Health for Community Dwelling Older People:
Trends, Inequalities, Needs and Care in Rural Vietnam

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Abstract

Background
In Vietnam, the proportion of people aged 60 and above has increased rapidly in recent decades. The majority live in rural areas where socioeconomic status is more disadvantaged than in urban areas. Vietnam’s economic status is improving but disparities in income and living conditions are widening between groups and regions. A consistent and emerging danger of communicable diseases and an increase of non-communicable diseases exist concurrently. The emigration of young people and the impact of other socioeconomic changes leave more elderly on their own and with less family support. Introduction of user fees and development of a private sector improve the coverage and quality of health care but increase household health expenditures and inequalities in health care.

Life expectancy at birth has increased, but not much is known about changes during old age. There is a lack of evidence, particularly in rural settings, about health-related quality of life (HRQoL) among older people within the context of socioeconomic changes and health-sector reform. Knowledge of long-term elderly care needs in the community and the relevant models are still limited. To provide evidence for developing new policies and models of care, this thesis aimed to assess general health status, health care needs, and perspectives on future health care options for community-dwelling older people.

Methods
An abridged life table was used to estimate cohort life expectancies at old age from longitudinal data collected by FilaBavi DSS during 1999-2006. This covered 7,668 people aged 60 and above with 43,272 person-years. A 2007 cross-sectional survey was conducted among people aged 60 and over living in 2,240 households that were randomly selected from the FilaBavi DSS. Interviews used a structured questionnaire to assess HRQoL, daily care needs, and willingness to use and to pay for models of care. Participant and household socioeconomic characteristics were extracted from the 2007 DSS re-census.

Differences in life expectancy are examined by socioeconomic factors. The EQ-5D index is calculated based on the time trade-off tariff. Distributions of study subjects by study variables are described with 95% confidence intervals. Multivariate analyses are performed to identify socioeconomic determinants of HRQoL, need of support, ADL index, and willingness to use and pay for models of care. In addition, four focus group discussions with the elderly, their household members, and community association representatives were conducted to explore perspectives on the use of services by applying content analysis.
Results
Life expectancy at age 60 increased by approximately one year from 1999-2002 to 2003-2006, but tended to decrease in the most vulnerable groups. There is a wide gap in life expectancy by poverty status and living arrangement. The sex gap in life expectancy is consistent across all socioeconomic groups and is wider among the more disadvantaged populations.

The EQ-5D index at old age is 0.876. Younger age groups, position as household head, working, literacy, and belonging to better wealth quintiles are determinants of higher HRQoL. Ageing has a primary influence on HRQoL that is mainly due to reduction in physical (rather than mental) functions. Being a household head and working at old age are advantageous for attaining better HRQoL in physical rather than psychological terms. Economic conditions affect HRQoL through sensory rather than physical functions. Long-term living conditions are more likely to affect HRQoL than short-term economic conditions.

Majority of older people had no need of support for each of the specific ADL items. Dependence in instrumental or intellectual activities of daily living (ADLs) is more common than in basic ADLs. People who need complete help are fewer than those who need some help in almost all ADLs. Over three-fifths of those who needed help received enough support in all ADL dimensions. Children and grand-children are confirmed to be the main caregivers. Presence of chronic illness, age groups, sex, educational level, marital status, household membership, working status, household size, living arrangement, residential area, household wealth, and poverty status are determinants of the need for care.

Use of mobile teams is the most requested service; the fewest respondents intend to use a nursing centre. Households expect to use services for their elderly to a greater extent than did the elderly themselves. Willingness to use services decreases when potential fees increase. The proportion of respondents who require free services is 2 to 3 times higher than those willing to pay full cost. Households are willing to pay more for day care and nursing centres than are the elderly. The elderly are more willing to pay for mobile teams than are their households. ADL index, age group, sex, literacy, marital status, living arrangement, head of household status, living area, working status, poverty and household wealth are factors related to willingness to use services.

Conclusions
There is a trend of increasing life expectancy at older ages in rural Vietnam. Inequalities in life expectancy exist between socioeconomic groups. HRQoL at old age is at a high level, but varies substantially according to socioeconomic factors. An unmet need of daily care for older people remains. Family is the main source of support for care. Need for care is in more demand among disadvantaged
Development of a social network for community-based long-term elderly care is needed. The network should focus on instrumental and intellectual ADLs rather than basic ADLs. Home-based care is more essential than institutionalized care. Community-based elderly care will be used and partly paid for if it is provided by the government or associations.

The determinants of elderly health and care needs should be addressed by appropriate social and health policies with greater targeting of the poorest and most disadvantaged groups. Building capacity for health professionals and informal caregivers, as well as support for the most vulnerable elderly groups, is essential for providing and assessing the services.
Original papers

The thesis is based on the following papers:


Glossary and definitions

**Ageing index**: the number of persons 60 years old or over per hundred persons under age 15.

**Development regions**: the less developed regions include all regions of Africa, Asia (excluding Japan), Latin America and the Caribbean, and Oceania (excluding Australia and New Zealand). The more developed regions include all other regions plus the three countries excluded from the less developed regions.

**Elderly or older people**: people aged 60 years and over

**Old-age dependency ratio**: the number of persons 60 years and over per one hundred persons 15 to 59 years.

**Old-age groups**: the young-old group includes ages 60-74 years; the middle-old group includes ages 75-84; the eldest-old group includes ages 85 and older.

**Sex ratio**: the ratio of men to women in a population.

**Types of houses**: permanent houses are those constructed by using long-term materials such as brick, concrete and iron; temporary houses are made of short-term materials such as soil, bamboo and leaves; semi-permanent houses are composed of long-term and short-term materials.
## Abbreviations and acronyms

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<td>ADL</td>
<td>Activity of daily living</td>
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<tr>
<td>CD</td>
<td>Communicable disease</td>
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<td>CHC</td>
<td>Commune health centre</td>
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<td>CRS</td>
<td>Community registration system</td>
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<td>DSS</td>
<td>Demographic surveillance site</td>
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<td>FGD</td>
<td>Focus group discussion</td>
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<td>HRQoL</td>
<td>Health-related quality of life</td>
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<td>IPL</td>
<td>International poverty line</td>
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<td>IRR</td>
<td>Incidence rate ratio</td>
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<td>LE</td>
<td>Life expectancy</td>
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<td>NCD</td>
<td>Non-communicable disease</td>
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<td>NPL</td>
<td>National poverty line</td>
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<td>RLE</td>
<td>Remaining life expectancy</td>
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<td>SE</td>
<td>Standard error</td>
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<td>SES</td>
<td>Socioeconomic status</td>
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<td>OR</td>
<td>Odd ratio</td>
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<tr>
<td>USD</td>
<td>United States dollar</td>
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<td>VND</td>
<td>Viet Nam dong</td>
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<td>WHO</td>
<td>World Health Organization</td>
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<td>WTP</td>
<td>Willingness to pay</td>
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<td>WTU</td>
<td>Willingness to use</td>
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Background

Population of older people

Old age is generally considered to consist of ages over the average lifespan of human beings. However, the age from which a person is considered as an older person varies between countries and regions, and has different bases, such as predominance of chronological time or social, cultural or functional markers. Conventionally, the age of 60 or 65 years is referred as the beginning of the old age in most developed countries as well as in many developing ones. In Vietnam, people 60 years and over are officially considered as older people, although retirement ages are 55 for women and 60 for men.

The total world population of older people has been growing for centuries. With the increase of life expectancy following improvement of health care and nutrition during the last century, this population has increased more rapidly. The average annual growth rate of people aged 60 years or over was almost equal between more and less developed regions in 1950-1955 (Figure 1). Then the rate increased in more developed regions while declines were seen in less developed ones. The rate in developed countries is currently three times higher than in less developed countries. By 2045-2050, the difference in rates is projected to be eighteen times [1]. In 2007, approximately 793 million people aged 60 and over accounted for 11.7% of the world population [2].

The total population of Vietnam reached 85 million in 2007, with 72.6% residing in rural areas [3] where socioeconomic status is lower. The proportion of the total population 60 and over increased remarkably in recent decades (Figure 2) [4, 5]. This age group is projected to grow faster than any other, and amount to 26.1% of the total population in 2050 [6].
The ageing index increased from 18.2% in 1989 to 24.3% in 1999 [5], and reached 37.0% in 2007 [7]. This is higher than the average of 30% for Southeast Asia [5]. The old-age dependency ratio increased from 0.13 in 1989, to 0.14 in 1999, and 0.15 in 2007 [8]. By 2050, the population pyramid of Vietnam will be similar to the current pyramids of developed countries such as Japan and Sweden that have a high proportion of elderly (Figure 3).

![Figure 3](image)

**Figure 3** - Actual and projected population pyramids of Vietnam, Japan and Sweden

The proportion of older people among the rural population increased from 7.4% in 1989 [9] to 8.2% in 1999 [10], 9.8% in 2004, 10.3% in 2006 and 10.9% in 2008 [11]. The elderly population in rural areas accounted for 77.7% of total elderly people in 1993 and 73.3% in 2004 [12]. This slight reduction was due to urbanisation within the country. The rural elderly are disadvantaged in terms of educational attainment, housing quality, access to media, [12], poverty status [10], and access to health care [13].

The majority of rural elderly lives in the Red River Delta and the Mekong River Delta. The proportion of older people in the Red River Delta was 27.2% in 1989-1999 and 25.8% in 2004. The proportion in the Mekong River Delta was 19.5% in 1989, 19.1% in 1999 and 20.6% in 2004 [11, 12]. Of the total population, the proportions of older people was highest in the Red River Delta, and increased from 11.9% in 2004, to 12.5% in 2006, and 13.0% in 2008 [11]. The proportion of older people living in the Northwest was lowest, and accounted for only 2.2% in 1989-1999. The proportion of older people among the general population in this region was also lowest and decreased from 7.2% in 2004-2006 to 6.6% in 2008 [11].

**Context of multiple transitions in Vietnam**

The increase in older people is influenced by the current process of multiple transitions within the country. These included rapid economic, as well as demographic and epidemiological changes. First, Vietnam’s economic transition was initiated by government adoption of a wide range of economic-policy reforms in 1986 that shifted the country from a central planning economy to a market
economy. This in turn led to a strong GDP growth rate with an increase from 3.4% in 1986 to an average of 8% per year from 1992 to 2006 [14-16]. The positive results of economic development have significantly contributed to improved household living standards [17].

However, inequality in income increased temporary migration from the rural to urban areas because of better employment opportunities [15]. This movement of young people and other effects of the country’s economic transition may have a negative effect by weakening traditional family structures and leaving more older people to live on their own with less physical and emotional support from family members [18]. On one hand, older men lose the benefits of living in an extended household where they receive more emotional and physical support from the household women. On the other hand, older women benefit when there are fewer expectations and demands for them to do housework and nurture the family in a less extended family.

Second, along with improved living standards and health care during the economic transition in Vietnam, crude mortality rates as estimated from population surveys and censuses, decreased from approximately 10 per 1,000 in the late 1970s, to 7.5 in the late 1980s, and 5.6 in the late 1990s [19]. These rates fluctuated between 5.6-5.8 in the first five years of the 21st century [20].

Vietnam’s vital registration system does not operate effectively [21]. The system cannot provide complete and accurate data on the number of deaths, cause of death, age, sex, and living standard of people who die. Most routine figures of death rates are estimated from public hospital data. Therefore, these figures likely under and misreport deaths.

Following the introduction of government policy aimed at lower population growth since the 1970s, and then successful implementation of the national family planning programme, fertility was substantially reduced from almost 6 births per woman to the current level of 2.1 births. This is almost equal to the replacement rate [5, 22]. Consequently, Vietnam’s population initiated a rapid aging process, with declines in both fertility and mortality (Figure 4).

The decline in fertility is the primary factor responsible for population aging. It directly influences aging at both the population level and the individual level.
The reduction in number of babies and then young people increases the level and speed of the aging process in a population and directly influences the number of potential caregivers in the immediate family [18]. The decline in mortality resulted in a longer life expectancy of the Vietnamese population. The WHO estimated life expectancy at birth increased from 66 years in 1990, to 70 years in 2000, and 72 years in 2006 [23, 24]. Rates are projected to increase to 77.1 years by 2025 and 80.3 years by 2050 [6].

Third, an epidemiological transition is emerging in Vietnam (Figure 5). Incidence of communicable diseases (CDs) has fallen while the incidence of non-communicable diseases (NCDs) has increased in recent decades [15, 22]. The contribution of CDs in annual numbers of cases and deaths due to all causes (medically diagnosed in public hospitals) decreased from 55.5% and 53.1% in 1976, to 24.9% and 13.2% in 2006.

The proportion of NCDs in total morbidity increased from 39.0% in 1986 to 62.4% in 2006. The proportion of NCDs in total mortality increased from 41.1% in 1986 to 61.6% in 2006. NCDs are the leading causes of death among both young adults and older people [25]. The incidence of NCDs increases rapidly with age, especially among elderly people [26]. But public hospital deaths account for only about 5% of the total annual mortality and cannot reflect the general mortality patterns of the population [21].

In addition to the above transitions, there have been remarkable changes in the network of caregivers for older people. These are mainly due to social changes aimed at more equal gender roles. The changes are facilitated by government efforts to encourage new lifestyles for a modern society. In particular, wives,
daughters and daughters-in-law have experienced changes in their traditional roles from only nurturing their family to paid work outside the home as well as changes in their social roles. In terms of social welfare, older people in the country are less financially reliant on their dependants due to retirement salaries, but the rural elderly rely less on social welfare and more on material support from their families.

Socioeconomic characteristics of older people

Among older people, there are more women than men. This sex imbalance is higher at older ages. In 1999, the sex ratio was 0.70 at age 60 and over and 0.48 at age 80 and over [10]. The imbalance is getting greater, with the ratio decreasing from 0.76 in 1992-1993, to 0.71 in 1997-1998 [12], 0.70 in 2006 [11], and 0.66 in 2009 [5]. The imbalance is higher in rural than urban areas. For instance, in 1999 the ratio was 0.69 in rural areas and 0.72 in urban areas [10].

In 1999, the majority of older people were in the young-old ages and accounted for 75% of older people. Only 5% is at the eldest-old ages in both the whole country and rural areas [27]. Among older people, the proportion of young-old decreased while the proportion of people at older ages increased (Figure 6) [12]. This indicates a rapid aging trend in Vietnam.

Most older people are married or widowed. Over time, the proportion of married people decreased while the proportion of widowed people increased (Figure 7) [11, 12]. At older ages, married status was less frequent and widowhood was more frequent [10]. Married status is likely more popular among men while widowhood is more common among women [12]. This may be due to the sex difference in mortality and life expectancy [10]. The mortality rate is higher among men and life expectancy is longer among women. Divorce and permanent separation are relatively uncommon among older people.

One-fourth of older people profess a religion. Three-fifths are Buddhist and one-fifth is Catholic. Religious adherence is slightly higher at the older ages. Women are more likely to profess a religion than are men. Religious adherence among the elderly is less common among those in rural (25%) compared to urban (33%) areas. People in the southeast and Mekong River Delta are the most often affiliated to a religion and accounted for 50% and 45% of those populations, respectively [10].
In 1999, the literacy rate among older people was 76.3% while the proportions who completed primary school was 33.7% and some secondary or higher education was 19.3% [10]. The literacy rate varies by region, and is generally improving [12]. The literacy rate increased from 50.2% to 57.2% in rural areas and from 35.5% to 51.7% among women during 1992-2004, although it is higher among men than women. The literacy rate is lower in rural than urban regions. The proportion of people with higher levels of education is lower at older ages, and higher among men [27]. The proportion with basic education or professional training in rural areas are lower than in urban areas [27].

One-third of the total population lived in households with elderly members during 1992-2004 [12]. Three-fifths of the elderly were household heads. Almost four-fifths lived with a child and over half lived with a married child. Eleven and a half per cent lived only with a spouse and 5.8% lived alone.; Living with a spouse was more common among men than women. At older ages, living with a married child or living alone was more frequent. Living with a child or a married child was more common in urban areas while living alone or with only a spouse was more common in rural areas. Living alone or only with a spouse was most frequent in the Northern Uplands, but only 3.4% and 9.7% in the Red River Delta [10]. Living alone or only with another other elderly person increased from 13.4% to 20.7% during 1992-2004. Four-fifths of those lived alone were women or living in rural areas [12].

Housing conditions of elderly have improved. During 1992-2004, the proportion of people living in semi-permanent houses increased from 52.6% to 63.6%; the proportion of those who lived in temporary houses decreased from 29.3% to 18.9%, and the proportion of elderly living in houses with electricity for lighting increased from 52.1% to 93.8% [12]. The rural elderly are more likely to live in temporary houses while urban elderly are more likely to live in permanent houses. In 1999, rural elderly had less access to electricity (77.4%) than the urban elderly (96.6%) [10].

Access to better water sources for drinking and cooking increased during 1992-2004. There were increasing proportions of those using tap water (13.1% to 18.0%) or deep drill wells (3.4% to 22.3%). The proportion of those using hand-dug constructed wells was reduced from 51.0% to 33.4%. The proportion of elderly

Figure 7 - Distribution of older people by married and widowed statuses, 1992-2008
using natural sources of water such as rivers, lakes, ponds or rain water decreased from 31.7% to 16.4%. The proportion using a simple toilets or no toilet decreased from 76.2 to 50.1%. The rural elderly are disadvantaged in their access to piped water and modern toilet compared to urban elderly. For example, in 1999, only 1.8% of rural elderly vs 50.1% of urban elderly had access to piped water, and 4.2% of rural vs. 58.5% of urban elderly had access to modern toilets [10].

Half of rural elderly and one-third of urban elderly remain economically active, either for salary or household agriculture and/or other enterprises [12]. Elderly people contribute to 15% of all working hours of their households [28]. Among the working elderly, 85% are involved in agricultural work [10]. Half of elderly men and two-fifths of elderly women are active; just over half of married elderly are active while just over one-fourth of the widowed elderly are active. Working is less frequent at older ages but became more common during 1992-2004 among those who are almost at old-age. This was especially notable among people at middle-old ages or older. Those who were active increased from 27.7% in 1992-1993 to 39.7% in 2004. About three-fifths of elderly who live alone or with other elderly are active [12].

Just over two-thirds of the elderly participate in housework at an average of 2.1-2.6 hours per day. They contribute to 35.4% of all housework hours in their households [28]. People at older ages are less involved in terms of their frequency and duration of housework. The majority of elderly who live alone or with other elderly are involved in housework. People in the rural areas participate more in housework than those in urban areas. Married people are more involved than widowed people, but the later participate for longer average times per day. The proportion of older people who participate in housework increased in almost all groups, including those by sexes, rural/urban regions, types of living arrangement, and age span. The only group for who this was not true was those at ages of 90 and over where a decrease was found between 2002-2004 [12]. When housework is considered together with economic activity, the gender-gap in working at old ages no longer exists [10].

In 2004, the elderly had an average per-capita income (6.4 million VND) that was higher than that for the whole population (6.1 million VND) or the non-elderly (6.0 million VND). Almost three-quarters of income were from agriculture, earnings, trade and other businesses. Remittances accounted for 16% of income and formal state transfers accounted for 11%. Income from formal transfers, so-called “social security”, for the elderly was threefold higher than for the whole population or for the non-elderly [28].

Among per-capital income from working or business, almost one-third was from agriculture, one-fourth from trade, and just over two-fifths from earnings and other businesses. Almost two-thirds of the elderly live in households that
receive some type of social security, 22.3% have an insurance pension, and 14% receive social welfare. Rural people are less likely to live in households that receive formal transfers than are urban people. People living in a household receive a social insurance pension in the twice as often in urban areas than in rural regions. The number of people who live in households and receive social welfare was two times higher in rural areas as urban ones [28].

Two-thirds of the per-capita remittance for the elderly is from domestics sources. Overall, 90% of elderly live in households where remittances are received. Four-fifths of the elderly live in households with only domestic exchanges while 1.5% has only foreign exchanges, and 7.7% has both types of exchanges. The rural elderly are more likely to have only domestic exchanges and urban elderly are more likely to have only foreign exchanges or both types of exchanges [28].

The proportion of elderly people who live below the national poverty line is slightly lower than that in the general population or among the non-elderly. The proportion of older people decreased from 57.6% to 19.3% during 1992 - 2004. Rural elderly are more likely to live below the poverty line than are urban elderly. The relative difference in the proportion between the two regions of elderly who live below the line increased from threefold in 1992/93 to fivefold in 2004. The proportion among men and married people is slightly higher than among women and the widowed. The proportion of elderly who live below the poverty line is highest in the Northwest and lowest in the Southeast. The proportion in the Red River Delta decreased from 54.8% in 1992/93 to 16.3% in 2004 [12].

In Vietnamese culture, older people are generally highly respected within the family and society. Many elderly still participate in social or community activities. Although it is traditional that “young children rely on their parents and older people rely on their adult children”, older people are commonly active in family life and care. They have a tendency to avoid or reduce physical supportive care from their children by providing their own self-care as much as possible.

**Health at old age and its determinants**

One-third of older people suffer from illness or injury within the past four weeks, and the majority (72.2%) suffered within the past 12 months. People in rural areas suffer more often at both four week (36.2%) and 12 month (72.9%) intervals than those in urban areas (25.4% during prior four weeks and 62.9% during prior 12 months) [29]. The proportion of poor health among the elderly is higher among women than men. The proportion of people with self-reported poor health increases from 50% at ages of 65-74 years to 81% among those over 85. Over one-third suffer acute diseases while more than one-fourth suffers chronic diseases. The rural elderly share the same profile of diseases as general population of older people [13].
The most common illnesses are headache, cough, dizziness, and back pain. The most prevalent chronic diseases are cardiovascular disease, diabetes, kidney disease, and cancer [21]. Women suffer more from both acute (37%) and chronic (29%) diseases than men (30% for acute, 24% for chronic diseases). However, the proportion of people who suffer from illness by sex was the same after the age of 80 years (Figure 8).

About 12% of people face disability. The proportion of disabled people in rural areas is at the same level as the whole country, but slightly higher than in urban areas (11%). Men had more disabilities than women. The proportion of people suffering from accidents and injuries in rural areas is equal to that of the whole country (1.4%), but lower than in urban areas. Men more often suffer from accidents and injuries than do women.

A rural district survey [30] indicates that one-third of people simultaneously suffer from three or more diseases; and women are more likely to have many concurrent diseases than men (Figure 9). During 2004-2008, the average duration of sick leave due to illness and injury decreased from 31.9 to 29.1 days/year [11], and longer duration of illness began shifting from men to women.

Among elderly with illnesses, 16% are inactive and 10% are bed-bound. The proportion of those who need help from caregivers is 3.5%. Self-reported severity of illnesses and dependence on caregivers increases at older ages (Figure 10).

Marital status and living arrangement are associated with elderly health. Married people are less likely to have illnesses than those who are widowed, separated, divorced or single. People who live with the elderly are more likely to suffer from illnesses (67%) than those living with non-elderly (53%). The average number of illness episodes among those who live with the elderly is higher (3.2 times/year) than among those living with non-elderly people (2.2 times/year).
Those living alone have a greater number of depressive symptoms than those living with a spouse, or children/grandchildren. In 2001-2002, the average episodes of illness per year was 2.4 [13]. The average number of episodes of illnesses among people in the four lowest wealth quintiles was more (2.6 times/year) than among those in the richest quintile (1.7 times/year). The proportion of illnesses among the lowest four wealth quintiles was higher than in the richest quintile. The proportion of those inactive or bed-bound due to illness was 23% among those categorized in the four lowest quintiles (23%) versus the richest quintile (4%).

Lifestyle is related to elderly health. A study found the average number of illness episodes among older people engaged in physical activities (2.1 times/year) to be lower than in those without the activities (2.6 times/year). Those in the active group were less likely to suffer from acute illnesses than in those without active lifestyles. However, cigarette smoking and alcohol consumption were not associated with illnesses in this study [13].

**National policies related to elderly care**

Many aspects of elderly care are mentioned in the constitution, related laws and other legislative documents in Vietnam. The constitution specifies that older people are supported by the government and society. The health care law specifies that older people are prioritized for disease examination and treatment, and that the ministry of health and the general administration of sports and gymnastics are responsible for providing guidelines on physical practices, rest and relaxation for prevention of aging. The marriage and family law highlights that adult children are responsible for respecting, taking care of and nurturing their parents, and that adult grandchildren are responsible for nurturing grandparents whose sons and daughters have all passed way.

The labour law directs that one year before retirement age employees are allowed to reduce working hours or working days, and employers are not allowed to assign employees who are reaching old age to hard or dangerous work, or exposure to things toxic or harmful to health. The civil law highlights that the responsibility of children/grandchildren to take care of parents and grandparents is an moral tradition. The law on criminal affairs specifies that level of punish-
ment is reduced for older people who are criminals, while it is increased for people who commit crimes against older people.

The 2000 elderly ordinance and the 2009 elderly law provide comprehensive remarks on elderly care. Older people are prioritized for use of curative services. The government allocates funds for commune health centres to organize curative care for older people who live alone and suffering from severe diseases and those who are unable to visit health facilities, and for government hospitals to develop geriatric wards. Development of community elderly care centres is encouraged. Elderly who live in poor households and without caregivers, and those aged 80 and over who have no formal remittances are provided with free health insurance and a monthly subsidy.

**Health system in Vietnam**

The health system is a mixed public-private provider system in which the public system plays a key role in health care, especially in policy, prevention, research and training. The private sector has grown steadily since ‘reform’ of the health sector in 1989 and is primarily active in outpatient care. Inpatient care is provided almost entirely through the public sector. The health care network is organized under state administrative units: central, provincial, district, commune and village levels, with the Ministry of Health at the central level [31].

In the public sector, there were 777 general hospitals, 128 specialized hospitals and 11,544 primary health centres by 2008. The establishment of the grassroots health care network (including commune and district levels) as the foundation for health care has yielded many achievements, most notably that of contributing towards attainment of national health care goals for the entire population. The health stations in communes provide primary health care services that include consultation, outbreak prevention and surveillance, treatment of common diseases, maternal and child health care, family planning, hygiene and health promotion.

The total number of private facilities rose from 56,000 facilities in 2001 to 65,000 in 2004. In the whole country, there were 77 private hospitals (accounting for 6.9% of the total number of hospitals nationwide) with 5,412 beds (accounting for 3.4% of the total number of hospital beds nationwide). Health care has been strengthened by implementation of national health programs to deal with important public health diseases and issues such as malaria, tuberculosis, HIV/AIDS and vaccine-preventable diseases.

Health workforce ratio to 10,000 inhabitants increased from 29.2 in 2001 to 34.4 in 2008. The number of doctors per 1,000 inhabitants is 0.6, the number of nurses is 0.7, and the number of pharmacists is 0.1 (not including the private sector). Of all health workers at the provincial level, the majority work in curative care (Figure 11). The percentage of health staff is higher at higher levels of administra-
tive units (Figure 12). At the district level, health staff accounts for 31.0% of the health work force and at the provincial level 45.0%. All communes and 90% of villages have village health workers, and 69% of communes had doctors in 2009.

The total health expenditure over GDP increases by year and was 6.2% of the GDP in 2007. The average health care expenditure per capita in 2008 was VND 1.1 million (about US$60, equivalent to $PPP178 per purchase power in dollars) [32]. Most health resources are used for curative (84%-86%) and preventive care (14%-16%). There is modest expenditure on scientific research and training (less than 2%). The public share in total health care expenditure increased markedly from 20% in 2000 to 43% in 2008. The proportion of the total state budget allotted health expenditures rose from 4.8% in 2002 to 10.2% in 2008. The proportion of out-of-pocket payment declined from approximately 80% in 2000 to 52% in 2008. Health insurance coverage in the community has risen. In 2010, it was estimated that the proportion of Vietnamese people covered by health insurance was 60.5% [32].

**Formal and informal health care at old age**

Almost three-fifths of older people use curative services during a 12 month period [29]. This proportion decreased during 2004-2008. The proportion of those using outpatient services was much higher than those using inpatient services (Figure 13). The ratio between these proportions increased from 3.3 to 4.5 during the same period.
Most of people use outpatient services from private health facilities, followed by government hospitals and commune health centres (CHC). The use of private facilities decreased while the use of government hospitals and CHCs increased during 2004-2008 (Figure 14).

In contrast, the majority of people use inpatient services from government hospitals, followed by CHCs, and there is much less use of private facilities or others. The use of government hospitals increased while the use of private sector facilities decreased (Figure 15).

Older people in rural areas have less access to health care than those in urban areas [13]. Another study [27] indicates that rural elderly use less hospital services (43.3%) but commune health centre (26.4%) and private facility services (15.9%) than urban elderly (17.3% hospital services, 67.5% CHCs, 6.6% private facilities). Urban elderly are more likely to have curative services at home (8.3%) than rural elderly (7.7%).

Elderly educational level or professional training is associated with selection of health service providers [27]. Most of people with secondary professional training, or colleges and above education use hospital services. Among those primary professional training, over two-thirds use hospital services while almost one-third use CHCs. Among those without professional training, two-fifths use hospitals while over one-third use CHCs.

Access to health services by older people is often limited by mobility and an inability to afford healthcare services,
especially for prolonged care [21]. In 2004, one-fourth of the elderly had health insurance cards while medical fee exemption cards were offered to 9.0% of people aged 60-89 and 12.2% of those aged 90 years and over [21]. The proportion of people using the cards is higher for outpatient services than for inpatient services [29].

The proportion of people using health insurance cards or medical fee exemption cards for curative services within 12 months increased from 36.8% in 2004, to 59.9% in 2006, and 63.1% in 2008 [29]. The proportion increased in all income quintiles during 2004-2008 (Figure 16). The gaps between income quintiles are getting narrower. As older people in poor households are provided with free cards, the gap between the richest and the poorest is even smaller that the gap between the richest the other groups.

When suffering from illnesses, three-fourths of older people receive informal care from their children/grandchildren, 1.8% receives informal care from others, and almost one-fourth had to care themselves. People in urban areas are more likely to have care from their children/grandchildren (79.4%) than those in the rural areas (70.5%). Those in rural areas are more likely to care themselves (27.5%) than those in urban areas (18.9%) [27].

Only 18% of older people participate in health promotion activities in health clubs, and 9.1% do so in health centres. Rural people are less likely to use the clubs than urban people (5.4% vs. 16.0%) but more often use the centres (12.8% vs. 5.4%). The majority of people (72.0%) do health promotion practices by themselves at home. Those living in rural areas are more likely to practice at home (75.1%) than those in urban areas (68.8%). Few older people (7.9%) are not interested in health promotion activities. More rural elderly (10.4%) ignore health promotion than do urban elderly (5.4%) [27].

Models of health care at old ages

Hospital-based care for older people focuses on curative and rehabilitative services. Health consultation services and chronic disease surveillance are organized in a limited number of national and provincial hospitals. The system of geriatric hospitals is hardly developed. There is a lack of geriatric wards in general hospitals. There is a shortage of gerontology specialists. Older people mainly have access to general hospitals or other specialized hospitals.

Other facility-based care mainly offers nursing, nurturing and relaxation services. This care is provided in facilities that are usually organized by the Ministry of Labour, Invalids and Social Affairs (MOLISA), as well as some public agencies, social associations and private firms. Older people living in long-term care facilities are mainly alone (without family) or from families with special situations, older people with special contributions to the country, and others who are sup-
ported under government subsidy programs. Shorter-term care centres include health, cultural, sport clubs or centres for older people. To date, the number of such facilities is very limited.

At-home care services upon request are offered by individuals or groups and some private centres that have started to primarily develop in cities. The individuals and staff of private firms are usually trained in nursing or nurturing skills. These services are mainly used for providing care for ill people, especially the elderly.

**Measurement of inequalities in health at old ages**

Higher socioeconomic status (SES) is associated with better health and longer life in different eras, sexes, and ages in many countries, and with a variety of health outcomes [33]. Different methods can be used for measuring inequalities in health. There has been a focus on measuring health inequalities between different socioeconomic groups as classified by education, ethnicity, income, etc. [34]. Death rates and life expectancy are common indicators of a population’s health status, and assessment of health inequalities based on life expectancy is useful for health policy and feasible in small areas [35, 36].

While socioeconomic inequalities in health are well documented in the industrialised world [37], literature on health inequalities in low- and middle-income countries is limited. This is particularly the case for changes in inequality over time within a country [38, 39]. Furthermore, there has been little research on socioeconomic inequalities in health for older populations in developing countries [39]. Vietnam is not an exception; there is limited evidence of health inequalities, particularly among older people, and as measured using longitudinal data.

**Study conceptual framework**

Health at old age is affected by ongoing multiple transitions in the country (Figure 17). Health can be measured by various health indicators, including those for specific health problems, such as prevalence or incidence of particular diseases, illnesses and injuries, and those for general health status, such as life expectancy, and health-related quality of life. While many figures on specific health indicators are available, those on general health status are rarely found in Vietnam.

Older people, their families, and other stakeholders may express the need and demand for care of older people differently, depending upon their perspectives on elderly health status, their health care knowledge, the affordability of available and expected health care services. These expressions differ under the influence of the individual, family and society socioeconomic statuses. Documentation on the needs and demand for care of health-specific problems among older people is more common while those for long-term care during daily living are limited, especially for new models of community-based care.
Health care networks include various partners of home care, community care and social care. Network response to the care needs and demands, as well as the quality, effectiveness and equality of services are associated with interactions between government or local health policy, available resources and technology. The current study focuses on the production of additional evidence on general health status and the fit between needs, demands, and supply, as well as new care options for different socioeconomic groups of older people in rural Vietnam.

**Figure 17 - Study conceptual framework**
Rationale of the study

Vietnam is faced with new, emerging health issues as it undergoes multiple transitions. Elderly health care, which has been a lower priority than many health issues in other vulnerable groups (ethnic minorities, children, women, and the poor), is now an important issue.

As a basic indicator of population health, increased life expectancy (LE) is a key target in national health plans and national socio-economic development plans [15, 22, 40]. In addition, an increase in LE is largely defined as a key indicator of successful aging [41]. Therefore, LE at old age can be an appropriate indicator to examine changes in overall health status among older people during the current transitional period in Vietnam. However, available figures on LE in Vietnam are limited.

Quality of life and its health-related domains have a wide range of determinants, with socio-demographic factors and economic status particularly important [42]. HRQoL and its determinants at old age are well documented in the developed world, but only explored to a limited degree in developing countries [43], and little is currently known about HRQoL at old age in Vietnam.

Elderly health care in Vietnam relies mainly on daily family support and short-term care in the health facility system when older people have health problems. Within Vietnam’s new context of multi-dimensional transitions, especially in rural settings, there is little knowledge about the daily care needs or the views on different options of community-based models of care for older people.

In order to provide evidence for designing new health and social policies for elderly care, this study was initiated in a rural area and then will be expanded to other settings of Vietnam. The results will be used for proposing pilot interventions in elderly care at the community level and serve as a baseline survey for the interventions.
Study objectives

2.1. General Objective
This study aims to assess general health status, needs of health and social care, and perspectives on future options for health and social care for community-dwelling older people in a rural area of Vietnam.

2.2. Specific Objectives

a) To estimate remaining life expectancy and health-related quality of life among older people;

b) To assess levels and trends of inequalities in health among older people;

c) To identify levels of dependence in activities of daily living, their socio-economic determinants, and levels of receiving needed support among older people;

d) To assess willingness to use and willingness to pay for future models of health and social care for older people in the community.
Setting and Methods

Study site and FilaBavi surveillance system

Since 1999, a demographic and health longitudinal surveillance system called FilaBavi has been operating in the rural Bavi district, which is part of the Red River Delta in Vietnam [44]. The district has an area of 410 km² with lowlands, highlands and mountainous areas, of which 30% is used for agriculture and 17% is forest. The district is composed of 32 communes with a total population of 235,000 people in 1999 and 262,763 people in 2007. Five main ethnic groups live in the district. The Kinh ethnic group forms the majority (91%) while the remainder includes minorities such as Muong, Dao, Tay, Khme and Hoa. The majority of the population is Buddhist (90%), and the rest are Catholics or another denomination.

In 1999, 0.3% of the adult population was illiterate, 69% had completed primary school, 21% the secondary level, 9% high school, and 0.6% had higher education. Three-quarters of the district population work in agriculture. In 2007, the majority of adults over 20 years had completed primary/secondary school (65% of men, 72% of women), high school or higher education (34% of men, 23% of women) with the rest were illiterate. Two-thirds of the population were farmers (39% of men, 57% of women) and other workers (31% of men, 9% of women) and the remainder were business people, students, government staff, retired persons or others.

The FilaBavi surveillance system consists of a representative sample of 67 out of 352 clusters in the district, selected randomly with a probability proportional to population size in each cluster since 1999. A cluster is defined as an administrative unit, usually a village. If a village was too large it could be divided into two clusters. On average, there were 600-700 inhabitants in each cluster. In 1999, 11,089 households and 51,024 inhabitants were included for surveillance, and this accounted for approximately 20% of the total district population, and was approximately equal to the system’s required sample size of 11,000 households.

A baseline household survey was conducted at the beginning of 1999 and then every second year. Out of all households followed by the system, an average of 12,540 households participated in each survey. People aged 60 and over represented 11.5% of the total population at the mid-year point in 2007.

Study design, sampling, sample size, data collection and processing

This study is mainly based on quantitative approaches, and includes a cohort study on remaining life expectancy, a cross-sectional survey on health-related quality of life, daily care needs, and options of community-based care; and it is complemented with focus group discussions of perspectives on needs and models of elderly care.
The cohort study reviews the demographic and socioeconomic data of all people aged 60 and over and their households followed by FilaBavi DSS during 1999-2006. The study covered 7,668 people at age 60 and over with 43,272 person-years, out of 64,053 people with 388,278 person-years. There were 1,399 deaths among the older people during the entire period. The other studies collected primary data at the FilaBavi DSS in 2007.

The survey sample size was calculated on the main study indicators. First, a sample size of approximately 600 people in a population-based survey is required to detect an improvement at the small change of 0.02 in the EQ-5D index with an effect size (odds ratio) of 0.80 [45]. Second, using an estimated proportion of 13% (estimated error of 2.6%) of elderly who need support for care in daily living in a rural area of Vietnam [46], a sample size of 643 elderly is required to assess the daily care needs. Third, referring an estimated proportion of elderly for hospitalization in a year, equal to 8% [13] and an estimated error of 1.6%, a sample size of 1,104 elderly is required for assessing the use of hospital care.

A sample size of 2,760 or 2,699 and 2,430 elderly is further required after adjusting for a design effect of 2 for cluster sampling of FilaBavi. This was then doubled for robustness of the multivariate analyses on the EQ-5D index and the need of daily care, and further accounts for a non-response rate of 15% in estimating the EQ-5D index or 10% in assessing the need of daily care and the use of hospital care. These figures are approximately equal to 50% of all people aged 60 and over in the FilaBavi sampling frame.

Subsequently, 50% of households with older people, followed by FilaBavi, were randomly selected for a household cross-sectional survey. This was 2,255 households with 2,968 people. During the survey period of July to October 2007, 166 households were excluded due to absence of the older people. However, each of these cases was replaced with the nearest unselected household with older people. In total, 2,240 households with 2,873 older people were included in the survey.

Two sets of structured questionnaires were designed for the survey; one for interviewing elderly, another for interviewing their household representatives. The elderly questionnaire included those on the EQ-5D, presence of chronic illnesses, needs of support in ADLs, models of community-based care, plus others individual characteristics of the elderly, such as date of birth, sex, education, marital status, household head status, living arrangement, and working status.

The other questionnaire included questions on household daily care for the elderly, opinions on future models of community-based care for the elderly, plus some general characteristics of households such as household size, number of generations and number of elderly living in the household. Using the questionnaires, face-to-face interviews were performed by 52 trained FilaBavi field personnel at houses with elderly members.
Six field supervisors reviewed each completed questionnaire and randomly selected 5% for re-interview. Each questionnaire with missing or irrelevant values was returned to the field personnel for checking and completion after re-visits to the corresponding households. Double entry of collected survey data was performed using EpiData 3.1 (http://www.epidata.dk) to check for consistent values of each variable. Correction of data-entry errors were made based on actual values from the completed questionnaires.

The qualitative study focused on perceived needs of care for the elderly, current and expected roles of different key stakeholders, encouraging and limiting factors for providing needed care for the elderly, solutions for overcoming barriers in provision of care, and expected future models of care.

Four focus group discussions were conducted in one commune with an average socioeconomic status for the Ba Vi district. The first discussion was with six elderly people and the second discussion was with six representatives of households with older people, organized at a village of the commune. The discussants in each group were balanced in terms of sex (three men, three women). The elderly belonged to different groups of older age. The household representatives were not elderly themselves and had different roles within their households (two household heads, two main caregivers, two other members).

Six to seven representatives of the key social stakeholders in elderly care, including local authorities, health sectors, elderly associations, women’s union, the youth union, and the former soldier’s union participated in each of the other discussions, one for the village level and another for the commune level. Using corresponding guidelines, the discussions and interviews were moderated or performed by a main researcher and 1-2 assistant researchers who were trained and experienced with qualitative research methods. The discussions and interviews were manually noted, tape recorded, transcribed, and translated to English.

Measurement of study variables

Primary data collected by the survey

The EQ-5D questionnaire used for assessment of HRQoL has been developed by the EuroQoL Group since 1987 [47]. This instrument defines the state of general health across five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression) and at three levels (no problems, some/moderate problems, severe problems). The combination of these categories theoretically results in 243 unique health states and provides an estimate of a health summary score, the EQ-5D index, on a scale where 1 is full health and 0 is deceased. The tool is standardised and widely used in clinical and population studies in different countries [48]. As the simplest and most popular instrument for measuring HRQoL, it is feasible to apply it to a large and low literacy popula-
It is also practical for measuring HRQoL at old age [50]. To date, there are 100 official language versions of the EQ-5D questionnaire, including the Vietnamese version used in this study.

The presence of chronic illnesses among older people was assessed. These included hypertension, diabetes, arthritis/osteoarthritis or rheumatism, stroke, angina or angina pectoris, bronchitis or emphysema/chronic obstructive pulmonary disease, depression, cancer, cataracts, and missing teeth. Only chronic illnesses that were reported as “diagnosed by a physician” were recorded. The number of chronic illnesses for each subject was classified into four categories (no disease, one disease, two diseases, or three or more diseases).

Three scales of ADLs were applied when measuring daily care needs. They included Katz’s basic ADLs [51] (bathing, dressing, toilet use, transferring in and out of bed or chair, urine and bowel continence, and eating), instrumental ADLs (cleaning house, cooking, shopping, travelling) and intellectual ADLs (writing, reading, listening to radio, watching TV). Support needs for each activity (none, need some help, complete dependence) were assessed, together with levels of support received (none, not enough, enough) and caregiver types (eg, sons/daughters, grandchildren, relatives).

Three options for possible care models were described to older people and representatives of their households. These included: a) a mobile team of nurses established in the respondent’s commune to provide home care services for the elderly at their request; b) a day care centre established in the village as a place the elderly could visit for some time every day or every second day; c) a nursing centre in the commune or district as a place the elderly could stay for as long as needed (many days, weeks or months).

The assumption for the last two models was that food would be served, relaxation activities provided, and available nursing care. For each model, the elderly and their household representatives were asked whether they would likely use the model if it was provided free of charge, for a fee (less than the actual cost) or the actual cost. Types of expected services in the first two models were listed as choices. Willingness to pay for, and frequency of using services, was asked for each model.

**Secondary data from FilaBavi DDS**

Life expectancy at old ages was estimated using longitudinal mortality data collected in FilaBavi during 1999-2006. Demographic events of the study subjects, such as birth, migration and death, and their person-years were recorded in the FilaBavi surveillance database during the study period used for the estimation. Life expectancy can be obtained from life tables calculated from period or cohort age-specific mortality rates [52].
The period mortality rate was based on deaths occurred and exposure time spent within a specific age interval over a period of observation. The cohort mortality rate is based on following people being at a specific age at the beginning of the observation period. Mortality rates were calculated by dividing the number of deaths by the person-time lived for each person during the observation period. Figure A1 (Paper I) illustrates the two ways of calculating age-specific death rates and life tables. In this study, estimates of life expectancy at old ages are based on cohort age-specific mortality rates.

Household and individual characteristics of all persons at age 60 and over during 1999-2007 were extracted from the FilaBavi surveillance database. Individual characteristics include dates of birth, death and migration, sex, level of educational attainment, and relationship with the household head and other household members. Household characteristics include land area, structural components of housing, assets, sanitation conditions, income, expenditures and debt.

Structural components of houses were types of roof, floor and wall according to different levels of permanent or temporary materials. Assets were classified by certain categories, such as furniture, communication and electricity equipment, types of vehicles, agricultural machines, cattle and others. These items were classified as “present or not”, regardless of the quantity and quality of each item. Sanitation conditions were assessed as water sources for drinking and cooking, type of latrine and presence of a bathroom.

All types of income (from agriculture, breeding, forestry and other sources) were recorded to provide the total income of a given household. The sum of daily food expenditures was multiplied by 30 days and added to the sum of other monthly expenditures to estimate total monthly household expenditure. Monthly income and expenditures were then divided by household size to generate “per capita” variables.

Data analysis

Summary of population and mortality data

Number of deaths and person-years in different study groups of people aged 60 and over during 1999-2006 were measured. Percentages of older people in the general population and percentages of older people by different socioeconomic groups at the baseline survey and re-surveys were calculated. The corresponding 95% confidence intervals of percentages and averages were estimated.

Estimation of remaining life expectancy

An abridged life table constructed according to Chiang’s revised methodology [53] is internationally used to calculate RLE and its confidence intervals. How-
ever, the original life table did not take into account the variance of the final age interval. To address this, the life table was further adjusted by ONS [54] using the Silcocks method [55] to calculate standard error of life expectancy. The present study used the adjusted life table with age intervals of 5 years to 85 and over as an appropriate option for estimating life expectancy in small populations [54, 56].

Zero death counts are frequently present at age intervals in small populations. In the adjusted life table, the counts are no longer thought to underestimate standard errors of life expectancy at age intervals, except at the final interval [54]. Thus, a substitution for zero death by using number of deaths estimated from an appropriate national, regional, or locally derived age- and sex-specific mortality rate has been evaluated as an appropriate alternative [56]. In the current study, zero deaths existed in the two socioeconomic groups with the smallest population sizes, including ethnic minorities and women with secondary or higher education. The substitution was made for zero deaths at the final age interval based on sex-specific mortality rates among those 85 and over calculated from FilaBavi data collected during 1999-2006.

Cohort life expectancy and corresponding 95% confidence intervals were estimated using longitudinal mortality data collected in FilaBavi during 1999-2006 for groups of older people classified by socio-demographic factors, economic status and living arrangement. Life expectancy was calculated for specific periods (1999-2002, 2003-2006 and 1999-2006) instead of annual estimations in order to maximise the possibility of identifying the significance of any differences between the groups. Trends in RLEs were observed between the two periods of four years during 1999-2006, and in all socioeconomic groups.

**Analysis of health-related quality of life**

Percentages of older people by level of EQ-5D with their corresponding 95% confidence intervals were calculated. EQ-5D index was estimated using the time trade-off method. EQ-5D valuation sets can be used across countries, especially where a country-specific set does not exist [57]. However, specific dimensions of national culture, such as power distance, individualism, masculinity, and uncertainty avoidance are potential factors in providing insight into EQ-5D value set coefficients for different countries [58]. Among countries with available population-based EQ-5D preferences, South Korea has the closest scores to Vietnam in most of the cultural dimensions [58]. Since a preference set for calculating EQ-5D indices is lacking for Vietnam, the time trade-off valuation set from South Korea [59] was used in this study. Average values of HRQoL with their corresponding 95% confidence intervals by socioeconomic group were estimated.

Multilevel-multivariate analyses were performed to measure the effect of socioeconomic factors on HRQoL index to a continuous scale using linear regression.
A backward stepwise procedure with a p-removal at 5% was applied to identify significant factors remaining in the final multivariate model. Random effects of clusters and households were further examined in the multilevel-multivariate analysis.

**Estimation of ADL index**

An index was calculated for each ADL scale by summing up the score from each activity (score is 0 if no need or needs some help; score is 1 if complete dependence). The basic ADL index ranges from 0 to 6. The instrumental and intellectual indices range from 0 to 4. Distribution of study subjects by socioeconomic group, need of any support for each activity (none vs. needs some help or complete dependence), level of support being received among those in need of help, types of caregivers among those who received support, and ADL indices were described using percentages and corresponding 95% confidence intervals.

Multivariate analyses using Poisson regression were performed to measure the effect of socioeconomic factors on an ADL index. A backward stepwise procedure with a p-value of 5% for removal was used to identify significant factors to remain in the final multivariate model. Robust standard errors were used for accurate estimation of the model cluster data parameters [60].

**Analysis on models of care**

Distributions of study subjects by socioeconomic group, willingness to use care models, frequency of using services, and types of expected service were described using percentages and corresponding 95% confidence intervals. Willingness to pay for care services was estimated as the average monthly expenditures with corresponding 95% confidence intervals in VND for the elderly or their households. Significant differences in percentages or averages between groups of older people, or between older people and their household representatives, were identified by comparing the corresponding 95% confidence intervals.

Multivariate logistic regression analyses were performed to measure the effect of ADL indices and socioeconomic factors on elderly willingness to use care services by models of care and levels of payment. Being independent in ADLs, female, aged 80 years and above, illiterate, having widowed status, living without a spouse, position as a household member (not head), not working until old age, belonging to the poorest quintile, and living above the national poverty line were used as references in the analyses. A backward stepwise procedure, with a p-value of 5% for removal, was used to identify significant factors that remained in the final multivariate model. Robust standard errors from cluster data were used for accurate estimation of the model parameters [60].
Estimation of wealth index

Wealth index was calculated by using principal component analysis to assess the economic status of older people’s households on the basis that wealth is an underlying unobservable measure relating to relative economic position within a social hierarchy [61]. The location of a particular household within the hierarchy can be assessed through its basic assets and structural components [62]. Household wealth is more suitable than income or consumption [62], particularly among the rural elderly in developing countries who usually do not earn income and rely more on their families for material survival [61].

Data on household characteristics collected from the baseline survey (1999) and four re-census surveys (2001, 2003, 2005 and 2007) were used to calculate the household wealth index. Before the computation, all categorical variables were dichotomised, the continuous economic variables were divided by the number of persons per household to form “per capita” variables, and missing values were replaced by mean values. These missing values are present in data on income (8 variables), expenditures (2 variables) and land/floor areas (3 variables). However, the percentage of observations with missing values per one variable is low, ranging from 0.02% to 0.15% among income variables, and from 0.01% to 0.35% among the other variables.

Households with and without older people were classified into wealth index quintiles for a particular period based on the average value of wealth indices calculated separately from the data of all the surveys during the period.

Application of poverty lines

A food poverty line of monthly minimum expenditure required to deliver a daily calorie intake of 2,100 calories per capita is widely applied to classify household poverty status in developing countries. The food poverty line is added to minimum expenditure for non-food basic needs to form a total poverty line that is an internationally comparative basic needs poverty line [63]. The current study used an estimate of the total poverty line based on data from the 1998 Vietnam Living Standard Survey. This is equivalent to a monthly expenditure of VND 149,156 (USD 10.7) per capita [64] as the international poverty line (IPL).

Specific national poverty lines were also used to classify household poverty status. The level of national poverty lines was affected by the availability of resources for special assistance programs for the poor [64]. National poverty lines for rural areas based on monthly per capita income were VND 70,000 (USD 5.0) for 1996-2000, 100,000 (USD 6.7) for 2001-2005 [65] and 200,000 (USD 12.5) for 2006-2010 [66].

Households were stratified into two poverty status groups according to the poverty line. The first group included households identified as living below a pov-
roperty line at all surveys when the older people were alive and during follow-up in a particular period. Households with older people that lived above the poverty line at any survey during the period of follow-up belonged to the second group.

**Analysis of demographic factors during 1999-2006**

Across the different study periods, older people were classified by demographic variables such as ethnicity, living area, educational attainment, status of household head, the presence of a spouse or children/grandchildren (sons, sons-in-law, daughters, daughters-in-law, grandchildren) in the household, household wealth index quintiles and poverty lines. The first three variables are completely (eg, ethnicity) or most likely (eg, residency and education) unchanged over time. The first value measured in a particular period was used for classification during that period.

The remaining demographic variables are more likely to vary over time. Older people identified as household heads from at least one survey during a particular period were classified as household heads during the total period. A similar classification was used for individuals living with a spouse. Living with children/grandchildren is a less stable variable because of movement or migration among young adults for marriage, study or employment. Therefore, during a particular period, only those older people identified as living with children/grandchildren at all surveys and during follow-up were classified as living with children/grandchildren. The other group includes those living without children/grandchildren at all surveys.

**Comparison and reference**

Statistically significant differences between the percentages or the average values by groups of subjects or study periods were identified by comparing their corresponding 95% confidence intervals.

Only the socioeconomic determinants that are significant for mortality in a stepwise multivariate analysis with Cox regression were considered in the analysis of disparities in RLE (Paper I: Table A1). Gaps in RLEs between the groups were examined for absolute differences between their RLEs. The 95% confidence intervals of the gaps were calculated for comparison between periods or socioeconomic groups.

Being female, aged 80 and over, illiterate, widowed status, living without a spouse or other family members, position as household member, not working until old age, smaller household size, residence in mountainous areas, belonging to the poorest quintile, and living above the national poverty line are reference categories in the multivariate analyses on 2007 survey data.
**Qualitative analysis**

Thematic content analysis was performed by two researchers. Only information that illustrates or explains the quantitative research results regarding care for the elderly is used in this thesis.

**Research Ethical Consideration**

Ethical approval for the FilaBavi demographic surveillance system, including data on socioeconomic status, was given by the Research Ethics Committee at Umeå University, Sweden (reference number 02-420). The present study was also approved by the Research Ethics Committee at Hanoi Medical University (reference number 51/HMU-RB).

As all selected households belonged to the sampling frame of FilaBavi DDS, and these individuals were familiar with the DSS data collection, only oral consent was required. Purposes of the study and the main contents of the interviews were briefly described, together with a commitment to keeping individual and household information confidential. The participants reserved the right to refuse to answer any question or withdraw from the interview at any time. All of the subjects reached by interviewers participated in the study.
Results

Older people and their socioeconomic characteristics

During 1999-2006 the study covered 7,668 people at age 60 and over with 43,272 person-years (15,941 for men and 27,331 for women), out of 64,053 people with 388,278 person-years followed by FilaBavi. There were 1,399 deaths among the older people during the whole study period. Lengths of follow-up and death counts among the older people by socioeconomic group in different study periods are presented in Table A2-4 in the annex of Paper I [67]. The profile of older people at age 60 and over among the general population at four surveys during the study period is described in Table A5 (Paper I: Annex). There is a notable trend of an increased proportion of older people for both sexes (Figure 18).

Distributions of people aged 60 and over by socioeconomic factors during 1999-2006 are presented in Table A6 (Paper I: Annex). Women account for approximately two-thirds of the population. At the baseline survey, one-third of men had reached an educational level of secondary or higher, while almost all women attained lower educational levels. Educational levels for both sexes increased significantly in the next surveys.

A majority of older people are household heads (around 80% of men and 70% of women). Two-thirds of women live without a spouse, a figure that remained unchanged between surveys. Only 28.4% of men lived without a spouse at the baseline survey, and the proportion of men living without a spouse in the last two surveys reduced significantly compared to previous surveys. Around one-quarter of people of both sexes live without children/grandchildren and the percentages increased over time.

The percentages of men in the middle to richest quintiles are higher than in the others (Figure 19), while women (Figure 20) are more equally distributed between wealth quintiles (approximately 20% in each). The share of men living above the national poverty line (80%) is higher than that of women (72%). The percentage of people living below the international poverty line is higher than those living below the national one. Furthermore, while the percentage of people living below the national poverty line is decreasing, the percentage living below the international poverty line reached a peak of more than 50% between 2001 and 2003.
The 2007 socioeconomic characteristics of older people are summarised in Table A1 in the appendix of Paper III [68]. The majority of older people are aged 60-69 and 70-79 years. People aged 80 and over account for just over one-fifth of the study population; those aged 85 and over account for 9.2% and those 90 and over are 2.7%. The percentage of women is almost double that of men (Figure 21). Almost half of the elderly completed primary school or above, and the illiteracy rate was 18%. Just over two-thirds are widowed and one-third still live with their spouse, equaling just over half of the married elderly. One-fifth lives in mountainous areas. Almost half live in households with more than four members.

Approximately 10% of older people live alone. Two-fifths are still working. The proportion of people living in households in the middle to richest wealth quintiles is higher than those belonging to the poorer or poorest quintiles. Approximately 15% of the study population live below the national poverty line.
Trends and socioeconomic inequalities in remaining life expectancy

RLE at age 60 for both sexes during 1999-2006 is shown in Table 1 of Paper I. Women can expect to live approximately seven years longer (an additional 26 years, to age 86) than men (an additional 19 years to age 79). Comparing the four-year periods, RLE for both sexes increases by approximately one year (Figure 22), but the change is only significant for women (Paper I: Table 2).

RLE for women is significantly higher than for men among all socioeconomic groups during the 8-year period. The gender gap within socioeconomic groups tends to be narrower among the more advantaged population, but is only significant between those living with a spouse, and between the poorest and the middle to richest wealth quintiles.

Higher educational level (Figure 23) is associated with longer RLE of borderline significance among men (Paper I: Table 1). There is no significant difference in RLE by educational levels among women. Between the study periods, RLE for women with higher educational attainment decreased by approximately 5 years, however this was not significant. Older people who are household heads have higher RLE (approximately 4 years for men and 5 years for women) compared with those who are household members (Figure 24).
Comparing the two periods, RLE increases for both sexes regardless of the status of household heads, but this is not significant (Paper I: Table 2). RLE for men in the poorest and poorer quintiles is significantly lower than those belonging to the next quintile (Figure 25). RLE for women does not vary significantly between wealth quintiles.

Comparing the different periods, the greatest improvement in RLE for both men and women is among the wealth groups with the lowest RLE. However, this is only significant for men. The pattern of significant differences in RLE between the wealth groups of men in the first four-year period is similar to that of the 8-year period. There is only one significant difference in RLE between the wealth groups of men observed in the latter four-year period, and that is between the poorer and richest quintiles.

RLE is significantly higher by approximately 12 years for both sexes among those living above the national poverty line (Figure 26). Comparing the two periods, RLE increases among those living above the line, but this is only significant for women (Paper I: Table 2). RLE decreases among those living below the line, but this was not significant. Older people living above the international poverty line can expect to live significantly longer (approximately 7 years for men and 6 years for women) than those living below the line (Figure 27).
Table 3 of Paper I presents the gaps in RLE between poverty levels. There is a trend for the gaps to widen between poverty levels against both the national and international poverty lines when comparing the two periods. However, the only significant change is against the international line among women. The gaps against the national line tend to be wider than those against the international line, but the difference was only significant for men during 2003-2006.

RLE is significantly longer among people living with a spouse (approximately 8 years for men and 2 years for women) compared with those living without (Figure 28). Comparing the study periods, women living with a spouse have significantly higher RLE in the latter period (Paper I: Table 2). RLE increases significantly by 4.4 years for men living without a spouse and decreases by 4.1 years among those living with a spouse. It is notable that the difference in RLE from living with a spouse tends to decrease over time.

Loss of a spouse is illustrated in Table 4 of Paper I. Those who lived without a spouse during 2003-2006 are stratified according to whether they lived with or without a spouse during 1999-2002. It is clearly worse to lose a spouse than to live without one for the entire period.

During the whole study period (1999-2006) no significant difference in RLE at old age was observed for either sex when living with or without children/grandchildren (Figure 29). However, during the first four-year period, RLE among women living without children/grandchildren is significantly higher than among their counterparts (Paper I: Table 2).

In contrast, during the latter period, RLE among older people living with children/grandchildren is significantly higher (borderline level for men and higher for women) than their counterparts. Furthermore, between the four-year periods, RLE increases insignificantly among those living with children/grandchildren but decreases significantly among those living without them.

Table 5 of Paper I shows RLE for different combinations of living arrangements. The worst combination for a man is to live without a spouse and children/grandchildren. RLE among women living with both a spouse and children/grandchil-
dren is significantly higher than those living with only a spouse or children/grandchildren. When living with a spouse, RLE is significantly higher among women who also live with children/grandchildren. Among those living above the national poverty line, women living without children/grandchildren have significantly higher RLE than those living with children/grandchildren.

**Health-related quality of life at old age and its determinants**

Table 2 of Paper II [69] describes the distribution of the elderly according to EQ-5D dimensions and levels. Across the five dimensions, pain/discomfort is the most reported problem, and is reported 2-4 times more frequently than the other dimensions (Figure 30). The percentage of people reporting problems within the self-care dimension is lowest, while those reporting problems in the dimensions of mobility, usual activities and anxiety/depression are almost equal but approximately 1.5-2 times higher than in the self-care dimension.

The percentage of people reporting moderate problems is highest in the pain/discomfort dimension, and is 3-5 times higher than in the other dimensions. The percentage of those reporting severe problems is highest in the usual activity dimension, and is 2-3 times higher than in the others.

Tables A1-5 (Paper II: Annex) present the percentages of problems present in each dimension. The percentage of some/moderate problems is higher by approximately 30-60% among women than men in all dimensions, including reaching borderline significance in the anxiety/depression dimension. The gender-gap in suffering some/moderate problems is highest in the pain/discomfort dimension and lowest in the anxiety/depression dimension (Figure 31).

A significant difference in the percentage of severe problems by sex only exists in the anxiety/depression dimension, where severe problems were reported more frequently among women than...
men. The percentage of women reporting severe problems is highest in the usual activity dimension, while there is no significant difference in this proportion across the other dimensions.

The proportion of the study population reporting moderate problems increases with age; by at least 50% in the mobility and self-care dimensions, and at least 25% in the usual activity and pain/discomfort dimensions (Figure 32). The proportion reporting severe problems in the two oldest groups is at least 3-5 times that of the younger groups in each dimension. However, there is no significant difference in the percentages reporting problems in the anxiety/depression dimension across the different age groups.

The proportion of people reporting no problems is greater among those with higher levels of education across all dimensions, except for insignificant differences between those who have completed primary/secondary school vs. high school or higher in some dimensions. In the self-care dimension, people with lower levels of education were more likely to report severe problems, particularly among those with primary/secondary education or less.

A higher proportion of illiterate people reports severe problems in the usual activity dimension than those who are literate. A similar finding occurs among those with primary education in the mobility, self-care and anxiety/depression dimensions. In the pain/discomfort and anxiety/depression dimensions, those who completed high school and higher education have the lowest proportion of reporting moderate problems than any other socioeconomic status group.

Across all dimensions, married people were more likely to report no problems and less likely to report some/moderate problems than those who were widowed. In self-care, usual activities and anxiety/depression dimensions, severe problems are reported more frequently among married people than those who are widowed. Anxiety/depression at a moderate level is reported most often among those who are separated, divorced or single compared to those of any other socioeconomic status. People living with a spouse were more likely to report no problems and less likely to report some/moderate problems than their counterparts in all dimensions.

In all but the anxiety/depression dimension, household heads were more likely to report no problems and less likely to report some/moderate problems
than those who were not household heads. Severe problems are less frequently reported among household heads than non-household heads in the mobility, self-care and usual activity dimensions.

In all dimensions, those who are still working are more likely to report no problems and less likely to report some/moderate problems than their counterparts (Figure 33). A higher proportion of those people who still work reported severe problems than their counterparts, except in the anxiety/depression dimension.

In terms of wealth quintiles, the percentage reporting some/moderate problems in the pain/discomfort dimension was lower among the richest than those in the poorer and poorest quintiles. In the anxiety/depression dimension, the proportion reporting some/moderate problems was lowest among the richest quintile and highest among the poorest quintile. Severe problems are more frequent among the poorest than the richer and richest quintiles for the anxiety/depression dimension, and are most frequent among the poorest than any other socioeconomic status. Moderate anxiety/depression among the poorest is only lower than that among separated, divorced or single people. In the pain/discomfort dimension, the percentage reporting severe problems is only lower among the poorest quintile than among the oldest people, yet not significantly so.

People living above the national poverty line are more likely to report no problems and less likely to report some/moderate problems than their counterparts in all dimensions, excluding the usual activity dimension. In each dimension except for pain/discomfort, the proportion reporting moderate problems is only lower among people living below the poverty line and present among the oldest group and illiterate people. Not all of the differences were significant. In the anxiety/depression dimension, the proportion reporting severe problems among people living below the poverty line makes it one of the top three socioeconomic status categories also reporting severe problems, together with the poorest wealth quintile and the illiterate elderly.
The mean EQ-5D indices by socioeconomic groups of older people are presented in Table 3 of Paper II. Men have a higher index than women, and the indices decrease with age (Figure 34). The indices increase with educational level except between the primary/secondary education and higher levels.

Married people have higher indices than those who are separated, divorced or single, and the indices for people living with their spouse, household heads and those who still work are all higher than for their respective counterparts. People belonging to the middle to richest quintiles have higher indices than those in the poorest quintile, and the index among people living above the national poverty line is higher than those living below, but only with borderline significance.

The relationship of socioeconomic factors with the EQ-5D index of older people obtained from multilevel-multivariate linear regression models is presented in Table 4 (Paper II). Ages of 60-69 and 70-79 years, literacy, belonging to the middle to richest quintiles, household head status and working until old age are good indicators of having better EQ-5D indices. Although there is a significant difference in the EQ-5D by marital status, living with or without a spouse and above or below the national poverty line in the simple analyses, these factors are no longer present in the final model of the hierarchy analysis. Random effects of clusters or households exist at the same levels when comparing each of the models.

Need of daily care

Distributions of older people by ADL indices for different age groups are presented in Table 1 of Paper III [70]. Instrumental and intellectual ADLs are the most frequent problems (Figure 35), and the frequencies increase with age. The proportion of people who are independent in basic ADLs (index=0) drops from 97.6% among those over 64 years of age, to 86.7% among those above 84 years. The proportion decreases significantly with each increment in ten-year age interval.

Dependency in the other ADL scales is more frequent. Almost three-
fifths of the elderly have problems in one or more ADLs in each scale, and the proportion increases by 5-year intervals. Most of people are dependent in 1-2 instrumental or intellectual ADLs, except those aged 80 and above for whom dependency in 3-4 items is common.

Needed support for specific items in each ADL scale among people aged 60 and older is described in Table 2 of Paper III. The majority of respondents have “no needs”. The proportion of older people that need help is highest in intellectual ADLs (13-32%), followed by instrumental ADLs (3-13%) and basic ADLs (3-8%). Very few older people belong to the category “complete dependence”. The most common problems in intellectual ADLS are writing and reading, for instrumental ADLs it is travelling, and for basic ADLs it is bathing.

The ADL supports received among those in need are presented in Table 3 of Paper III. A significant group does not receive any or enough help. This is most pronounced for instrumental and intellectual ADLs (Paper III: Table 4). More than 70% of individuals have enough support in all ADL dimensions except shopping (62.5%). There is a wide range in proportions of those not receiving enough support for different items. This varies from 5-14% for basic ADLs, 9-29% for intellectual ADLs, and 20-38% for instrumental ADLs with the exception of only 4% for travelling.

Caregivers for the different ADL dimensions are described in Table 4 of Paper III. Children and grandchildren are the main ADL caregivers and spouses are not as important. Children are the most frequent caregivers for basic ADLs and traveling. Children and grandchildren play the same role in the other instrumental and intellectual activities. Support from spouses is received by only 9-12% of those who require assistance with basic ADLs. Less than 7% receive spousal support for instrumental ADLs and 5% for intellectual ADLs. Other caregivers, including other relatives and neighbors, provide care for less than 3.5% of older people. This excludes 26.8% from neighbours, 7.3% from relatives for shopping, and 4.9% from relatives for traveling.

Distributions of older people who need any support, either some or complete support, for at least one item in each ADL scale by socioeconomic group are presented in Table A2 (Paper III: Appendix). Almost one-tenth of people reported a need of some support in a basic ADL while over two-thirds were in need of some support in an instrumental or intellectual ADL. Percentages of people who need any support increased at older age groups. There are specific gaps in support needs by sex, educational level, marital status, living arrangement, household head status, working status, household size, area of residence, and household economic conditions."

Table 5 of Paper III presents the relationship of socioeconomic factors to ADL indices. Younger age groups, literacy, married status, living alone, position as
RESULTS

household head, working until old age, smaller household size, living in the highlands or lowlands, and belonging to higher wealth quintiles are indicators of having fewer numbers of ADLs that are completely dependent on caregiver support. Being separated/divorced/single, living with children/grandchildren, living below the national poverty line, and having a higher number of chronic illnesses are risk factors of having a higher number of complete dependences in ADLs. Being male is an indicator of having a higher number in instrumental ADLs but its effect is the opposite for intellectual ADLs. A contrasting picture is observed for instrumental and intellectual ADLs among those living with a spouse.

Options of care for older people

The elderly and their household willingness to use care services by model are presented in Table 2 of Paper IV. Use of care from a mobile team was chosen most often. Fewer respondents intend to use a nursing centre. “We will take part in these activities enthusiastically” said one household member in a focus group. Household heads expect to use services for their elderly to a greater extent than do the elderly themselves for all models and payment levels (Figure 36). In the focus group, a 70 year old man stressed that children must take responsibility for their parents and he was doubtful whether society would organize a nursing centre.

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Figure 36 - Percentages of respondents who are willing to use services by model of care and level of payment

Willingness to use the services decreased when potential fees were higher. As a 68 year old daughter said, “If we have to contribute money, we will do that. However, we can only pay a little.” Almost two-fifths of the elderly were willing to use mobile team care at full cost. But only one third were willing to pay full
cost for day care centre services, and only 15% for nursing centre services. The proportion of respondents who expect to use care if it is free-of-charge is higher than those willing to pay at full cost: 1.7-2.2 times higher for household representatives, and 2.0-2.7 times higher among the elderly.

Willingness to use services by ADL index is presented in Table 3 of Paper IV. People who are dependent in instrumental ADLs are more likely to use free-of-charge services from a mobile team. Those dependent in basic ADLs are less likely to use services from a day care centre at any level of payment. Those dependent in intellectual ADLs are less likely to use services from any care model at any level of payment. The exception was free-of-charge services from a mobile team. People are less likely to use services at higher levels of payment for all the models of care.

The expected frequencies of using services are summarized in Table 4 of Paper IV. Most elderly expect to use a mobile team 1-3 times per month. The next largest group expects use to be 1-2 times per day. The second largest group is more dependent and needs daily services. The most frequently expected use of a nursing centre was 1 week per month, followed by 2-3 weeks per month, and then ≥1 month per year. There was no significant difference in expected frequency of use by payment level for use of services in any of the models.

Opinions on the types of service provided by a mobile team and a day care centre are described in Table 5 of Paper IV. The highest demand is for medical examinations from a mobile team; this was followed by health consultation, and taking drugs or injections. The least frequently requested services are rehabilitation, assistance with personal hygiene, and eating and drinking. Both household heads and seniors most frequently suggest regular examinations would be used. This need is also supported by association representatives.

The most demanded day care centre services are physical exercises, health consultations, relaxation and nursing care. The least required services are relationship exchanges and drinks. The elderly and their household representatives have almost the same expectation of service types that would be provided in either care model. One exception was that a higher percentage of household members expect their elders to need nursing care at day care centres than did the elderly themselves.

Willingness to pay for services in each care model is presented in Table 6 of Paper IV. Both elders and their households are willing to pay the highest monthly amount for using a nursing centre care but the elderly are only willing to pay the lowest amount for day care centre use. Their households are willing to pay the same amount for using mobile team or day care centre services. Households are willing to pay higher costs for day care and nursing centre care for their elderly relatives. In contrast, the elderly are willing to pay more for mobile team services than their households are.
The relationship of ADL indices with socioeconomic factors on WTU is summarized in Table 7 of Paper IV. Older people who are more dependent in intellectual ADLs are less likely to use services from any model of care except free services from a mobile team. Those who are more dependent in instrumental ADLs are more likely to use services from a mobile team or a nursing centre, except if the mobile team is at full cost or the nursing centre is a free service. Those who are more dependent in basic ADLs are less likely to use services from a day care centre at any level of payment.

Those who are younger elderly, men, married, with elementary/secondary school educational levels, living with grandchildren, or living in the highlands, state that they are more likely to use care services. Those who are separated/divorced, live with a spouse or alone, live with a son or daughter, live in the lowlands, work until an older age, live below the national poverty line, or are in the poorest quintile are less likely to use services. People with an educational level of high school or higher are more likely to use free services from a day care centre but less likely to use services from a nursing centre.

The elderly in the richest two quintiles are less likely to use free services from a nursing centre. Those in the richest quintile are less likely to use free service from a mobile team but more likely to use services from a day care centre requiring partial payment. Those in the wealthiest quintile are less likely to use free services but more likely to use mobile team services requiring partial payment. Respondents who were in the middle wealth quintile were more likely to use free services but less likely to use day care services at full price.
Discussion

Overall trends in health at old ages

There is a noticeable time trend of increased RLE among the rural older people in Bavi. A significant increase in RLE is generally present in women, and particularly so in some socioeconomic groups, such as the non-poor, the middle wealth quintile and those living with a spouse. Among men, a significant increase over time only occurs among those living without a spouse, while there is a significant decrease among those living with a spouse, thus levelling out the large gap.

Inequalities in RLE exist for both sexes with remarkable advantages among household heads, persons living with a spouse, and those living above the poverty lines. Some advantages in RLE are present solely among men with secondary or higher education and those in the middle and wealthier quintiles. Women can expect to live significantly longer than men during all periods and in all socioeconomic groups.

HRQoL at old age in rural areas reaches an average level of 0.876 and varies substantially according to socioeconomic determinants, particularly age group, educational level, marital status, household head status, working status and household wealth quintiles. To the best of our knowledge, there are only a few population-based studies of HRQoL at old age in Vietnam. Since the present study is the first to apply the EQ-5D to a general population of older people, there are no comparable figures from previous studies. Our finding that HRQoL varies by socioeconomic status is consistent with that of previous population-based studies using the EQ-5D in other countries [71-75]. Although using another measurement scale HRQoL, the current study reconfirmed the findings of a previous study in Vietnam and Bangladesh [76] that determinants of poor HRQoL are advanced age, being female, and poor household economic status.

A marked improvement in elderly health

The majority of available RLE figures are based on period estimation. The current study is one of the few available cohort calculations of life expectancy at old ages and likely the first in Vietnam. The cohort life expectancy for men aged 60 during 2003-2006 is roughly equal to the situation in the United Kingdom two decades ago, of 19.6 years in 1987 [77]. Life expectancy for Vietnamese women matched more recent levels in this developed country (26.9 years in 2000). Although the estimates from this study are not comparable with country measures in terms of time and area scales, the comparison shows a marked increase in RLE among rural older people, particularly women.

This trend may not be surprising considering the dramatic improvement in levels of population health compared with the country’s economic development, which has been documented using other aggregate health status indicators such as infant mortality rate [78, 79] and life expectancy at birth [21, 80]. Within the
context of rapid socioeconomic development, the high level of RLE for women comparable with that in developed countries is reasonable, since the difference in ageing among women in countries at varying economic levels is caused by different mortality rates between birth and middle-age rather than that at old age [81].

Strikingly high life expectancy has been documented for other developing countries where per capita wealth and health expenditures are low by international standards [82]. The current study provides additional evidence on Vietnam’s exceptional population health, which might be partially explained by the appropriateness of the current health system. The health system has been consolidated and expanded towards achieving the parallel goals of equity and efficiency during rapid development [21]. On the other hand, existing public and private resources for health and elderly care amount to a very small fraction of what is available in Europe. Therefore, resource levels are not a particularly good predictor of elderly life expectancy.

In addition, EQ-5D indices among the 60-69- and 70-79 year old Vietnamese study participants (0.80, SE = 0.010) are higher than those for the same age groups among Swedes measured in 1998 (0.79, SE = 0.012) [72], and Americans measured in 2000-2002 (0.823, SE = 0.003 and 0.790, SE = 0.004, respectively) [83]. This could be due to HRQoL in rural Vietnam reaching beyond recently set EQ-5D levels in these developed countries. This is with the improvement of objectively-measured overall health status in Vietnam. The cross-country comparisons should be treated with caution, however, because HRQoL assessed by the EQ-5D instrument is a subjective measurement of general health status and can vary among people according to cultural or social norms and differences in expectations regarding health. EQ-5D index scores at old ages from other Asian countries that would be comparable with figures from the current study are not available.

**Significance of variations in health**

Although there is currently no explicit agreement on a clinically important difference for the EQ-5D, a range from 0.033 [84] to 0.074 [85] has been advocated for minimally important differences between socioeconomic groups and groups with particular clinical conditions [71]. The shifts in age groups and working status that constitute changes in the EQ-5D index of at least 0.064 and 0.053, respectively, are within this range. Variations of the index according to other determinants, particularly household wealth quintiles (0.016-0.024), educational levels (0.019-0.032) and household head status (0.017), are lower than this range, and thus not clinically significant.

Therefore, clinically significant socioeconomic factors should be considered in evaluations of the effectiveness of clinical or public health interventions for improv-
ing HRQoL at old age, especially controlling for the influence of age. Applicable to current Vietnamese policies on social and health care for older people, age is a good indicator for setting target groups of older people involved in social and health care interventions to improve HRQoL in the context of limited resources.

Need of care in daily living at old ages

This community-based survey indicates a need of help in one or more specific ADLs for almost one-third of rural older people. The majority of older people do not need support in each of the specific ADL items. Over three-fifths of those who need help receive enough support in all ADL dimensions. The main caregivers of the rural elderly are their children and grandchildren. Care needs are related to age, sex, educational level, marital status, working status, household size, living arrangements, residential areas, household wealth, and poverty status. To the best of our knowledge, there are not any published, comparative figures on the daily care needs for older people assessed with the same ADL scales from previous studies in Vietnam.

The study findings on basic and instrumental ADL indices at age 65 or older are consistent with those documented in the literature. The proportions of basic ADL dysfunction among the community elderly population is 2-8%, and the elderly are more likely to be dependent in instrumental ADLs than in basic ADLs [86]. Complete dependence in both instrumental and intellectual ADLs is much higher and increases by age faster than for basic ADLs. This suggests that future interventions to improve daily care for rural elderly should provide greater focus on instrumental and intellectual functions, rather than on basic ADLs.

The finding that the majority of older people have no need of support in specific ADL items may be explained by the fact they are mainly at young-old ages (61.8%) and middle-old ages (29.0%). Among those who express the need for support, most require some help, and the majority receive enough support. Only a few receive no support. The proportion of people who do not receive enough support in many instrumental and intellectual ADLs is much higher than for basic ADLs. Furthermore, there is a strong, existing tradition in rural Vietnam that older people live with their children. These characteristics indicate that an improvement in home-based care is more important in future interventions than improving institutional care.

There is an unmet need for support in ADLs while the main sources of support for elderly care are from children and grandchildren. This indicates a discernible need of complementary daily care patterns outside of the family. This is especially important in the context of an increasing temporary migration of the young labour force from rural to urban areas, and the transition from extended households to nuclear households in Vietnam. The necessity for development of a social network and services for community-based long-term elderly care in rural Vietnam is essential and the needs are increasing.
The proportion of people at different old ages (ie, ≥60, ≥65, ≥70 and ≥75) who need support for at least one basic ADL in the current study (ie, 9.6%, 11.7%, 14.5% and 18.8%; Paper III, Table A2) are all lower than among rural elderly in Malaysia (14.3%, 19.9%, 25.3% and 32.9%, respectively) [87]. Only at age ≥60 is this proportion much lower than among rural elderly in Bangladesh (21.7% for men, 36% for women) [118]. At age ≥65, the proportion is lower than among elderly in the United States (18.4%) [119]. At age ≥80, the proportion (26.2%) is higher than among rural elderly in China (14.3% for men, 18.5% for women) [88]. Explanation of the differences between countries is difficult because of differences in ADL measurement, elderly perspectives and expectations of caregiver support, and availability and accessibility of social care service networks.

**Willingness to use and pay for care**

During the Vietnamese transition to a modern society, the need for community-based long-term elderly care is acknowledged by the elderly, their households and representatives from the village and commune levels. This unanimity is the most interesting finding of this study. Willingness to use care services is affected by elderly ADL dependence, socioeconomic status, living arrangement and required payment level. The study respondents were willing to pay for care services at certain levels but indicated that society or associations have a responsibility to provide elderly care. There currently are no comparative figures on the need for community-based long-term elderly care in Vietnam.

Older people in Vietnam prefer to receive care at home. This is in accordance with tradition and consistent with patterns in other countries [89]. The majority of households and elderly only expect to stay intermittently in a nursing centre, such as 1-3 weeks/month, rather than using more long-term care as do elderly in developed countries. The frequency of using services from any model was not dependent on the payment levels. This may be because willingness to pay was asked as a monthly payment rather than by episode of service use.

In spite of household representative expectations that their elderly would use services more often than did the elderly themselves, the consensus is surprising. The findings indicate a trend in expansion of elderly care from family caregivers to a social network. This trend is likely the result of demographic pressures and socioeconomic transitions within the country. Willingness to use free services was 2-3 times higher than willingness to pay full price. This suggests a large gap between household needs and affordability of care for the rural elderly. Health insurance and medical fee exemption in Vietnam cover 33.5% of older people aged 60-89 and 37.1% of those aged 90 years and above [21]. With this coverage, additional social and health policies are necessary to promote the formulation and use of community-based care models. Especially, further expanding the sup-
port for accessing free of charge health insurance for elderly people at younger ages, and including long-term care services in reimbursement schemes of health insurance would compensate for the limited affordability of care.

The elderly expect to receive professional care, including curative, preventive and rehabilitative services from a mobile team more than they expect informal care with tasks of daily living at home. “I would suggest to the authorities that there be regular check-ups for old people” was a common view from the elderly. This opinion was supported by village leaders: “The best thing we can do is organize regular check-ups for the elderly”. Medical doctors, medical doctor assistants, and nurses, working together with informal caregivers, will be essential for provision of future home care. Current estimates are 5.9 physicians and 5.6 nurses per 10,000 inhabitants in the public and private health sectors [90]. Therefore, capacity building of a network between health professionals and informal caregivers should be addressed in strategies to expand community-based elderly care. Social associations are also willing to contribute: “If they need builders, our members can help. Moreover, we can contribute some money”.

The 2008 Vietnam Household Living Standard Survey [11] estimated that household per capita health care expenditures in rural areas accounts for 7% of the total household per capita expenditures. In the current study, elderly are willing to pay 2-4% of the monthly per capita household expenditures and their families were willing to pay 3-6% for services from each care model. Therefore, the maximum amount that respondents were willing to pay was almost equal to the per capita expenditures for health care.

Higher dependency in instrumental ADLs is related to higher WTU for a mobile team (except at full cost) or nursing centre (unless it is a free service). Dependent people may think they cannot afford the service at full cost price, and free-of-charge services may encourage the expectation of using services from both groups, regardless of need. This suggests that additional supports through future interventions are needed for rural people to access enough care.

A higher intellectual ADL index was associated with a lower WTU from all models of care, except free services from a mobile team. This may be because support for intellectual ADLs are mainly provided by family caregivers [70], rather than using a day care, nursing centre, or paying for services from a mobile team. People who are more dependent in basic ADLs are less likely to use services from a day care centre at any level of payment. This may be explained by the fact that physical exercises, health consultations and relaxation were examples of the services that could be provided in a day care centre rather than nursing care. Or, people in need of personal care preferred or relied on family support, particularly from their sons, daughters or grandchildren, rather than from outsiders.
Health deterioration and needs at older ages

Measurement of HRQoL using the EQ-5D is more oriented towards functional dimensions that deteriorate at older ages [71, 91, 92]. The remarkable decrease in HRQoL at older ages in the present study supports the findings of previous studies. Variation in the EQ-5D index by age group is greater after simultaneously adjusting for the effects of other socioeconomic determinants, and is greater when compared with those of the other factors. These findings confirm the primary effect of age in reducing HRQoL among the rural elderly.

Deterioration in HRQoL by age group is remarkable in most of the dimensions, but not for anxiety/depression. We surmise that this decrease with age mainly contributes to the decline in physical rather than mental functions. Although varying insignificantly by age group, the proportion reporting problems within the mental dimension are equal to or higher when compared with those in the dimensions of physical functions. Therefore, interventions for improving HRQoL at old age should address both problems of deteriorating physical functions at the older ages and the need to reduce the same level of mental problems at all ages.

In terms of dimensions of physical functions, the proportion of elderly reporting problems, especially at the severe level, is much higher among people aged 80-89 and 90 and over than among the younger groups and any other socioeconomic group. This suggests that the group of oldest people is the most vulnerable. In an attempt to improve health status of the elderly, all Vietnamese people aged 85 and over have been granted free health insurance since 2007, as an extension to a policy introduced in 2003 under limited public resources that applied only to those aged 90 and over [93].

The earlier policy would reach only approximately 3% of older people: those who are 90 and over in the rural setting of the present study (Table 1, Paper II). The age extension will cover more, approximately 9%, but this remains only half of the most vulnerable group, including those at age of 80 and over. Therefore, current and future social and health policies for improving HRQoL at old age should be extended further to cover the most vulnerable groups.

Younger-old ages are indicators of a lower index for each ADL scale. This can be explained by better general health status at these younger ages. Being younger elderly is associated with interest in using a day care centre regardless of levels of payment. This could be because younger elderly are healthier and eager to participate in health promotion activities.

Gender aspects on health and needs

The gender gap in RLE exists consistently among socioeconomic groups, but varies insignificantly. One hypothesis is that the gender gap is less dependent on socioeconomic status and living conditions and more on inherent internal biological
factors. A second hypothesis is that the gap can be attributed to different ways of living. In many societies, femininity is associated with carefulness and caution that may protect against health-damaging lifestyles. Masculinity, on the other hand, may be exhibited by risky behaviours such as smoking, drinking, high-speed driving, and these are most pronounced among the lowest social classes. Typical male occupations may also be more risky. The latter hypothesis would suggest that the gender gap in old age is a consequence of accumulated variations in risk exposure across the lifespan, and this material supports such a hypothesis.

The gender gap is also influenced by the existence of a spouse and is twice as influential in the group living without a spouse as those living with one. The figure is shaped by the larger beneficial effects for men who live with a spouse. The reduced gap in better wealth quintiles suggests that improvement of household wealth can narrow the gap in the rural setting, although it is more beneficial for men than for women.

Variation in HRQoL by sex has been observed at different levels in other countries, but the gender gap is more likely to be statistically insignificant [92], i.e., that women are more disadvantaged in the EQ-5D index than men [71, 72, 75, 94, 95]. Gender disparity is argued to be greater because EQ-5D may not capture intermittent symptoms among women, but rather identifies more common chronic ones such as migraines or major depression [96].

In the present study, the gender gap is greatest among those reporting severe problems in the usual activity dimension, and those reporting moderate problems in the self-care dimension. This suggests that interventions for reducing HRQoL gender gaps at old age should pay greatest attention to these physical dimensions.

Men have higher indices for basic and instrumental ADLs while women only have a higher intellectual ADL index. This might be due to characteristics associated with patrilineality and patrilocality [97] that continue to strongly influence rural areas, as well as the fact that literacy is lower among women. The cultural traditions may increase the emotional expectation of help with basic and instrumental ADLs among men. Lower literacy among women might lead to a greater need for help with intellectual ADLs.

The tendency among men to use more services can be attributed to rural women being more active in the care of grandchildren and housework, while men expect to care for themselves under the patrilineal and patrilocal culture [97] that remains strong in rural Vietnam.

Marital status and need of daily care
Married status is a predictor of a lower intellectual ADL index. This suggests that emotional exchange within marriage is important in maintaining physical functions at old ages. Another factor may be that married people in rural areas are
more likely to be younger than those who are widowed. Thus, being married may correlate with younger age and, as expected, those of younger age are in better health than those who are older. Those who are separated/divorced/single are at risk for a higher instrumental ADL index compared to widowed people. This means that being separated/divorced/single is a higher risk status than being widowed in terms of ADL needs in old age.

It is notable that only 55.8% of married elderly live with their spouse. The rest may live with the families of other children. People who live with a spouse are less likely to use services; widowed, divorced or single elders are more likely to use services. This may be explained by the spouse being one of the most important sources of emotional and practical support [98]. Married people have a tendency to use more services that are free-of-charge or with lower costs. This may be influenced by the 44.5% of married people who do not live with a spouse.

**Poverty, health and needs**

*Inequalities in RLE caused by long-term and extreme economic disadvantages*

Others have suggested that socioeconomic variations are the most fundamental causes of inequalities in health [99]. This relationship persists in life expectancy at old age. There is a tendency toward increased longevity in higher socioeconomic groups in both developed and developing countries [100-104]. In the same vein, the present study shows that RLE is significantly higher in better economic groups, classified by thresholds of per capita income or expenditures according to the national or international poverty lines. In relation to living conditions defined by household wealth, RLE is significantly higher among men from middle and higher wealth groups than those from the lower groups.

Moreover, the above trend indicates that disparities in life expectancy are influenced more by income and expenditures than by living conditions. It is notable that older people with disadvantaged life expectancy belong to households living below poverty lines in any survey during the follow-up period. This implies that long-term lower economic status causes the disadvantage rather than short-term conditions. Disadvantages in RLE between the poverty levels are high, and this is in contrast to the weak socioeconomic gradient measured by the wealth index. This finding shows the effects of extreme poverty on health compared with the prevailing view of a social gradient.

During all periods, inequalities in RLE for men exist between particular wealth quintiles while there is no significant difference in RLE for women across the standard levels. Therefore, either better living conditions are more beneficial for RLE among men than women, or the household economic level reflects the well-being of the men better than that of the women. Significant differences for the
second four-year period are only observed between the poorer and the richest quintiles, while other significant differences between the quintiles exist in the first period. This indicates a reduced inequality in RLE caused by living conditions and can probably be explained by the overall improvement of household living standards during Vietnam’s economic reforms.

The RLE gap when estimated against the national poverty line is wider than that of the international poverty line. The threshold set for the national line is based on per capita income level, which in turn is based on the availability of government resources to support the poor. This might be lower than necessary for older people to reach a health status achievable with a minimum expenditure to meet basic needs.

People living below the poverty lines faced a lower life expectancy between the four-year periods, but there is a trend of increased RLE among those living above the poverty lines. This shows that poverty burden on life expectancy is heavier among those living below the poverty lines, although socioeconomic conditions in the society are generally improved. Furthermore, the gap in RLE between those of different poverty status widened across the four-year periods. This indicates a greater influence of economic disparities on longevity inequalities over time.

The highest gains in RLE are among the wealth groups with lowest RLE in the first period. Thus, the disparity between wealth quintiles was reduced. This change might be attributed to investments in equitable social policies beginning in 1998 that targeted the poor and other vulnerable groups [64, 105, 106]. These large-scale investments include support for improving commune infrastructure (electricity supply, road construction, schools, and commune health stations) in the most disadvantaged areas, and implementation of extensive public health programmes, including maternal health care and free access to health care for the poor. Nevertheless, the gain in RLE among men in the poorest quintile is not large or homogenous enough to be significant. This suggests a need for additional support to enable improvement in health status at old age for those with the poorest living conditions.

**Disparities in HRQoL caused by economic conditions**

EQ-5D indices are lower among the poorer and poorest than among other wealth quintiles. However, significant differences in the proportion reporting problems between the poorer or poorest and other wealth quintiles only exist in the pain/discomfort and anxiety/depression dimensions. This shows that the poorest and poorer are the most vulnerable in terms of household living conditions and low HRQoL at old age. These conditions affect HRQoL through mental, rather than physical, dimensions.

On the other hand, variations in the EQ-5D index according to position on the national poverty line are not significant once adjusted for other factors in the hi-
erarchy analyses. HRQoL at old age is more likely affected by long-term economic conditions than short-term conditions measured by per capita household income.

**Economic determinants of care**

Living below the national poverty line is indicator of higher intellectual and instrumental ADL indices. This short-term economic condition might relate to the ADL indices through the mechanism of better economic conditions contributing to better health status [67]. Higher household wealth promotes a lower intellectual ADL index but does not improve the other scales. Household wealth is a long-term economic indicator that primarily reflects household living conditions and is sensitive to intellectual exchanges. Generally, short-term conditions are more extensively related to ADL scales than long-term conditions.

People who live below the national poverty line or belong to the lower wealth quintiles are more likely request free services and less likely to use services with payment requirements. Therefore, subsidies are likely to be needed if rural elderly are to access care, and this is especially the case for those in poor households. Poverty status is only related to use of services with payments, but household wealth is related to use of both free and paid services. This suggests that the household short-term economic status has less effect than long-term status on willingness to use care models. Whether the poorest quintile is less likely to use free services from a day care centre than the middle quintile, or more likely than the poorer and middle quintiles to use services with full costs from a mobile team and day care centre is unknown.

**Living arrangement, health and needs**

In Vietnam, as in many developing countries, the family (rather than the state) is the main source of financial and material support for older people [107-109]. Mutual exchanges exist, with older people typically contributing in different, non-financial ways to support the well-being of other family members [107, 110]. A partner is one of the most important sources of emotional and practical support [98]. This is confirmed in the present study since living with a spouse guarantees a significantly higher RLE for both sexes. This also shows the important mutual support between spouses that is beneficial for longevity. Furthermore, the transition from living with a spouse to without implies a health risk. Those experiencing this transition have a lower RLE than those who have lived without a spouse in both periods; the loss of a spouse through death or divorce usually implies major grief, stress and worry as well as the loss of social and material support [98].

RLE gained from living with a spouse is higher among men than women. Men benefit more by living with a spouse than do women. This gain in RLE for men
may be the result of the traditional role of women in nurturing their family. The tendency for a lower difference in gained RLE over time from living with a spouse indicates the effect of changing social roles of women during recent decades.

Initial examination of the current study finds that living with children/grandchildren is neutral for RLE disparities. However, the influence of living with children/grandchildren becomes evident when stratified by periods, or adjusted for living with a spouse and poverty status. Particularly among older people living without a spouse, men have a RLE benefit from living with children/grandchildren while women have a RLE risk. The benefit for men may result from patrilineality and patrilocality [97] which remain strong in rural Vietnam. The lower RLE for women who live with children/grandchildren may be the result of older women being involved in domestic work, including caretaking of younger children. This is a common feature in rural areas of developing countries [107].

When living with a spouse, there is no significant difference in RLE for men, regardless of whether or not they also live with children/grandchildren. This suggests that daily material and emotional support for older men from their spouse is essential and more important for longevity than support from children/grandchildren. Women who live with a spouse gain in life expectancy when also living with children/grandchildren. The gain might partially result from sharing the parental burden of childcare with their husband.

When living above the national poverty line, RLE is significantly higher among older women living without children/grandchildren than those living with them. This might be due to lifestyle practices suitable for old ages, which differ from those of younger generations, as well as from a reduction in domestic workload and childcare. However, the tendency for a higher RLE over time among older people living with children/grandchildren suggests that the parental role changes with time.

Living with a spouse increases the likelihood of having a higher intellectual ADL index but a lower instrumental ADL index. This might be because it is easier for pairs of older people to support each other in intellectual ADLs since instrumental ADLs are physically heavier.

People who live in smaller households have a lower instrumental ADL index. A lower expectation of having help among those who live in families with fewer potential caregivers, or with a lack of outside caregivers, may be responsible.

In the rural areas, it is common for older married couples to temporarily live in different households of their children. This phenomenon accounts for 24.3% among married subjects in the present study (Table A1). On one hand, this allows for adult children to share responsibilities of nurturing and caring for older parents, especially among the poor. On the other hand, a proportion of older people provide help for their adult children by doing housework or taking care of their grandchildren. This type of living arrangement may also explain the low propor-
tions of having support in ADL from a spouse. Loneliness is a factor promoting a lower ADL index in both basic and instrumental scales, while living with children/grandchildren is a risk factor for a higher ADL index in one or both of the instrumental and intellectual scales. This is surprising. The presence of children and grandchildren in the household may encourage a higher expectation of having ADL support, while lack of a social network among those who live alone may limit the expectation of outside support.

Living in the lowlands or highlands predicts a lower instrumental ADL index than living in mountainous areas. This may be explained by the poorer general health status due to more disadvantages in living and health care conditions among people in mountainous areas. People in the highlands have a lower intellectual ADL index than those in mountainous areas. This may be explained by better health status and higher literacy but also more needs and conditions for intellectual exchanges (eg, newspapers, TV, radio) among those in the highlands. People who live in the lowlands usually have more geographic and economic access to health services than those living in mountainous areas. This may lead to a lower expected use of mobile teams and nursing centres.

Role of education in health and needs

Education is one of the key socioeconomic channels for acting on inequalities in health since it shapes occupational opportunities and earning potential [99]. These factors consequently affect living standards and health care. Education affects disparities in life expectancy until old age because health status at a young age still influences life expectancy at later ages [111]. In addition, education provides basic knowledge and life skills that enable better-educated people to gain more ready access to information and resources that promote health across their lifespan [112].

Educational disparity in life expectancy exists in the present study. RLE is significantly higher among men with better education. This finding, although limited to men, is consistent with studies in other countries with different levels of development [104, 111, 113]. A wide confidence interval for RLE results from the small proportion of women with better education and might hide potential inequalities in educational levels among women.

As HRQoL is a subjective health outcome, people with different levels of educational attainment may understand its dimensions differently, particularly with regard to psychological functions. Previous studies found that people with higher levels of educational attainment usually have higher EQ-5D indices [71, 72, 92, 94]. In the present study, literate older people have a significantly higher index with a difference of 0.019-0.032. This reconfirms the affect, albeit low, of basic education on HRQoL at old age, and relates to the fact that educational gaps in the dimensions mainly exist between the lower levels of education and
moderate levels of problems. Successful implementation of the so-called “Education for All” strategy in Vietnam and other developing countries may have a long-term positive impact on the future educational gap at old age.

People with higher educational levels have lower instrumental and intellectual ADL indices. This is likely due to the better health status that results from greater income during their working ages [99] as well as greater acquisition of life skills, knowledge and health care [112].

The observed trend among people with low levels of education of using more free services from a nursing centre or lower cost services from a day care centre may be influenced by the lower incomes that are typical of this group [99].

**Household head status in relation to health**

Older people who are household heads have both higher RLE and better EQ-5D indices than those who are household members. This shows the important role of household decision-making in improving health status among older people, particularly relating to household health expenditures and food consumption.

Furthermore, in all dimensions of EQ except anxiety/depression, the proportion of people reporting problems is lower among household heads than household members. Therefore, being a household head is more influential in physical than psychological terms.

Household heads have lower basic and intellectual ADL indices and fewer support needs. This may be because these older people are more likely to have better health status and higher literacy than other household members.

**Association of working status with health and needs**

A smaller proportion of older, working people reports problems in EQ-5D than those who are not working. Moreover, under almost all dimensions, the proportion of working people who report problems is lower than that of any other socioeconomic status. Consequently, working people have a much higher EQ-5D index than their counterparts.

Variation by working status is equal to that by age group, and is highest when compared with those caused by the other determinants considered in this study. The proportion of those who report problems by working status are equal at all levels for the anxiety/depression dimension and suggests that working status affects HRQoL through physical rather than mental dimensions.

The majority of working people are younger than those who are not working. In turn, working helps people stay healthy. These characteristics may be explained by our finding that working at old ages is a positive predictor of a lower ADL index and a lower need for support.
The need to spend time generating income as well as a better general health status among people still working at older ages [69] may explain their lower expectation of using day care centre services.

**A need for long-term care for elderly with chronic illnesses**

Variation in the number of chronic illnesses is related to all ADL indices. This is consistent with the finding of a previous study among Canadian seniors [114] where having more than one chronic condition increases the likelihood of dependency. In the current study, the relationship is profound on the basic scale but slight on the other scales. Therefore, older people with chronic illnesses should be targeted with supportive care that focuses on basic ADLs rather than instrumental and intellectual ADLs. This indicates the need of long-term care for such people because basic ADLs include basic personal care. As chronic illness is prevalent in a large portion of older people (42%), support for long-term elderly care becomes an issue in rural areas.

**The most vulnerable groups**

Among many examined socioeconomic factors, only four (ie, age group, loneliness, household head status, working status) significantly relate to the basic ADL index. Many more factors relate to instrumental and intellectual scales. The multivariate model coefficient of determinants of basic ADLs (24.5%) is higher or nearly equal to those for the instrumental (15.3%) and intellectual (20.0%) scales. This suggests that future interventions to improve daily care for the elderly should address socioeconomic determinants of instrumental and intellectual care over those for basic care. This is not to say that factors related to basic care are less important than the other aspects of care.

Among older people, approximately 30% are 80 years or older, and 18% are illiterate (Paper III: Table A1). These are the most vulnerable and have the highest number of dependent ADLs. People who are separated/divorced/single, household members, not working, living with children/grandchildren, belonging to the poorest quintiles, or living below the national poverty line are more likely to have a higher ADL index than their counterparts. These vulnerable groups should be targeted in future interventions to improve daily care for older people.

**A need of pilot intervention**

A representative at the commune level pointed out that “three main limitations are lack of budget, knowledge and guidelines”. More must be learned about the implementation process. The current study identifies a number of activities that would improve care models. However, information is limited about how to implement programs with constrained resources. Therefore, a well-designed pilot
intervention that focuses on the development of an intervention, the implementation process, and attitudes of users and providers is needed.

**Some methodological issues**

*Limitations in the cohort study*

Mortality data collected by FilaBavi has been evaluated as an accurate data source that is able to identify 99.8% of deaths in communities from the quarterly household follow-up surveys and 96.0% from the re-census. Official data documented by the Community Registration System (CRS) missed 19% of deaths and the majority were among infants and the elderly [115]. Among deaths at age 60 and over, the re-census missed 3% for both sexes, and CRS missed 13% for men and 19% for women. This small gap in FilaBavi data therefore lead to a slight overestimation of RLE at old age.

The older persons followed up during 1999-2006 were all born before 1946 when a birth registration system did not exist in rural Vietnam. The official registrations of birth data were introduced a couple of decades later and thus there may be some recall bias in the data, especially from the oldest people. Consequently, calculation of their ages might be affected by the bias, and in turn could affect the estimation of life expectancy in this study. Other studies indicate that age overstatement is a source of bias in mortality rates at older ages [116]. A formal check of possible age overstatement by using a comparison between T80/T60 in FilaBavi DSS data and a “gold standard” country (Sweden) has been performed. That study shows that there is no reason to suspect age overstatement in the current data (Paper I: Table A7).

Socioeconomic data used for this study were extracted mainly from five surveys that were conducted every second year. The present study did not account for possible temporary or sudden shifts in socioeconomic status, such as income, expenditures and living arrangements that might occur between the surveys in a specific period.

The use of means for missing values of continuous variables of income, expenditures and land/floor area in calculating the wealth index might cause a misclassification of household wealth toward the middle quintile. However, the fact that the percentage of observations with missing values is very low suggests that distortion of this index estimate is insignificant since it that takes into account many other variables.

Currently, few multivariate analysis methods exist for life expectancy studies, especially for small areas. The present study mainly used univariate analysis methods for examining a single factor’s influence on life expectancy at old age. Therefore, most interactions between socioeconomic factors have not yet been considered. Only a few factors, such as living with children/grandchildren (which did not show significant disparities in the univariate analysis), have been further
stratified by certain other factors to consider possible interactions in the relevant socioeconomic groups.

There are some distribution skews in older people across particular socioeconomic factors. These are likely the result of small sample sizes in some groups such as women with higher educational levels. The possibility of identifying significant disparities in RLE related to these small groups may be reduced. Furthermore, changes in life expectancy usually need to be observed on a larger scale for a long period. Initial results from the present study were obtained from a small area after a short follow-up time. Some changes between particular socioeconomic statuses may not have been recorded.

**Issues in the cross-sectional survey**

Most instruments for assessing HRQoL were developed in European and North American contexts. There is also a shortage of multidimensional assessment scales that are internationally applicable among older people living at home [117]. Totally appropriate HRQoL assessment instruments are lacking for older persons in the context of developing countries such as Vietnam. In the current study, findings on HRQoL at old age used the EuroQol instrument and only reflect basic dimensions of health status. EuroQol does not capture the others important dimensions such as social, spiritual, financial and environmental ones.

Although Vietnam and South Korea have similar scores in many dimensions of national culture that potentially affect EQ-5D value set coefficients, it is uncertain how much value the preference from South Korea carries for a Vietnamese population. Measurement of HRQoL using the EuroQol instrument is only helpful for the day of data collection and may not capture intermittent symptoms, especially among women.

ADLs do not cover all disability domains. Therefore, assessment of elderly care needs may underestimate other care needs for functional impairments that were not assessed. Community-based models of elderly care, especially mobile teams, are rare in Vietnam. Respondents had little or no experience in using or paying for such services. This is why pilot interventions are needed. The analysis of willingness to use and pay for services is limited by certain socioeconomic determinants and does not currently cover the health issues that face the elderly. The presence of chronic illnesses might be underestimated because only illnesses diagnosed by physicians were recorded.

Radio and television are now popular in rural areas, but not all households have these appliances. People in a rural community live close together. Members of a household usually visit other households. It is the norm in rural areas for those in households without radio or television to listen to radio or watch televi-
sion in the houses of their neighbours or relatives. Survey questions on the need of support in listening to radio or watching television were difficult to response to among those living in households without such audio-visual equipment who have mobility disabilities.

Household economic data, particularly expenditures and income, were extracted from re-census data. These figures fluctuate, especially by seasons in rural areas of Vietnam. The proportion of older people who are illiterate or can barely read and write is high in rural areas. People with low literacy may understand the survey questions differently. The majority of illiterate subjects need support from literate people when they want to read or write. Some of them might not need any support in writing (19.4%) or reading (10.7%) as they did not have any need for reading or writing, or did not want to communicate by reading or writing. The significant relationship from this cross-sectional survey does not allow for any inferential explanation of causal pathway between socioeconomic factors of HRQoL, the need of daily care, and willingness to use services at the old age.

Issues in qualitative study
The study might not capture all perspectives on elderly care in different settings within the rural district because its FGDs were only performed in one commune. Older people involved in the FGDs were from different age groups and sexes but did not include those facing functional issues in travelling and communicating or more severe health issues that limit focus group discussion participation. Therefore, the discussion results might not adequately reflect the need and expectation of care among these disadvantaged people.
Conclusions

Life expectancy at older age in rural areas has reached a high level that is comparable to that of developed countries, particularly for women. Life expectancy increased between 1999-2006. This increase is significant and attributable to the improvement in health among women and the less poor groups. However, life expectancy tends to decrease in the most vulnerable groups, such as people living below the poverty lines and those living without children/grandchildren. Furthermore, there are wide gaps in remaining life expectancy between different poverty levels and living arrangements. The gap in remaining life expectancy by poverty status is getting wider over time. A gender gap exists consistently in all socioeconomic groups and tends to be wider among the more disadvantaged groups. The notable increase in life expectancy at old age not only reflects the important impact of both the economic growth and the general improvement of living conditions, but also confirms that current social and health policies targeted at older people in Vietnam are appropriate and effective. These policies should be more extensively implemented. The existing gaps in remaining life expectancy suggest that the policies and corresponding interventions should be more strongly focused on the poorest and most disadvantaged groups and provide additional support at more appropriate levels. Studies on trends and disparities in life expectancy among older people in Vietnam should be extended to cover different settings and for longer periods in order to provide the comprehensive evidence necessary to design appropriate policies as the country undergoes rapid and multiple transitions.

HRQoL at old age is at a high level, and varies substantially by socioeconomic factors. Younger age, position as a household head, working until old age, literacy, and belonging to better wealth quintiles are all determinants of higher HRQoL among older people in this rural area of Vietnam. Ageing has a primary influence on the deterioration of HRQoL at older ages, mainly due to reductions in physical rather than mental functions. Educational disparity in HRQoL is low, and exists mostly between basic and higher levels of education. Being a household head and working at old age are advantageous for attaining better quality of life in physical but not psychological terms. Economic conditions affect HRQoL through sensory rather than physical functions. Finally, long-term living conditions are more likely to affect HRQoL than short-term economic conditions. Socioeconomic determinants are of importance in evaluating HRQoL at old age, and should be addressed in social and health policies designed to improve health among these vulnerable groups in the context of multiple socioeconomic transitions.

There is an unmet need for ADL support among older people in rural Vietnam. This population mainly relies on help from their children and grandchildren.
Care needs are related to age group, sex, educational level, marital status, household membership, working status, household size, living arrangement, residential area, household wealth, poverty status, and presence of chronic illness. Further research to explain more clearly these relationships will be useful. The development of a future network for improving community-based, long-term elderly care is increasingly necessary. This should focus more on instrumental and intellectual ADLs among the general population of older people, and on basic ADLs among those with chronic illnesses. Home-based care is more important than institutional care for future interventions. Those who are at the oldest ages, illiterate, separated, divorced, or single, household members rather than household heads, not working, living with children/grandchildren, belonging to the poorest wealth quintiles, living below the national poverty line, and with chronic illnesses should be the primary targets for daily care in old age.

There is a demand for community-based elderly care in rural Vietnam. Household members expect to use services for their elderly to a greater extent than do the elderly themselves. This holds true for different models and payment levels. Willingness to use services decreases when potential fees are increased. The proportion of people who would require services is 2-3 times higher than the proportion of those willing to pay for the services. Households are willing to pay more than are their elderly members for day care and nursing centre services. The elderly were willing to pay more for mobile teams than are their households. ADL index, age group, sex, educational level, marital status, living arrangement, household head status, living area, working status, poverty status, and household wealth are factors related to the willingness to use services. Despite many differences, there is overall agreement that community-based elderly care will be used, and partly paid for, if it is provided by the government or associations. Network capacity building by health professionals and informal caregivers, as well as expanding support for the most vulnerable elderly through social security policies, is needed to assess which care services are essential for building and expanding care models. Pilot interventions are needed to scrutinize how these should be implemented in rural Vietnam.
The researcher

The author of this thesis graduated as a medical doctor in 1994 and a Master of Science in epidemiology in 1999. His career started as a researcher in the Department of Clinical and Experimental Research of the National Institute of Malaria-ology, Parasitology and Entomology, Vietnam in 1994. He has participated in management of the Unit of Research Management and International Cooperation of the institute since 2000.

Dr. Hoi has been involved as an invited lecturer in the teaching and research activities of the Faculty of Public Health at the Hanoi Medical University since 1999. He began official work as a lecturer and researcher at the university in 2002. Work in professional and management activities of different units of the university include the Department of Biostatistics and Medical Informatics and the Unit of Teaching and Consulting Health Research since 2002, the Clinical Epidemiology Center since 2003, and the Department of Administration and General Affairs from 2005-2009.

Since early 2011, he has been participating in management of the Central Health Information and Technology Institute, Vietnam Ministry of Health. During his professional practice, he has provided technical assistance as consultant or advisor in different areas such as primary health care, child health, communicable and non-communicable disease, and the health system for collaborations with international organizations such as WHO, ADB, EU, MDM and PATH.

Elderly health research began as a new area of works just before he registered for his Sandwich PhD training program at Umeå University in 2007. He tries to acquire more knowledge and improve the expertise of his practice through participating in the training program and conducting research. Through valuable collaborations with Vietnamese and Swedish colleagues, he hopes that these research findings will make a significant contribution to the overall health improvement of people in Vietnam and comparable countries.

With such a spirit, and in order to translate the evidence from this research and other related studies in Vietnam, as well as other comparable countries, into new policies and practices, the author and his colleagues in EVIPNet Vietnam and Umeå University have recently developed a new project. The project is entitled “Improving access to and use of research results for developing new policies and models of health care in Vietnam: Pilot on community-based care for older people”. Grant funding for this project was recently awarded by SIDA for implementation during 2011-2014. This will help us continue with new efforts to improve elderly health.
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References

20. GSO: Results of the population change and family planning survey 1 April 2004. Hanoi; 2005.


REFERENCES


43. Tajvar M, Arab M, Montazeri A: Determinants of health-related quality of life in elderly in Tehran, Iran. *BMC Public Health* 2008, 8(3(23)).


45. Roset M, Badia X, Mayo NE: Sample size calculations in studies using the EuroQol 5D. *Quality of Life Research* 1999, 8:539-549.

46. Primary Health Care in Later Life: Improving services in Vietnam and Bangladesh. Research and Evaluation Division, Bangladesh Rural Advancement Committee; Health Strategy and Policy Institute, Vietnam; Overseas Development Group, University of East Anglia, UK; 2002-2005.


48. EQ-5D: a standardized instrument for use as measure of health outcome [http://www.euroqol.org/eq-5d/what-is-eq-5d.html]


85. Walters SJ, Brazier JE: Comparison of the minimally important difference for two health state utility measures: EQ-5D and SF-6D. Quality of Life Research 2005, 14:1523-1532.


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Appendices

1. **Paper I**

2. **Paper II**

3. **Paper III**

4. **Paper IV**
   Hoi LV, Chuc NTK, Sahlen KG, Lindholm L: Willingness to use and pay for options of care for community dwelling older people in rural Vietnam. BMC Health Service Research (Submitted).