risk factor survey should be repeated every 3-5 years.

There is also an urgent need for information on other NCD risk factors (alcohol consumption, diet, physical activities and obesity, etc) and qualitative studies to enhance understanding of the knowledge and attitudes towards CVD as well as cultural factors, e.g. values, beliefs and norms, which are believed to affect risk behaviours.

The linkage between CVD risk factors and mortality in such a setting also needs further investigation, in order to prioritise health promotion messages. Studies on the economic impacts of CVD and the capacities of health care systems to respond to CVD epidemics are also worthwhile.

Deeper comparative analyses on patterns of mortality and risk factors across INDEPTH sites should also be undertaken to further characterize the epidemiological transition in a range of developing countries.
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Finally, to the people in FilaBavi for their cooperation and participation in the FilaBavi project. They have generously provided useful information, and I wish that this work might be of some use, in return.


REFERENCES


REFERENCES

REFERENCES


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REFERENCES


REFERENCES


APPENDIX

Appendix 1: The WHO STEPS questionnaire

<table>
<thead>
<tr>
<th>Identification information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country: Vietnam</td>
</tr>
<tr>
<td>Centre: FilaBavi-Hatay</td>
</tr>
<tr>
<td>Interviewer:</td>
</tr>
<tr>
<td>Participant Code¹:</td>
</tr>
</tbody>
</table>

1  Name:

2  ID:

3  Address -> Household ID: Cluster:

4  Starting time of the questionnaire:

   Ending time of the questionnaire:

<table>
<thead>
<tr>
<th>Demographic Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>D 1. Sex [ ] 1=male, 2=female</td>
</tr>
<tr>
<td>D 2. How old are you? .......(years)</td>
</tr>
<tr>
<td>D 3. What is your date of birth? day / month / year</td>
</tr>
<tr>
<td>D 4. In total, how many years have you spent at school or full-time study? .......(years)</td>
</tr>
</tbody>
</table>

¹ Note - unique identification number to be attributed by the centre should be repeated on EVERY page
Smoking / Tobacco Use

S1. have you ever smoked any tobacco product such as cigarettes, cigars, or pipes?
   \[ \_ \]  1= yes, 2= no, 3= not sure
   if no or not sure go to next section (alcohol consumption)

S2. have you ever been a daily smoker (smoked every day for at least 6 months)
   \[ \_ \]  1= yes, 2= no, 3= not sure
   if no or not sure go to next section (alcohol consumption)

S3. do you now smoke any tobacco product such as cigarettes, cigars, or pipes?
   \[ \_ \]
   1= Yes, daily (every day);
   2= Yes, but not every day; - go to next section (Alcohol consumption)
   3= Yes, but occasionally; - go to next section (Alcohol consumption)
   4= No, not at all; - go to next section (Alcohol consumption)

-> to ask daily smoker:

S 4. when did you start smoking daily (every day)?

   either \[ \_ \] day \[ \_ \] month \[ \_ \] year
   or \[ \_ \] weeks ago \[ \_ \] months ago \[ \_ \] years ago
   or \[ \_ \] years old

S 5. on average, how many of the following items do you smoke each day?

   \begin{tabular}{l l}
   \hline
   manufactured cigarettes & \_ \\
   hand-rolled cigarettes & \_ \\
   pipefuls of tobacco & \_ \\
   cigars/cheroets/cigarillos & \_ \\
   bidis & \_ \\
   goza/hookah & \_ \\
   other (specify) & \_ \\
   \hline
   \end{tabular}
Alcohol Consumption

A1. have you ever consumed any type of alcoholic drink (such as beer, coolers, wine, spirit, fermented cider or example2)?

    [ ]

  1= yes
  2= yes, but not in the last 12 month - go to next section(nutrition)
  3= no, never; - go to next section(nutrition)

A2. in the past 12 months, how often have you had at least one drink containing alcohol?

    [ ]

  1= 5 or more days a week
  2= 1-4 times per week
  3= 1-3 times a month
  4= less than monthly

A3. when you drink alcohol, on average, how many drinks do you have3?

    _ _ [number]

for men only:

A4. in the past 12 months, how often did you drink 5 or more drinks containing alcohol in a single day?

    _ _ [number of occasions]

for women only:

A5. in the past 12 month, how often did you drink 4 or more drinks containing alcohol in a single day?

    _ _ [number of occasions]

for everyone:

A6. counting all types of beverages combined, what was the largest number of drinks you had on a single occasion in the past 12 month?

    _ _ [number of drinks]

2 examples need to be substitute with culturally relevant items for finalising the country specific questionnaire and exclude alcohol for medicinal purposes. By ‘drink’ the equivalent of a ‘standard’ drink is implied (see Chapter 7).

3 On a typical day you drank alcohol within the past 12 months.
A7. During the past 7 days, how many standard drinks of any alcoholic beverage did you have each day (use show card)?

Number of standard drinks

<table>
<thead>
<tr>
<th>Day</th>
<th>Number of standard drinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>_ _</td>
</tr>
<tr>
<td>Tuesday</td>
<td>_ _</td>
</tr>
<tr>
<td>Wednesday</td>
<td>_ _</td>
</tr>
<tr>
<td>Thursday</td>
<td>_ _</td>
</tr>
<tr>
<td>Friday</td>
<td>_ _</td>
</tr>
<tr>
<td>Saturday</td>
<td>_ _</td>
</tr>
<tr>
<td>Sunday</td>
<td>_ _</td>
</tr>
</tbody>
</table>

Nutrition

N 1. how many servings of fruit do you usually eat each day?

1= don’t eat fruit at all  
2= don’t eat fruit every day  
3= 1 serving per day  
4= 2 - 4 servings per day  
5= 5 servings or more per day

N 2. how many servings of vegetables do you usually eat each day?

1= don’t eat vegetables at all  
2= don’t eat vegetables every day  
3= 1 serving per day  
4= 2 - 4 servings per day  
5= 5 servings or more per day

N 3. Do you eat the following?

<table>
<thead>
<tr>
<th>Food</th>
<th>[ ]</th>
<th>1=Yes, 2= No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Chicken</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Eggs</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Milk Products (Cheese, Yoghurt, etc)</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Fish</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
</tbody>
</table>

N 4. Do you like to eat fried food

1=Yes, 2= No

N 5. Do you like to eat:

<table>
<thead>
<tr>
<th>Food</th>
<th>[ ]</th>
<th>1=Yes, 2= No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat with fat on it?</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Sausage, hamburger</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Minced, grilled pork</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Animal internal organs (liver, kidney, heart, intestine)</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
<tr>
<td>Fried groundnut with salt</td>
<td>[ ]</td>
<td>1=Yes, 2= No</td>
</tr>
</tbody>
</table>
APPENDIX

N 6. Do you like to eat dairy products such as:
   Butter? [ ] 1=Yes, 2= No
   Cheese? [ ] 1=Yes, 2= No
   Cream? [ ] 1=Yes, 2= No
   Full cream milk? [ ] 1=Yes, 2= No

N 7. Which type of oil does your family use in cooking?
    [ ]
    1=Vegetable oil, 2= Animal fat , 3=Both

N 8. Do you like to add more salt to food than other family member does?
    [ ] 1=Yes, 2= No

N 9. Do you like to eat preserved foods such as:
   Shrimp sauce? [ ] 1=Yes, 2= No
   Salted dried fish, shrimp? [ ] 1=Yes, 2= No
   Salted vegetable [ ] 1=Yes, 2= No
   Salted egg? [ ] 1=Yes, 2= No
   Salted animal meat? [ ] 1=Yes, 2= No
APPENDIX

Physical activity\(^4\)

If you work mostly in the household please tick □
If you are unemployed or looking for work please tick ○

**Section A: Occupational physical activity (paid or unpaid work)\(^5\):**

I would like to ask you about activities related to your main occupation on a typical day. Firstly, how long is your typical work day (hours)?

During these hours how frequently does your work involve you in the following:

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Always</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting or standing with only a little walking;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities that require the same physical effort as continuous walking, gardening.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities that require the same effort as heavy lifting or heavy construction work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Section B: Travel related physical activity**

I would like to ask you about the way you travel to and from places (Work, market, church etc) on a typical day. How often do you travel by…:

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Always</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private transport such as car, taxis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public transport such as bus, train, boat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorcycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walking (on foot)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Section C: Non-occupational and non-travel related physical activity (i.e. excluding work and travel activities)**

I would like to ask you about all the other, non-work related activities\(^6\) you do on a typical day. How frequently do you spend time on…:

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Always</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainly sitting (incl in front of TV/computer) or standing and only a little walking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activities that require the same effort as continuous walking, or gardening, climbing stairs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you answered ‘mostly’ or ‘often’ how much time do you spend on those? __ hours __ minutes

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Always</th>
<th>Usually</th>
<th>Sometimes</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities that require the same effort as heavy lifting or strenuous sports.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you answered ‘mostly’ or ‘often’ how much time do you spend on those? __ hours __ minutes

---

\(^4\) See special instruction sheet to replace examples of activities with appropriate terms related to the same intensity level (low, medium high).

\(^5\) Occupation includes main activities related to paid and unpaid work, household work and occupation by seeking work as distinct from Section C (discretionary or ‘leisure’ time activities).

\(^6\) This includes ‘leisure’ time or discretionary physical activities.
Blood Pressure

M.5. Systolic blood pressure (mm Hg)  1st measure ___  2nd ___  3rd ___
M.6. Diastolic blood pressure (mm Hg)  1st measure ___  2nd ___  3rd ___

History of Hypertension

M 7. Have you had your blood pressure measured in the last 12 months?
[   ] (1=Yes, 2=No, 3=Uncertain)

M 8. Have you ever been told by a doctor or other health worker that you have high
blood pressure?
[   ] (1=Yes, 2=No, 3=Uncertain)

M 9. Are you taking drugs for high blood pressure prescribed by a doctor?
[   ] (1=Yes, 2=No, 3=Uncertain)*

Other medical history

M 10. Have you ever been told by a doctor or other health worker that you have
heart diseases?
[   ] (1=Yes, 2=No, 3=Uncertain)

M 11. Have you ever been told by a doctor or other health worker that you have
suffered a stroke
[   ] (1=Yes, 2=No, 3=Uncertain)

M 12. Have you ever been told by a doctor or other health worker that you have
diabetes?
[   ] (1=Yes, 2=No, 3=Uncertain)

M 13. Have you ever been told by a doctor or other health worker that you have
serious illness?
[   ] (1=Yes, 2=No, 3=Uncertain)

If yes, specify:
1.
2.
3.

M 14. Are you currently taking any of the following medications?
Corticosteroid (pred. dexamethasone)  [   ] 1=Yes, 2=No
NSAIDs (Voltaren, Feldene)  [   ] 1=Yes, 2=No
Oral contraceptive pill  [   ] 1=Yes, 2=No
Cam thao (traditional herbal medicine)  [   ] 1=Yes, 2=No

* A third measurement needs to be taken if the first and the second are 10 mmHg or more apart
* taken in the last two weeks. If ‘yes’, a line to specify the medication can be added.
### I. RESPONDENT IDENTITY

1. **NAME OF THE RESPONDENT**
2. **AGE**
3. **RELATION TO THE DECEASED**
   - Parent
   - Spouse
   - Child/Inlaw
4. **WHAT IS YOUR HIGHEST EDUCATION?**
   - Illiterate
   - Primary school
   - Secondary school
5. **DID YOU TAKE CARE OF THE DECEASED DURING THE FINAL ILLNESS?**
   - Yes
   - No
6. **DID YOU PRESENT WHEN THE DEATH OCCURRED?**
   - Yes
   - No

### II. DECEASED IDENTITY

1. **NAME OF THE DECEASED**
2. **ID NUMBER**
3. **HOUSEHOLD NUMBER**
4. **ENUMERATION AREA CODE**
5. **AGE**
6. **DATE OF BIRTH**
7. **SEX**
   - Male
   - Female
8. **MARITAL STATUS**
   - Single
   - Married
   - Divorced
9. **OCCUPATIONAL STATUS**
   - Farmer
   - Public officer
   - Worker/Labor
   - Business/Service
   - Retired

### III. DEATH INFORMATION

1. **DATE OF DEATH**
2. **HOW LONG WAS THE FINAL ILLNESS?**
   - Very sudden
   - Over days
   - Over weeks
3. **WHERE DID THE DEATH OCCUR?**
   - At home
   - Hospital
   - Public Health Center

---

**Appendix 2: VA questionnaire**

**General verbal autopsy**

<table>
<thead>
<tr>
<th>DATE OF INTERVIEWER</th>
<th>CODE OF INTERVIEWER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE OF DATA EDITING</th>
<th>CODE OF EDITOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DATE OF DATA ENTRY</th>
<th>CODE OF OPERATOR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**General VA Questionnaire Page 1**
4. WAS THE DECEASED ADMITTED TO HOSPITAL DURING THE FINAL ILLNESS?
   1. Yes  
   2. No  
   9. Do not know
   Specify the name: ________________________________

5. DID THE DECEASED RECEIVE ANY TREATMENT?
   1. No, no treatment at all
   2. Yes, self-medication/treatment
   3. Yes, from public health center
   4. Yes, from hospital - Specify: __________________
   5. Yes, from paramedic(nurses/midwives)
   6. Yes, from private doctor
   7. Yes, from traditional healer
   8. Other, specify: ________________________________
   9. Do not know

6. DID THE DECEASED SUSTAIN ANY ACCIDENT OR INJURY WHICH LED TO DEATH?
   1. Yes  
   9. Do not know
   2. No ———— Go to Q7

   6.1. WAS THE INJURY ACCIDENTAL OR INTENTIONAL?
       1. Accidental
       9. Do not know
       2. Intentional

   6.2. WHEN DID THE DECEASED DIE AFTER THE ACCIDENT OR INJURY?
       1. At the time of accident
       2. During the way to hospital
       3. < 24 hours afterwards
       4. >= 24 hours afterwards
       9. Do not know

   6.3. WHAT KIND OF INJURY OR ACCIDENT THAT LED TO DEATH?
       1. Transport accident (pedestrian)
       2. Transport accident (passenger or driver)
       3. Fall
       4. Drowning
       5. Burn
       6. Firearm
       7. Food poisoning, specify: _________________________
       8. Drug poisoning, specify: _________________________
       9. Chemical poisoning, specify: _____________________
       10. Animal bite
       11. Electric shock
       12. Lightning stroke
       13. Hanging
       14. Suicide, specify: _______________________________
       15. Homicide, specify: _____________________________
       16. Other, specify: ________________________________
       99. Do not know

7. IF THE DECEASED IS A WOMAN OF CHILDBEARING AGE,

   7.1. HOW MANY TIME HAD SHE PREGNANT?
   times

   7.2. HOW MANY TIME HAD SHE DELIVERED?
   times

   7.3. HOW MANY TIME HAD SHE HAD ABORTION?
   times

   7.4. HOW WAS HER PREGNANCY STATUS ON DEATH?
       1. Not pregnant
       2. Pregnant: Specify: _____________________________
       3. Aborted: Specify: ______________________________
       4. Delivered less than 42 days ago
       5. Delivered more than 42 days ago
       9. Do not know

General VA Questionnaire Page 2
**OPEN HISTORY QUESTIONNAIRE**

**Ask:** Could you tell me about the illness/events that led to his/her death? Prompt: Was there anything else?

**Instruction to interviewer:** Allow the respondent to tell you about the illness in his or her own word. Do not prompt except for asking whether there was anything else after the respondent finished. Keep prompting until the respondent say there was nothing else.

<table>
<thead>
<tr>
<th>DISEASE HISTORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 3 MONTHS AGO</td>
</tr>
<tr>
<td>3 MONTH AGO</td>
</tr>
<tr>
<td>2 MONTHS AGO</td>
</tr>
<tr>
<td>1 MONTHS AGO</td>
</tr>
<tr>
<td>2 WEEKS AGO</td>
</tr>
<tr>
<td>1 WEEK AGO</td>
</tr>
<tr>
<td>PRIOR TO DEATH</td>
</tr>
<tr>
<td>OPERATION HISTORY</td>
</tr>
</tbody>
</table>

General VA Questionnaire  Page 3
**Adult Verbal Autopsy Questionnaire**

### I. Diseases and Life-style History

1. **Did the deceased suffer any of the following illness and for how long?**

<table>
<thead>
<tr>
<th>Diseases</th>
<th>1. Yes</th>
<th>2. No</th>
<th>9. Do not know</th>
<th>Duration</th>
<th>1. Months; 2 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart Disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renal Disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hepatic Disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epilepsy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allergic Reaction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Specify:

---

2. **Did the deceased have any operations just before death (during terminal illness)?**

<table>
<thead>
<tr>
<th>1. Yes</th>
<th>2. No</th>
<th>9. Do not know</th>
<th>Go to Q3</th>
</tr>
</thead>
</table>

2.1. **How many days before death was the operation done?**

2.2. **Where was the site of operation?**

1. Head/Neck
2. Chest
3. Abdomen
4. Other, specify:

---

3. **Did the deceased ever smoke tobacco?**

<table>
<thead>
<tr>
<th>1. Yes</th>
<th>2. No</th>
<th>9. Do not know</th>
<th>Go to Q4</th>
</tr>
</thead>
</table>

3.1. **How long had the deceased been smoking?**

3.2. **How often did the deceased smoke?**

1. Chain-smoker
2. Daily
3. Once in a while
4. Do not know

3.3. **How much tobacco did the deceased smoke?**

1. < 6 cig daily
2. 6-11 cig daily
3. >12 cig daily
4. Do not know

---

4. **Did the deceased ever drink alcohol regularly?**

<table>
<thead>
<tr>
<th>1. Yes</th>
<th>2. No</th>
<th>9. Do not know</th>
<th>Go to Q5</th>
</tr>
</thead>
</table>

4.1. **How long had the deceased been drinking alcohol regularly?**

5. **Had the deceased showed any changes in eating habit recently?**

<table>
<thead>
<tr>
<th>1. Yes, excessive food intake</th>
<th>2. Yes, decrease food intake</th>
<th>3. No, no changes</th>
<th>9. Do not know</th>
</tr>
</thead>
</table>

6. **Had the deceased showed any changes in drinking habit recently?**

| 1. Yes, excessive water intake | 2. Yes, decrease water intake | 3. No, no changes | 9. Do not know |
## II. DISEASES SYMPTOMS

### 1. FEVER: DURING THE LAST ILLNESS, DID THE DECEASED HAVE FEVER?

1. Yes  
2. No → Go to Q2  

1.1. HOW MANY DAYS DID THE DECEASED HAVE FEVER?  
   days

1.2. WHAT WAS THE SEVERITY OF THE FEVER?

1. Mild  
2. Moderate  
3. Severe  
9. Do not know

1.3. WHAT WAS THE PATTERN OF THE FEVER?

1. Continuous  
2. Intermittent  
9. Do not know

1.4. DID THE DECEASED HAVE CHILLS?

1. Yes  
2. No  
9. Do not know

### 2. RASH: DURING THE LAST ILLNESS, DID THE DECEASED HAVE RASH?

1. Yes  
2. No → Go to Q3  

2.1. WHERE WAS THE RASH LOCATED?

2.1.1. FACE

1. Yes  
2. No  
9. Do not know

2.1.2. TRUNK

1. Yes  
2. No  
9. Do not know

2.1.3. EXTREMITIES

1. Yes  
2. No  
9. Do not know

2.1.4. WHOLE BODY

1. Yes  
2. No  
9. Do not know

2.2. HOW MANY DAYS DID THE DECEASED HAVE RASH?  
   days

2.3. WHAT DID THE RASH LOOK LIKE?

1. Measles rash  
2. Rash with clear fluid  
3. Rash with pus  
4. Other, specify:

### 3. WEIGHT LOSS: HAD THE DECEASED LOST WEIGHT RECENTLY?

1. Yes  
2. No → Go to Q4  

3.1. HOW LONG BEFORE DEATH?  
   1.Days; 2.Months; 3.Years

3.2. WHAT WAS THE SEVERITY OF WEIGHT LOSS?

1. Mild  
2. Moderate  
3. Severe  
9. Do not know

### 4. PALLOR: DID THE DECEASED LOOK PALE DURING THE FINAL ILLNESS?

1. Yes  
2. No → Go to Q5  

4.1. HOW LONG BEFORE DEATH?  
   1.Days; 2.Months; 3.Years

4.2. DID THE DECEASED HAVE WHITE AND PALE NAIL?

1. Yes  
2. No  
9. Do not know

### 5. JAUNDICE: DID THE DECEASED HAVE YELLOW DISCOLORATION OF THE EYES OR SKIN?

1. Yes  
2. No → Go to Q6  

5.1. HOW LONG BEFORE DEATH?  
   1.Days; 2.Months; 3.Years

### 6. CYANOSIS: DID THE DECEASED HAVE CYANOTIC LIPS OR NAIL BED?

1. Yes  
2. No → Go to Q7  

6.1. HOW LONG BEFORE DEATH?  
   1.Days; 2.Months; 3.Years
### 7. Itchy Skin: Did the deceased have itchy skin during the final illness?
- 1. Yes
- 2. No
- 9. Do not know

#### 7.1. How long before death?
1. Days; 2. Months; 3. Years

### 8. Bleeding: Did the deceased have any bleeding manifestation?
- 1. Yes
- 2. No
- 9. Do not know

#### 8.1. On which part of the body?
- 8.1.1. On the skin
- 8.1.2. From nose
- 8.1.3. Gum/mouth
- 8.1.4. Other, specify:

#### 8.1.1. On the skin
- 1. Yes
- 2. No
- 9. Do not know

#### 8.1.2. From nose
- 1. Yes
- 2. No
- 9. Do not know

#### 8.1.3. Gum/mouth
- 1. Yes
- 2. No
- 9. Do not know

### 9. Unhealed wound: Did the deceased suffer from any wound that was difficult to heal?
- 1. Yes
- 2. No
- 9. Do not know

### 10. Oedema and Swelling: Did the deceased have oedema and swelling in any part of the body?
- 1. Yes
- 2. No
- 9. Do not know

#### 10.1. Face
- 1. Yes
- 2. No
- 9. Do not know

#### 10.2. Neck
- 1. Yes
- 2. No
- 9. Do not know

#### 10.3. Armpit
- 1. Yes
- 2. No
- 9. Do not know

#### 10.4. Abdomen
- 1. Yes
- 2. No
- 9. Do not know

#### 10.5. Groin
- 1. Yes
- 2. No
- 9. Do not know

#### 10.6. Leg/feet
- 1. Yes
- 2. No
- 9. Do not know

#### 10.7. Ankle
- 1. Yes
- 2. No
- 9. Do not know

#### 10.8. General
- 1. Yes
- 2. No
- 9. Do not know

WHERE AND HOW LONG DID THE OEDEMA AND SWELLING OCCUR?

1. Days; 2. Months; 3. Years
### 11. Cough: Did the deceased have cough during the final illness?
- **1. Yes**
- **2. No**
- **9. Do not know**
- Go to Q12

#### 11.1. For how long had the deceased had cough?
- **1. Days**
- **2. Months**
- **3. Years**

#### 11.2. Was the cough productive?
- **1. Yes**
- **2. No**
- **9. Do not know**

#### 11.3. Did the deceased cough blood?
- **1. Yes**
- **2. No**
- **9. Do not know**

#### 11.4. Did the deceased have night sweat?
- **1. Yes**
- **2. No**
- **9. Do not know**

### 12. Shortness of breath: Did the deceased have shortness of breath?
- **1. Yes**
- **2. No**
- **9. Do not know**
- Go to Q13

#### 12.1. For how long had the deceased had shortness of breath?
- **1. Days**
- **2. Months**
- **3. Years**

#### 12.2. Did it occur on exersion?
- **1. Yes**
- **2. No**
- **9. Do not know**

#### 12.3. Did it occur on lying flat?
- **1. Yes**
- **2. No**
- **9. Do not know**

#### 12.4. Did the deceased have noisy breathing?
- **1. Yes**
- **2. No**
- **9. Do not know**

### 13. Chest pain: Did the deceased have chest pain?
- **1. Yes**
- **2. No**
- **9. Do not know**
- Go to Q14

#### 13.1. How did the pain start?
- **1. Suddenly**
- **2. Gradually**
- **9. Do not know**

#### 13.2. Where was the pain?
- **1. On left chest**
- **2. On right chest**
- **3. On mid chest**
- **4. All the chest**
- **9. Do not know**

#### 13.3. How was the pain during resting?
- **1. Continuously**
- **2. On and off**
- **9. Do not know**

#### 13.4. How was the pain during activity?
- **1. Continuously**
- **2. On and off**
- **9. Do not know**

#### 13.5. When the deceased had a severe attack, how long did it last?
- **1. < 30 minutes**
- **2. < 24 hours**
- **3. > 24 hours**
- **9. Do not know**

#### 13.6. Did the deceased have palpitation?
- **1. Yes**
- **2. No**
- **9. Do not know**

### 14. Headache: Did the deceased have headache during the final illness?
- **1. Yes**
- **2. No**
- **9. Do not know**
- Go to Q15

#### 14.1. How did the headache start?
- **1. Suddenly**
- **2. Gradually**
- **9. Do not know**

#### 14.2. Did the deceased have blurred vision?
- **1. Yes**
- **2. No**
- **9. Do not know**

### 15. Stiff neck: Did the deceased have stiff neck during the final illness?
- **1. Yes**
- **2. No**
- **9. Do not know**
- Go to Q16

#### 15.1. For how long had the deceased had stiff neck?
- **1. Days**
- **2. Months**
- **3. Years**

---

**Adult VA Questionnaire**

Page 4
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>16. DIARRHEA:</strong> DID THE DECEASED HAVE DIARRHEA DURING THE FINAL ILLNESS?</td>
<td>1. Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. No</td>
<td>Go to Q17</td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>16.1. FOR HOW LONG HAD THE DECEASED HAD DIARRHEA?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Days</td>
<td>2. Months</td>
</tr>
<tr>
<td></td>
<td>3. Years</td>
<td></td>
</tr>
<tr>
<td><strong>16.2. HOW MANY TIMES DID THE DECEASED PASS STOOL ON THE DAY WHEN THE DIARRHEA WAS MOST SEVERE?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>16.3. WHAT WAS THE CONSISTENCY OF STOOL?</strong></td>
<td>1. Soft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Watery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>16.4. WHAT WAS THE COLOR OF THE STOOL?</strong></td>
<td>1. Normal colour</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Black</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Bloody</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>16.5. DID THE DECEASED HAVE SUNKEN EYES?</strong></td>
<td>1. Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>16.6. DID THE DECEASED HAVE DRY SKIN?</strong></td>
<td>1. Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>17. CONSTIPATION:</strong> WAS THE DECEASED UNABLE TO PASS STOOL FOR SOME DAYS?</td>
<td>1. Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. No</td>
<td>Go to Q18</td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>17.1. WHAT WAS THE CONSISTENCY OF STOOL?</strong></td>
<td>1. Normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Hard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>18. VOMITTING:</strong> DID THE DECEASED HAVE VOMITTING DURING THE FINAL ILLNESS?</td>
<td>1. Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. No</td>
<td>Go to Q19</td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>18.1. WHAT DID THE VOMIT LOOK LIKE?</strong></td>
<td>1. Watery fluid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Yellowish fluid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Coffee color fluid</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Blood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Faecal matters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>19. ABDOMINAL PAIN:</strong> DID THE DECEASED HAVE ABDOMINAL PAIN DURING THE FINAL ILLNESS?</td>
<td>1. Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. No</td>
<td>Go to Q20</td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
<tr>
<td><strong>19.1. WHAT TYPE OF PAIN WAS IT?</strong></td>
<td>1. Cramping</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Dull ache</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Burning sensation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Other, specify:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9. Do not know</td>
<td></td>
</tr>
</tbody>
</table>
19.2. WHERE EXACTLY WAS THE PAIN?
1. Upper abdomen
2. Middle abdomen
3. Lower abdomen
4. All over abdomen
5. Do not know

19.3. WHAT WAS THE PATTERN OF THE PAIN?
1. Continuously
2. Intermitten (On and Off)
3. Do not know

19.4. WHAT WAS THE SEVERITY OF THE PAIN?
1. Mild
2. Moderate
3. Severe
4. Do not know

20. ABDOMINAL DISTENTION: DID THE DECEASED HAVE ABDOMINAL DISTENTION DURING THE FINAL ILLNESS?
1. Yes
2. No
3. Do not know

20.1. HOW DID THE DISTENTION DEVELOP?
1. Rapidly over days
2. Slowly over weeks
3. Do not know

20.2. WHAT WAS THE CONSISTENCY OF THE DISTENTION?
1. Fluidy
2. Gas-filled like
3. Do not know

21. URINARY PROBLEM

21.1. WAS THERE ANY CHANGE IN THE COLOR OF THE URINE?
1. Yes
2. No
3. Do not know

21.1.1. WHAT WAS THE COLOUR OF THE URINE?
1. Dark yellow
2. Blood stained
3. Other, specify:
4. Do not know

21.2. WAS THERE ANY CHANGE IN THE AMOUNT OF THE URINE?
1. Yes
2. No
3. Do not know

21.2.1. HOW WAS THE CHANGES?
1. Increasing urine volume
2. Decreasing urine volume
3. No urine at all, specify how many days:
4. Do not know

21.3. WAS THERE ANY DIFFICULTY OR PAIN IN PASSING URINE?
1. Yes
2. No
3. Do not know

21.3.1. WHAT WAS THE DIFFICULTY?
1. Unable to pass urine
2. Continuously dribbing
3. Burning sensation
4. Intense pain
5. Other, specify:
6. Do not know

21.4. WAS THERE ANY DIFFICULTY TO CONTROL URINATION?
1. Yes
2. No
3. Do not know

21.4.1. WHAT WAS THE PATTERN OF THE INCONTINENCE?
1. Continuously
2. Intermitten (On and Off)
3. Do not know

22. MASS: DID THE DECEASED HAVE ANY MASS IN ANY PART OF THE BODY?
1. Yes
2. No
3. Do not know

22.1. FOR HOW LONG HAD THE DECEASED HAD MASS?
1. Days
2. Months
3. Years

22.2. HOW WAS THE GROWTH OF THE MASS?
1. Rapidly growth
2. Slowly growth
3. Do not know
22.3. WHERE WAS THE MASS?
| 22.3.1. HEAD/NECK | 1. Yes | 2. No | 9. Do not know |
| 22.3.2. BREAST | 1. Yes | 2. No | 9. Do not know |
| 22.3.3. ABDOMEN | 1. Yes | 2. No | 9. Do not know |
| 22.3.4. HAND/LEG | 1. Yes | 2. No | 9. Do not know |
| 22.3.5. SKIN | 1. Yes | 2. No | 9. Do not know |
| 22.3.6. OTHER, SPECIFY |   |   |   |

22.4. WAS THERE ANY ULCERS OR EXCRETION ON THE MASS?
| 1. Yes | 2. No | 9. Do not know |

22.5. WAS THERE ANY ENLARGED/SWOLLEN GLAND?
| 1. Yes | 2. No | 9. Do not know |

23. **CONSCIOUSNESS:** DID THE DECEASED HAVE ANY CHANGE IN THE LEVEL OF CONSCIOUSNESS DURING THE FINAL ILLNESS?
| 1. Yes | 2. No | 9. Do not know |

23.1. WHAT WAS THE LEVEL OF CONSCIOUSNESS?

23.2. FOR HOW LONG HAD THE DECEASED HAD CHANGE IN THE LEVEL OF CONSCIOUSNESS?

23.3. HOW DID THE LEVEL OF CONSCIOUSNESS CHANGE?
| 1. Suddenly | 2. Rapidly over days | 3. Slowly over months | 4. Other, specify: |

24. **FITS:** DID THE DECEASED HAVE FITS DURING THE LAST ILLNESS?
| 1. Yes | 2. No | 9. Do not know |

24.1. FOR HOW LONG HAD THE DECEASED HAD FITS?

24.2. WHAT WAS THE LEVEL OF CONSCIOUSNESS BETWEEN FITS?
| 1. Fully conscious | 2. Unconscious | 9. Do not know |

24.3. DID THE DECEASED HAVE LOCK-JAW?
| 1. Yes | 2. No | 9. Do not know |

24.4. DID THE DECEASED HAVE STIFFNESS OF WHOLE BODY DURING FITS?
| 1. Yes | 2. No | 9. Do not know |

25. **PARALYSIS/WEAKNESS:** DID THE DECEASED HAVE PARALYSIS/WEAKNESS?
| 1. Yes | 2. No | 9. Do not know |

25.1. ON WHICH SIDES OF THE BODY?
| 1. One side | 2. Both sides | 9. Do not know |

25.2. ON WHICH PART OF THE BODY?
| 25.2.2. Lower limb | 1. Yes | 2. No | 9. Do not know |
| 25.2.3. Face | 1. Yes | 2. No | 9. Do not know |

25.3. HOW LONG DID THE DECEASED HAVE PARALYSIS/WEAKNESS?
| 1. Over hours | 2. Over days | 3. Over months |

25.4. DID THE DECEASED HAVE SORE (DECUBITUS) ON THE BACK OR GLUTEUS?
| 1. Yes | 2. No | 9. Do not know |
### 26. DIFFICULTY IN SWALLOWING: DID THE DECEASED HAVE DIFFICULTY/PAIN ON SWALLOWING?

1. Yes  
2. No  
3. Do not know

#### 26.1. FOR HOW LONG HAD THE DECEASED HAD THE COMPLAINT?

- 1. Days  
- 2. Months  
- 3. Years

### III. PREGNANCY RELATED DEATH

Only applicable for FEMALE who die due to abortion, or die during delivery or during 42-days after delivery

Not applicable for deaths during pregnancy that was not due to abortion.

| 1. WHERE DID THE DECEASED HAVE DELIVERY/ABORTION? |  
|-----------------------------------------------|---|
| 1. At home | 4. At clinic |
| 2. At hospital | 5. On the road |
| 3. At public health center | 9. Do not know |

| 2. WHO MANAGED THE DELIVERY/ABORTION? |  
|-----------------------------------------------|---|
| 1. Health professional | 3. Lay people |
| 2. Traditional Birth Attendant | 9. Do not know |

| 3. HOW DID THE DELIVERY/ABORTION OCCUR? |  
|-----------------------------------------------|---|
| 1. Normally | 9. Do not know |
| 2. Induced |

| 4. DID THE DECEASED HAVE EXCESS BLEEDING BEFORE DEATH? |  
|-----------------------------------------------|---|
| 1. Yes | 2. No | 9. Do not know |

**IF DEATH WAS DUE TO ABORTION, STOP. YOU HAVE FINISHED.**

| 5. WHAT WAS THE MODE OF DELIVERY? |  
|-----------------------------------------------|---|
| 1. Vaginal delivery | 4. Abdominal operation |
| 2. Vacuum | 9. Do not know |
| 3. Forceps |

| 6. DID SHE HAVE OBSTRUCTED LABOUR? |  
|-----------------------------------------------|---|
| 1. Yes | 2. No | 9. Do not know |

| 7. HOW LONG WAS SHE IN LABOUR? |  
|-----------------------------------------------|---|
| 1. < 24 hours | 9. Do not know |
| 2. >=24 hours |

| 8. DID THE DECEASED HAVE DIFFICULTY IN DELIVERING PLACENTA? |  
|-----------------------------------------------|---|
| 1. Yes | 2. No | 9. Do not know |

| 9. HOW MANY BABIES WERE BORN? |  
|-----------------------------------------------|---|
| 1. Single | 9. Do not know |
| 2. Multiple |

| 10. HOW MANY BABIES WERE BORN ALIVE IN THIS PREGNANCY? |  
|-----------------------------------------------|---|

| 11. HOW MANY WERE STILL-BIRTH IN THIS PREGNANCY? |  
|-----------------------------------------------|---|