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**ANTENATAL AND DELIVERY CARE UTILIZATION
IN URBAN AND RURAL CONTEXTS IN VIETNAM:
A study in two health and demographic surveillance sites**

Tran Khanh Toan

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Women are not dying because of diseases we cannot treat. They are dying because societies have yet to make the decision that their lives are worth saving.

Dr. Mahmoud Fathalla

To my family

ABSTRACT

Background. Pregnant women need adequate antenatal care (ANC) and delivery care for their own health and for healthy children. Availability of such care has increased in Vietnam but maternal mortality remains high and variable between population groups.

Aims. The general aim of this thesis is to describe and discuss the use of antenatal and delivery care in relation to demographic and socio-economic status and other factors in two health and demographic surveillance sites (HDSS), one rural and one urban. One specific aim of the thesis is to present experiences of running the urban HDSS.

Methods. Between April 2008 and December 2009, 2,757 pregnant women were identified in the sites. Basic information was obtained from 2,515 of these. The use of ANC was followed to delivery for 2,132. Three indicators were used. ANC was considered overall adequate if the women started ANC within the first trimester, used three or more visits and received all the six recommended core services at least once during pregnancy. Delivery care was studied for all the 2,515 women.

Main Findings. Nearly all 2,132 participants used ANC. The mean numbers of visits were 4.4 and 7.7 in the rural and urban areas. Mainly due to less than recommended use of core ANC services, overall ANC adequacy was low in some groups, particularly in the rural area (15.2%). The main risk factors for not having adequate ANC were (i) living in a rural area, (ii) low level of education, (iii) low economic status and (iv) exclusive use of private ANC providers. Rural women accessed ANC mainly at commune health centers and private clinics. Urban women accessed ANC and gave birth at central hospitals and provincial hospitals. Caesarean section (CS) was common among urban women (38.5%). Good socioeconomic condition and male babies were associated with delivery in hospitals and CS births. Almost all women had one or more antenatal ultrasound examination, the mean was about 4.5. Rural women spent 3.0% and 19.0% of the reported annual household income per capita for ANC and delivery care, respectively, compared to 6.1% and 20.6% for urban women. The relative economic burden was heaviest for poor rural women.

Conclusion. The coverage of ANC was high in both contexts but with large variations between population subgroups. The major concerns are that poor women in the rural area received incomplete services according to recommendations and that many women, particularly the well-off, in the urban area appeared to overuse technology, ultrasound scanning, delivery in high-level health care and CS delivery. National maternal healthcare programs should focus on improving ANC service content in rural areas and controlling technology preference in urban. The pregnant women with relatives and friends as well as ANC providers share the responsibility for a positive development. All parties involved must be targeted to improve knowledge, attitudes and practices.

Keywords: *Antenatal care, delivery care, utilization, adequacy, hospital delivery, caesarean section, health and demographic surveillance site, rural and urban, Vietnam.*

LIST OF PAPERS

This thesis is based on the following papers:

- I. **Tran TK, Nguyen CT, Nguyen HD, Eriksson B, Bondjers G, Gottvall K, Ascher H, Petzold M: Urban - rural disparities in antenatal care utilization: a study of two cohorts of pregnant women in Vietnam. *BMC Health Serv Res* 2011, 11:120.**
- II. **Tran TK, Gottvall K, Nguyen HD, Ascher H, Petzold M: Factors associated with antenatal care adequacy in rural and urban contexts-results from two health and demographic surveillance sites in Vietnam. *BMC Health Serv Res* 2012, 12:40.**
- III. **Tran TK, Eriksson B, Pham AN, Nguyen CT, Bondjers G, Gottvall K. Technology preference in delivery care utilization from user perspective-a community study in Vietnam. *Submitted*.**
- IV. **Tran TK, Eriksson B, Nguyen CT, Horby P, Bondjers G, Petzold M. DodaLab, an urban Health and Demographic Surveillance Site, the first three years in Hanoi, Vietnam. *Submitted*.**

The original papers are printed in this thesis with permission from the respective journals and are referred to in the text by their Roman numerals.

ABBREVIATIONS

ANC	antenatal care
CHC	commune health center
CI	confidence interval
CS	cesarean section
GDP	gross domestic production
HDSS	health and demographic surveillance site
HMU	Hanoi Medical University
IMR	infant mortality rate
LMIC	low- and middle-income country
MD	medical doctor
MDGs	Millennium Development Goals
MMR	maternal mortality ratio
MoH	Ministry of Health
NHV	Nordic School of Public Health
OR	odds ratio
SBA	skilled birth attendant
SRB	sex ratio at birth
U5MR	under-5 mortality rate
USD	US dollar
VND	Vietnamese dong
WHO	World Health Organization

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PREFACE

I was born during American war in a poor province in the middle part of Vietnam. After graduation as a MD from Hue Medical School in 1995, I returned to my hometown and became a lecturer at Quang Binh Secondary Medical School. In 1996, I moved to work for the provincial medicine center. Seven years working there as an Expanded Program on Immunization (E.P.I.) secretary gave me the opportunity to come to and involve in vaccination campaigns for mothers and children at almost all communes in the province. Witnessing and sympathizing with the difficulties of the poor people in mountainous and remote areas to have access to health services, I gradually came to love the works of a public health worker, which was not my favorite from the beginning.

In 1999, I attended a post-graduate training course in Hanoi Medical University (HMU) and got a Master of Public Health in 2002. During three years studying at HMU, I conducted my first community health study in FilaBavi and was exposed to the basic concepts of a health and demographic surveillance sites (HDSS). Coming back to HMU in 2005 for a fellow program, I worked with some Vietnamese and Swedish professors, who became my supervisors when I registered as a PhD student at the Nordic School of Public Health two years later. In the end of 2007, a new urban HDSS, called DodaLab, was established in Dong Da district as a result of our attempts to respond to a need for an urban field site for community health research and training. The first study on the use of maternal health care was started in 2008 in DodaLab and FilaBavi to begin the research idea of following pregnant mothers and their newborn children in parallel in urban and rural areas.

In this research project, I participated in the preparation, establishment and implementation of DodaLab HDSS and in conducting my empirical studies. I was responsible for selecting the field site; designing and testing the tools; recruiting and training the fieldworkers as well as supervision of data collection and managing. I was also responsible for recruitment of the pregnant women in the two sites from April 2008 to December 2009 and later for data analysis. With support from the Swedish and Vietnamese supervisors and contribution from the other authors, I drafted, revised and submitted all four papers as the first author. None of these papers is included in any other thesis.

I am now very happy with my choice of studying in Sweden. The research training that I have gone through there has increased not only my knowledge but also my interest and enthusiasm in doing public health research. To improve maternal health and health care in a broad sense, the views and practices of other stakeholders than the mothers are needed. I hope I will be able to do more community health researches in HDSS in the future. This thesis is just a starting point, for me and for the DodaLab HDSS.

1. BACKGROUND

This thesis is about maternal and child health at individual and population level with focus on the use of antenatal health care (ANC) and delivery care in Vietnam. The overall orientation of the thesis is public health, specifically reproductive and maternal health. High maternal morbidity and mortality are major global health problems. An assumption is that appropriate use of health care during pregnancy and at delivery can contribute to mitigate the suffering due to these problems. A discussion of the health care system with its availability and quality of services therefore becomes the other main component of the research accounted for in this thesis.

1.1. Maternal and child health

1.1.1. Maternal health

Maternal health comprises the health of women during pregnancy, childbirth, and the postpartum period. Health problems during pregnancy may have serious consequences, not only for the woman but also for her child, her family, and her community. Although motherhood is often a positive and fulfilling experience, for too many women birth is associated with suffering, ill-health, and even death [1].

Maternal health and health care are important determinants of neonatal survival and child health outcomes. Therefore, improvements of maternal and child health are important global public health goals. In the Millennium Development Goals (MDGs) formulated in 2000, members of the United Nations are committed to reduce the under five mortality rate (U5MR) by two thirds and the maternal mortality ratio (MMR) by three fourths during the period 1990–2015 [2].

Access to appropriate maternal healthcare services is a fundamental right. Seventy-five percent of maternal deaths occur during childbirth and the postpartum period, and the vast majority of these deaths are avoidable. Provision of skilled care for all women before, during, and after childbirth is a key strategy for saving women's lives and ensuring the best chance of delivering a healthy infant [3, 4]. ANC and delivery care are considered basic components in any maternal healthcare program [5].

1.1.2. Maternal and child mortality

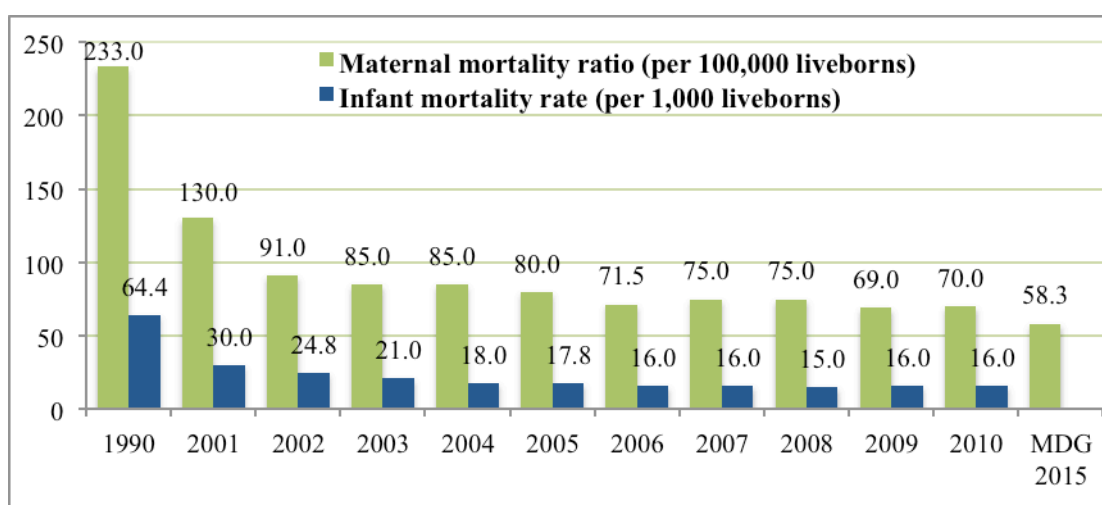
Global estimates of MMR decreased by 48% during 1990–2010, from 400 to 210 per 100,000 live births. The annual decline rate was 3.1%, just over half that needed to achieve the MDG5 target [6]. An estimated 287,000 women died worldwide in 2010 from causes related to pregnancy and childbirth. Large numbers of these deaths were preventable [6].

Meanwhile, U5MR globally decreased by 35% from 88 to 57 deaths per 1,000 live births in 1990 and 2010, respectively and the infant mortality rate (IMR) decreased correspondingly, from 61 to 40 per 1,000 live born children [7].

Maternal and child mortality are recognized as having some of the largest health disparities between regions and countries [8]. About 99% of maternal and child deaths occur in low- and middle-income countries (LMICs) [8, 9]. Sub-Saharan Africa has the highest MMR (500/100,000 live born in 2010) and accounts for nearly 56% of maternal deaths worldwide [6]. In some parts of the world, women have a one in six risk of maternal death [10]. In sub-Saharan Africa, one in eight children die before reaching 5 years of age, nearly double the average in other developing regions and 20 times that in developed regions [11].

In Southeast Asia, the estimated MMR was 200/100,000 live born and the U5MR was 57/1,000 live born in 2010, a decline by 67% and 49%, respectively, compared to 1990 [6]. These figures are lower than averages reported for the rest of the developing world (260/100,000 live born and 99/1,000 live born, respectively). However, Southeast Asia has the third highest absolute number of maternal and child deaths, after sub-Saharan Africa and South Asia, mainly due to its large population and high birth rate [11, 12].

Vietnam achieved remarkable improvements in maternal and child health during the latest 20 years. Between 1999 and 2010, Vietnam reduced MMR (by 70%), U5MR (by 57%), and IMR (by 64%) [13]. Nevertheless, MMR in Vietnam in 2010 was higher than in many countries in Southeast Asia (e.g., Thailand and Malaysia) [6]. Although the estimated MMR in 2010 reached the goal of the national strategy for reproductive health for 2001–2010 [14], achieving the MDG5 target by 2015 will require much effort (Figure 1) [13].



Source: Ministry of Health

Figure 1. Maternal Mortality ratio and Infant Mortality Rate in Vietnam, 1990–2009

1.1.3. Role of maternal health care

Most maternal deaths are avoidable because healthcare solutions to prevent or manage complications related to pregnancy and birth are well known [15]. The safe motherhood package formulated by the World Health Organization (WHO) in 1994 included four components: ANC, family planning, safe delivery, and essential obstetric care [16]. The WHO package was devised to ensure women's ability to go safely through pregnancy and childbirth and to deliver healthy infants [17]. Theoretically, the package claimed it could prevent 80% of all maternal deaths [18]; skilled birth attendance at every delivery was estimated to reduce maternal mortality by 13%–33% [19]. Universal adoption of the WHO package by LMICs could avert 41%–72% of neonatal deaths worldwide [20].

1.1.4. Antenatal care

ANC (i.e., “care before birth”) was introduced in high-income countries in the early 1900s, aiming to help women remain healthy; find and correct adverse conditions, when present; and promote the health of the unborn [21]. The rationale for the widespread introduction of ANC is the belief that it is possible to detect and effectively manage early signs of, or risk factors for, illness and death during pregnancy [22].

A typical ANC program includes three basic components: assessment of mother and foetus, preventive and if necessary, curative, health care as well as health counseling and education. The benefits of ANC appear obvious; however, the optimal number of visits and the content of ANC for low- or high-risk pregnancies remain an issue for discussion and recommendations vary between countries. Generally, ANC programmes in high-income countries often recommend more ANC visits, with more services than recommended in LMICs [21, 23-25]. For LMICs, a new WHO model including four ANC visits with the first visit within the first trimester has recently been recommended for women with uncomplicated pregnancy [26]. Compulsory measurement of blood pressure, urine, and blood tests as well as optional weight and height measurement should be done at each visit [22, 26]. Cost effective interventions free of charge to all pregnant women is recommended to ensure the universal access and utilization of such interventions [21]

Over 70% of women worldwide have at least one ANC visit during pregnancy, but the gaps between countries are large. Coverage is extremely high in high-income countries (98%) compared to in LMICs (68%). The lowest coverage is seen in Southeast Asia, where only 54% of women use ANC throughout pregnancy [22]. In most African countries, less than 70% of pregnant women receive ANC, and most of them have only one or two visits, sometimes only late in pregnancy.

In LMICs, more than 80% of women in the highest wealth index quintile use ANC compared to around 30% among women in the poorest quintile [27]. Many of the women who do not have access to prenatal care are those who need it most, typically poor women in rural areas and urban slums [5]. The quality of ANC in many countries remains very poor and requires renewed effort to reach MDG4 and MDG5 by 2015 [9, 28, 29].

1.1.5. Delivery care

Delivery care was introduced earlier than ANC. The key issue during childbirth is the attendance of a skilled birth attendant (SBA). According to WHO,

“a skilled birth attendant” refers to a health professional such as a midwife, doctor or nurse, who is trained and competent in the skills needed to manage normal childbirth and the immediate postnatal period, and who can identify complications and, as necessary, provide emergency management and/or refer the case to a higher level of health care” [3].

The United Nations has called on all countries to increase their efforts toward skilled birth attendance and set targets of 80% coverage by 2005, 85% by 2010, and 90% by 2015 [30]. However, WHO suggests that in countries with very high MMR, the goal should be at least 40% of all births assisted by SBAs by 2005, 50% by 2010 and 60% by 2015 [31].

During 2005-2010, estimates suggested that 69% of births worldwide were supported by skilled birth attendants. While many wealthy countries have nearly universal coverage [32], less than 50% of all births in Africa take place with a skilled attendant. In some African countries, skilled birth attendance is even less than 20% [19, 30]. Socioeconomic inequality in delivery care in LMICs exceeds the inequality of ANC use [27].

Caesarean section (CS) is common in modern obstetric practice. When performed appropriately, following medical indications, CS is a potentially life-saving procedure. Despite warnings about risks of adverse maternal and newborn outcomes due to CS birth without medical indication, the rate of CS birth has increased worldwide [33, 34]. A significant number of such births might be performed on women who request the procedure without any medical indication [34, 35]. Several factors might contribute to the global increase of CS, including improved socioeconomic condition, new medical technology, and increased perception of safety [36].

1.2. Maternal Health care in Vietnam

1.2.1. ANC policy and recommendations in Vietnam

A systematic review of randomized controlled trials, conducted by the WHO in 2001, concluded that models with reduced number of ANC visits could be introduced into clinical practice without any risk of adverse consequences to the women or to the fetus [37, 38]. Vietnam's ANC policy is based on the new WHO model [27] and primarily focused on a limited set of essential services according to national priorities in maternal health and available resources [21].

During the present study, the National Guidelines for Reproductive Health care of 2002 were in force in Vietnam. New guidelines were given in 2009 including statements about the use of ultrasound scans and screening for syphilis in hospitals. Other changes were minor. According to the 2002 guidelines, pregnant women were recommended to use at least three ANC visits during pregnancy with at least one visit during each trimester and with the following medical services included at all or some visits:

- Clinical assessments, including measurements of body weight and height, blood pressure, fetal examination (fundal height, fetal abdominal circumference and fetal heart rate), and vaginal examination (during the first visit, if the signs of pregnancy are not clear).
- Laboratory tests, including urine test (for proteinuria) and blood test (for hemoglobin). A hematocrit test, syphilis and HIV screening are also recommended if these services are available at the health facilities i.e. only in hospitals.
- Care provisions, including tetanus vaccination, iron and folate supplements (for areas with high prevalence of severe iron deficiency anemia), and malaria prophylaxis (for malaria endemic areas).
- Antenatal health counseling about nutrition and diet regime, working regime, hygiene, and ANC schedule. Counseling regarding preparation for birth should be given [39].

Ultrasound examination can be seen as a component of ANC and is available in all hospitals and most private clinics. It was officially recommended for pregnant women in the 2009 national guidelines where ultrasound examination is defined as an optional ANC service, when available. A pregnant woman should then have three scans, one per trimester [40]. In the recommendation, the first scan aims to estimate the gestational age. The purpose of the second and the third scan is not described but according to experts, the second scan is used to detect physical defects and the last one should identify position and posture of the fetus in the uterus. It is explicitly forbidden, by law, to use the ultrasound examination for determination of the sex of the child. The ultrasound provider is not allowed to divulge that information to the mother.

The national Vietnamese guidelines suggest that pregnant women should give birth at health facilities, for normal pregnancies at the primary health care level. In remote areas, home births assisted by health workers or traditional birth attendants are acceptable. CS is allowed to be performed only by obstetricians in separate operating rooms in hospitals. During the postpartum period (i.e., within 42 days post-delivery), the guidelines recommend at least two health checkups for both mother and child.

1.2.2. Utilization of ANC and delivery care

ANC and delivery care utilization has increased during the last 20 years in Vietnam. In 2009, 88% of women reported using ANC and 94.4% received skilled birth attendance [41]. However, there are large variations between regions in ANC and delivery care utilization. For example, only 56% of births in the mountainous region in northwestern Vietnam were assisted by SBA compared to nearly 100% in the Red River Delta [42]. Among all maternal deaths, 40% occurred at home and 8% occurred during transfer between facilities. For the same deaths, 65% of the mothers had not used ANC at all, 22% had one ANC visit, and only 13% had two or more visits [14].

Although some national [42, 43] or local [44, 45] studies have been conducted, information on ANC and delivery care in Vietnam remains limited. Almost all studies used simple indicators, such as number of visits and time for initiation of ANC. Neither did those studies or the national health statistics profile address the service content of ANC visits [41].

1.2.3. Current maternal health and healthcare issues

In spite of impressive achievements, several difficulties and challenges remain in Vietnam regarding maternal and child health. The MMR is still relatively high and the IMR remained unchanged between 2006 and 2009, especially deaths during the early perinatal period (the first 7 days after birth) [46]. Some specific problems in maternal and child health and health care have been emphasized, including:

- *Disparities in maternal and child health status.* Maternal and child mortality is very high in remote and ethnic minority areas and among poor. MMR is 2-fold in rural areas compared to urban areas and 4-fold among ethnic minority mothers compared to the Kinh majority [46]. U5MR in mountainous areas and poor households is 3- to 4-fold compared to lowland areas and higher income families [46]. Utilization of ANC and delivery care is also lower in these disadvantaged areas and groups. Reducing the inequality in maternal and child health and health care is a priority of the current national strategy for population and reproductive health for the period 2011–2020 [47].

- *Limited quality of services, especially in mountainous and remote areas.* The service provision networks have only limited coverage in remote, isolated, and disadvantaged areas for essential maternal services. At commune health centers in these areas, there is lack of human resources and medical equipment for maternal health care and services provided are mostly only clinical [13]. The national strategy for population and reproductive health for 2011-2020 emphasizes that in the future the maternal and child health program must focus more effectively on improving the quality of services, including information, communication, and counseling [47].
- *Misuse of technology.* Medical technologies (e.g., obstetric ultrasound) can potentially pose social, ethical, and economic dilemmas for both health workers and recipients of health services. In a 2008 study women had an average of 6.6 ultrasound scans during pregnancy; one fifth of all pregnant women received 10 or more scans [48]. CS births are increasing rapidly in central hospitals. With 36% of women giving birth by CS, Vietnam had the second highest rate of CS among nine Asian countries involved in a 2008 WHO survey [49].
- *Increasing sex ratio at birth (SRB).* Sex Ratio at Birth (i.e., the number of male live births per 100 female live births) has increased in Vietnam over the last decade [50] associated with “son preference” behaviour, ultrasound examination, and selective abortions [51, 52]. SRB is estimated to continue increase in coming years and is predicted to rise to 115 by 2015 without interventions [52]. Control of SRB is a demographic priority, with SRB targets of below 113 for 2015 and 115 for 2020 [47], that is not decreasing SRB but slowing down the increase.

1.3. Health and Demographic Surveillance Systems

The lack of adequate routine demographic information for policy makers and health managers led to the development of Demographic Surveillance Systems (DSS) and, later HDSS, as a way to monitor populations in many LMICs. A geographically defined population in a HDSS is used as an open cohort under continuous prospective demographic monitoring and updated through repeated enumeration cycles (Figure 2).

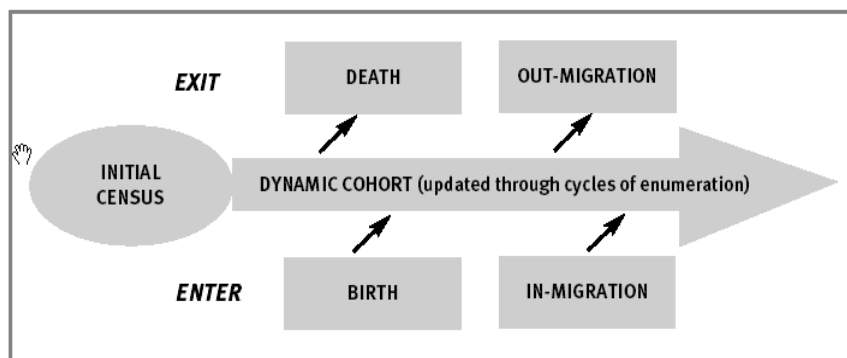


Figure 2. Typical Framework of a Health and Demographic Surveillance System

The basic function of an HDSS is to create a population registration system in a small area, where vital events (primarily births, migration, and deaths) are registered continuously and where educational, social, and economic information is obtained and updated at regular time intervals. This information is essential for planning purposes [53, 54]. HDSS can also provide a framework for studies investigating many aspects of community health in different settings and can serve as a platform for public health research training [55].

The first HDSS was developed in Matlab, Bangladesh, in 1966 [56], followed by others in other LMICs in Africa and Asia. The International Network for the Demographic Evaluation of Populations and Their Health in Developing Countries [57] was established in 1998. It currently includes 42 HDSS in 19 countries [57, 58]. A large number of studies on mortality have been conducted in the HDSS framework in these LMICs [59, 60].

Almost all HDSSs are located in rural areas, including FilaBavi and ChiliLab in Vietnam. The urban HDSS in Hanoi aims to be a similar infrastructure for research and research training in an urban area. In 2006, Hanoi Medical University, the Nordic School of Public Health, and the Hanoi Health Bureau initiated discussions about an urban HDSS in Hanoi; the Oxford University Clinical Research Unit joined the stakeholder group later. To enable urban rural comparisons, the DodaLab HDSS was set up in the urban Dong Da district in 2007. The FilaBavi HDSS had been running in a rural district of Hanoi, Vietnam since 1999.

1.4. The rationale of the research accounted for in this thesis

The Vietnamese health reforms during the 1980s contributed to increased availability of health care facilities and quality improvement of healthcare services in general. However, they also led to larger gaps in the use of health care between regions and social and economic groups in the communities [61]. Disparities in maternal health and use of maternal health care between different geographic areas and different social groups have also been reported [13].

Almost all previous studies of ANC and delivery care in Vietnam have been cross-sectional and conducted in rural areas before the year 2000. Very few studies have addressed the urban rural comparison issue. The mean number of ANC visits for women was always the key quantitative description of ANC utilization [45, 62, 63]. Few studies addressed the content of ANC i.e. medical counseling and services. Few attempts to define overall ANC adequacy were made [44, 64, 65]. There is still a lack of studies of associations between ANC and delivery care and possibly related factors in Vietnam.

A number of research questions follow from the above and provide the basis for the subsequent formulation of study aims:

- How large are the differences between rural and urban areas regarding antenatal and delivery care utilization?
- For ANC, how large are the differences in number of ANC visits, timing of visits during pregnancy and contents of ANC visits?
- For delivery care: what are the differences in delivery place, delivery attendance and delivery method?
- What social, economic and other factors are associated with antenatal and delivery care utilization in urban and rural areas?
- Can such associations explain differences between the two contexts?
- Is it possible to make a HDSS in the urban area work well enough to obtain information with satisfactory quality?

1.5. Aims of the research

1.5.1. General study aim

The aim of the research was to study antenatal and delivery care utilization in relation to demographic, socio-economic status and other factors in two HDSSs, one rural and one urban, to provide knowledge for evidence based decision making regarding maternal health care.

1.5.2. Specific study aims

In this thesis, the research is presented as three specific studies and a description of the new urban HDSS, each in one article and with the following aims.

- To compare the patterns and adequacy of antenatal care used in an urban and a rural HDSS in Vietnam (paper I);
- To identify factors, demographic, social and economic associated with three ANC adequacy indicators: number of visits, timing of visits and content of services. The aim was also to compare the patterns of associations between ANC use and these factors between an urban and a rural area (paper II);
- To investigate delivery care regarding utilization, expenditure and technology preference and related factors in urban and rural areas (paper III);
- To present the experiences and some concrete results for the three first years of operation of an urban HDSS in central Hanoi, Vietnam and discuss advantages and disadvantages of conducting health studies using a HDSS framework (paper IV).

2. CONTEXT AND STUDY SETTING

2.1. Vietnam

2.1.1. General information

Vietnam is located in Southeast Asia and borders China to the North, Laos to the Northwest, Cambodia to the Southwest and the South China Sea to the East. Its total population is about 87 million people who live in a surface area of 331,000 square kilometers. The country is divided into 8 geographic regions with 63 provinces and cities. Each province is divided successively into districts, communes, and hamlets. With a population of more than 8 million people, Hanoi is the largest city and the capital.

Vietnam has 54 ethnic groups, of which the majority (Kinh) accounts for about 85.7% and resides mainly in the plains. The highest population densities are in the two river delta regions, the Red River in the north, including Hanoi and the Mekong River in the south, including Ho Chi Minh city. Fifty-one percent of the population belongs to the reproductive age group (15–49 years old). More than 70% are farmers who live in rural areas [66]. By surpassing USD 1,000 per capita in 2010, Vietnam entered the ranks of middle-income countries [67].

The main health indices for Vietnam are quite good compared to other countries at the same level of overall development. In 2008, the life expectancy at birth was 73 years (70 for males and 75 for females), and U5MR was 25/1,000 live births, putting the total fertility rate under the replacement level, with 2 children per woman [41].



Figure 3. The Map of Vietnam

Table 1. Main Indicators of Vietnam in 2010

Indicator	Value
Area (km ²)	331,051
Population (millions)	86.9
Population growth rate (‰)	10.3
Total fertility rate	2.0
Life expectancy at birth (years)	74 (72/76)
Literacy rate among adults (%)	93
Gross Domestic Product (GDP) per capita (\$)	1,100
IMR/1,000 live births	16.0
U5MR/1,000 live births	23.8
MMR/100,000 live births	69
SRB (male births/100 female births)	111.2
Number of medical doctors/10,000	7.0
Number of midwives, nurses/10,000	12.5

Source: Ministry of Health and General Statistics Office

2.1.2. Healthcare system

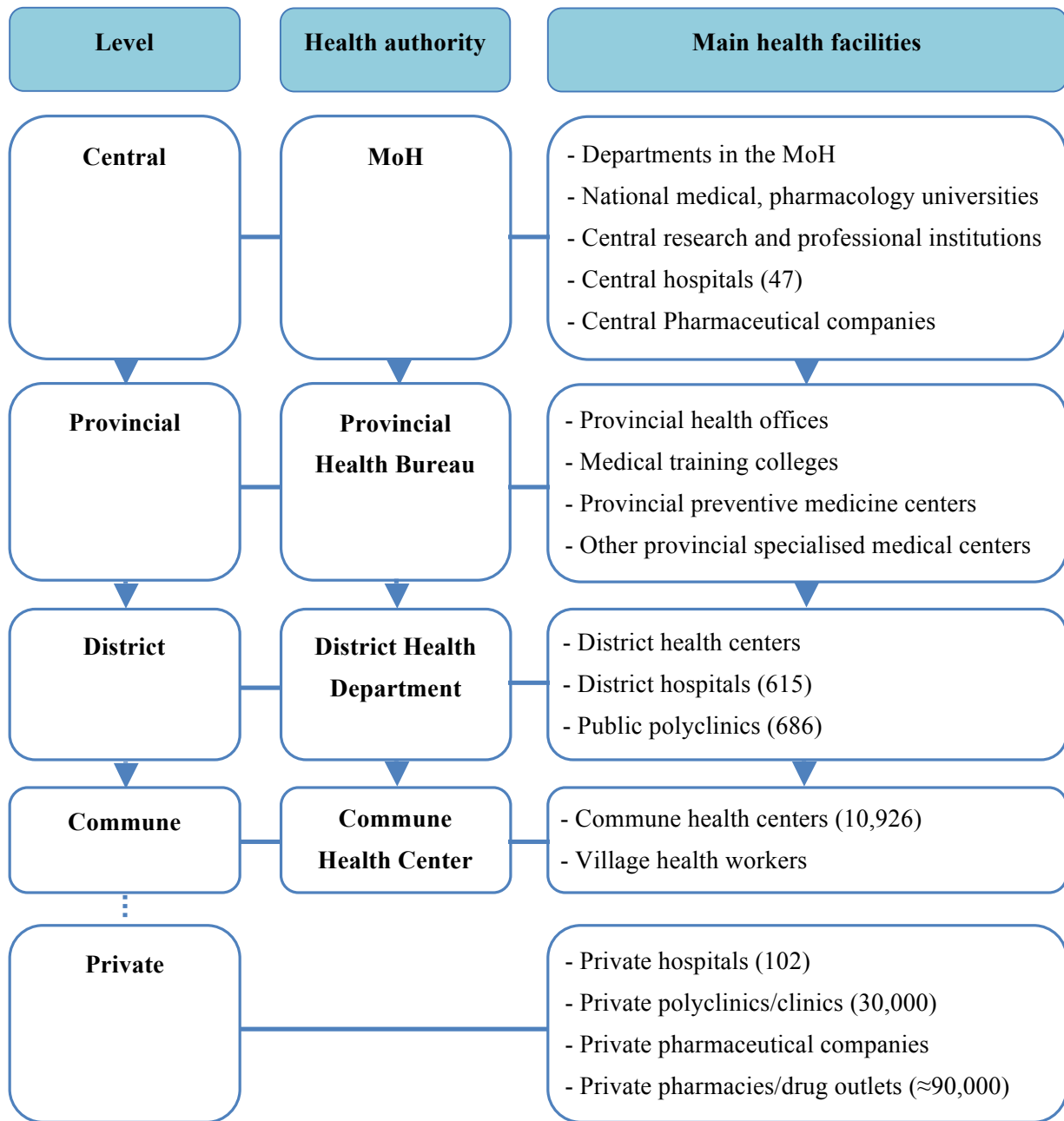
Before 1986, Vietnam was a country with a centrally planned economy. The health care system was totally public and fully financed by the government. In 1986, the Vietnamese government initiated Doi Moi, a wide-ranging reform program that shifted the country from a planned economy to a market-oriented economy. Doi Moi also launched some reforms in the health sector, most importantly the introduction of user fees for health services in public health facilities and the legalization of private medical practice in 1989 [61].

Currently, Vietnam has a mixed public – private healthcare system as given in Figure 4. The public healthcare system is organised into four administrative levels (central, provincial, district and commune) based on the structure of all provinces across the country. At the central level, the Ministry of Health (MoH) comprises of 16 departments and is responsible for formulating and executing health policies and programs for the entire country. In addition, national research institutes, training institutions, pharmaceutical companies and 47 general and specialized hospitals, which are mostly located in large cities, are subordinated to the MoH.

At the provincial level the Department of Health has a similar structure as the MoH and is responsible for all provincial health institutions. There is typically one general hospital and some health centers e.g. preventive medicine centers and mother and child's health protection centers, that operate independently from the hospital for each province. There is also a secondary medical school responsible for training of nurses and midwives. Provincial health care services receive technical support from the MoH and other central institutions.

At the district level, the District Health Department is responsible for administrative direction and management the district healthcare system. Generally, there is a District Health Center, which includes a district hospital responsible for curative services and a preventive medicine center responsible for implementing national preventive programs e.g. expended immunization and maternal and child healthcare programs. Some rural areas have one or several polyclinics that operate under the direction of the district hospital, mainly providing basic curative care for people in several communes.

At the commune level, there is a commune health center (CHC) that operates under the management of the District Health Center and is responsible for primary curative and preventive care as well as implementation of national health programs, including the maternal and child healthcare programs. Under CHC, village health workers provide health information, education, and communication; first aid and care of common diseases; and implement family planning and other national health programs.



Source: Ministry of Health 2011

Figure 4. The Vietnamese health care system

The private health sector was first introduced in Vietnam in 1989 and has thereafter quickly developed in the whole country. It has contributed to relieve the overload of patients in the public health care facilities and to provide more easy access for people in need of healthcare [68]. The importance of the private sector in the Vietnamese healthcare system is increasing. In 2009, there were almost 90 private hospitals, more than 30,000 private clinics and close to 90,000 private pharmacies. The private sector is now responsible for 43% of out-patient and 9% of in-patient health care services [69]. Figure 4 summarizes the health care system.

The private health facilities are operated under the “Law on private pharmaceutical and clinical practice”, which was launched in 1993 and revised in 2003. However, despite its large contribution, private healthcare sector has been under debate regarding quality of service. Private providers are profit oriented and tend to overuse high technology and expensive medicine. Most private clinics are operated by public health workers outside working time. There are large numbers of unlicensed private providers, especially in rural areas. The quality of health care services in the private sector is normally poorer than in the public and the operation of private clinics is often out of the authority’s control [70, 71].

In average, there are 7 physicians and 12.5 midwives and nurses for every 10,000 inhabitants in 2010 in Vietnam [72]. These figures are slightly higher to those in other Southeast Asian countries (5.6 physicians, 10.9 midwives and nurses), a bit lower than those in lower middle-income countries (7.8 physicians, 15.1 midwives and nurses) and much lower compared to those in high-income countries such as Sweden (37.7 and 118.6, respectively) [7].

2.1.3. Healthcare financing

Before Doi Moi health care was subsidised from the Government and health care services were free of charge for all people. During 1980s, Vietnam suffered from a severe economic crisis and government resources were no longer sufficient to respond to the need of the population. Thus, in 1989 public hospitals were allowed to charge user fees, which patients have to pay for a part of real service cost [73]. The fiscal budget for health care is not enough [74, 75]. In 2009, user fees accounted for 15.3% of the recurrent budget of all public health facilities. User fees have also increased household financial burden for health care, limited access to health care of the poor and created disparities in health service utilization and health outcomes among different socio-economic groups and regions [76].

In order to have further financial sources for health care sector, health insurance was introduced in Vietnam in 1992. According to the Law on Health Insurance issued in 2008, there are three main schemes of health insurance: (i) compulsory schemes for public staff and workers, pensioners, formal private sector employees and students; (ii) social schemes for the poor, the children under six, ethnic minority people living in disadvantage areas and other vulnerable groups; and (iii) voluntary schemes for self employed and nonworking population and others [77]. In 2009, health insurance covered 58.2% of the Vietnamese population and contributed 35.3% of the budget of all public health facilities [41].

The health insurance package covers a wide range of diagnostic, treatment and rehabilitation costs, mostly in the public health care facilities and in a small number of

private facilities. A 20% co-payment is applied for most insured groups. Reimbursement of providers is mainly on a fee-for-service basis but capitation and case-mix options (such as diagnosis-related group, DRG) have been recently introduced. Currently, the main financial sources for health care are general taxation, social health insurance, private prepayment and out of pocket payment. In 2009 the total health expenditure was about 6.7% of GDP, of which private prepayment and out of pocket payment accounted for 62.5% [7].

2.1.4. Provision of maternal healthcare

Until 1980s, pregnant women accessed maternal healthcare mostly at CHCs or public maternity homes. At these facilities, ANC and delivery care were provided mainly by midwives, assistant physicians with a specialty in obstetrics and pediatrics, physicians or sometimes by nurses. Only women with a high-risk pregnancy were referred to district, provincial, and central hospitals, where physicians were mainly responsible for ANC and delivery care. The initiative to seek ANC had to be taken by the pregnant women herself, possibly following advice from relatives or other women. She could also decide how many visits she would like to do and at what time during the pregnancy. The initiative and choices are still with the individual woman. All maternal healthcare services were free of charge in the old system. This has changed.

With the development of private sector, women now have more alternatives for ANC and delivery care. A pregnant woman can seek her ANC in public health care facilities, CHCs or hospitals at different levels. Private health care providers can also be used. In private clinics, midwives work together with obstetricians to provide ANC. There are very few maternity clinics where midwives and nurses provide ANC independently. For the private sector, ANC is provided also in maternity clinics but delivery care is available only in hospitals.

The basic principle is that women shall pay for ANC and deliver care through user fees. In public health care facilities, ANC and delivery care cost might be covered by health insurance. Insured women then co-pays with 20% of the cost. They also have to pay by themselves for pregnancy screening tests which are not for treatment purpose and for technology assisted reproductive services e.g. in vitro fertilization and family planning services. Abortion services are not paid for unless pregnancy must be suspended due to pathological reasons in fetus or mother [77]. When women use ANC and delivery care at the private sector, they most often have to pay for the total cost.

ANC and delivery care is paid for per service in both the public and private sector. As all services are paid separately, the cost depends on the choices of number and type of services. Particularly, ultrasound examination means a separate cost for the woman.

2.1.5. Culture and the two child policy

2.1.2.1. Culture and maternal health care

Vietnamese culture is strongly influenced by Confucianism. Societal beliefs, values and preferences in the Vietnamese society highly emphasize the value of having sons [50, 78, 79]. The strong son preference in the Vietnamese population is derived from a largely patrilineal and patrilocal kinship system that places a strong normative pressure on families to have at least one son [80, 81]. Sons are responsible for carrying on family lines and names; performing ancestor worship; and taking care of parents in their old age. Having a son also improves a woman's status in the family and confirms a man's reputation in the community [80].

The typical Vietnamese family structure is both hierarchic and male dominated with several generations living together in one household. Men are normally wage earners and the decision makers in the families [82]. Women are in a vulnerable position, especially when the family resources are scarce [83]. Married couples usually reside with the husbands' family and the household income is often under the control of the parents-in-law and/or husband. The childbirth experience of mother and mother-in-law could greatly influence the maternity care of young women [83]. The strong patriarchal society and prevailing Confucian norms has limited women's autonomy and reduced their possibility to make independent decisions about their own reproductive health [84]. The responsibility of other members of the family, such as husbands or parents-in-law in decision-making can also be a barrier preventing women access to necessary care [83, 85]

2.1.2.2. The two-child policy

Different population and family planning programs have been implemented in Vietnam since the early 1960s. The two-child policy was officially stipulated in 1988 [86], further reinforced in 1993 [87] and revised in the Population Ordinance in 2003 [88]. A degree of coercion was used to enforce the two-child policy, including financial sanctions, professional and administrative punishments [89], [90]. Although many have suggested that the two-child policy has not been rigorously enforced, the policy contributed to decline the total fertility rate from 6.39 children per woman in 1960 to 3.8 in 1989, 2.3 in 1999 and 2.03 in 2009 [66, 91]. People are now likely to accept the small family size as the government's current encouragement. Having fewer children, families have more resources for maternal and child health and can better afford to raise children.

However, the policy has also contributed to a gender imbalance in Vietnam [80, 81, 92]. In the provinces where the policy is more rigorously enforced, the fertility and infant mortality is lower but sex ratio at birth is much higher [66]. The declined fertility caused a specific

effect that families have to fulfill their wish for a son in a smaller family. It is not like in the past when people just kept giving birth to the “last ovum” until they got a son. Now people apply technological measures for selective reproduction. Couples may choose abortion if an ultrasound scan shows that the pregnancy will produce a girl [92] though fetus’ sex determination and selection is legally forbidden [90].

2.2. The study settings: FilaBavi and DodaLab HDSS

The current study was conducted in two HDSSs, one rural (FilaBavi) and one urban (DodaLab) in Hanoi, Vietnam. The distance between the sites is about 60 km (Figure 5). The HDSSs aim to provide basic information for health planning and policy decisions as well as community health research and training. The FilaBavi HDSS was developed in 1999 in the rural Ba Vi district, and comprises 69 hamlets. These were selected using stratified random sampling and have together about 51,000 persons in 11,000 households (20% of the district’s population) [93]. The selected clusters in FilaBavi are seen as black spots in the map of Figure 5.

To develop an urban site, three communes (Kim Lien, Quang Trung, and Trung Phung) were selected from 21 communes of the Dong Da district as representatives of the high-, middle-and low-economic levels. The communes are seen with different colors in the map of Figure 5. The DodaLab HDSS was established in late 2007 after a baseline survey covering about 11,000 households and 38,000 inhabitants (12% of the Dong Da district population) [94]. In both sites, all inhabitants in these hamlets and communes were surveyed. Participation in the project was voluntary with verbal consent. The nonresponse rate was 2.3% in DodaLab and 0.7% in FilaBavi.

Routine data collection included quarterly follow-up surveys to collect health and demographic events and major biennial household surveys to update demographic and socioeconomic information at the individual and household level. In the two HDSS, 106 mostly female fieldworkers (46 in FilaBavi and 60 in DodaLab) were recruited and trained for data collection. They were responsible for collecting data through household interviews, using structured questionnaires. A manual was developed and used for training and during data collection.

In both sites, women can access ANC at either public or private health facilities. FilaBavi has commune health centers and one district hospital. DodaLab has many more public hospitals and private clinics within or in the nearby vicinity. According to the results from the first baseline surveys in both sites, respondents estimated the average road distances to access the nearest public hospital at 1.8 km in DodaLab and 10.2 km in FilaBavi [93, 94].

3. METHODS

3.1. Study Design

The study compares two cohorts of pregnant women one in FilaBavi and one in DodaLab HDSSs. The routine quarterly surveys in both sites, conducted between April 2008 and December 2009, identified 2,757 pregnant women (1,633 in FilaBavi and 1,124 in DodaLab). The women were then followed through quarterly household interviews using structured questionnaires until they gave birth or otherwise terminated the pregnancy. When the research project ended, 94 women had out-migrated and 148 women had terminated their pregnancy before childbirth due to miscarriage or induced abortion. Altogether, 2,515 births were recorded and analyzed for the study of delivery care (paper III). Of those, 383 women who had only one antenatal interview due to late immigration or late identification of pregnancy were excluded from the studies of ANC utilization (papers I and II) which thus generated data from 2,132 pregnant women who had at least two antenatal interviews and were followed until they gave birth (Figure 6).

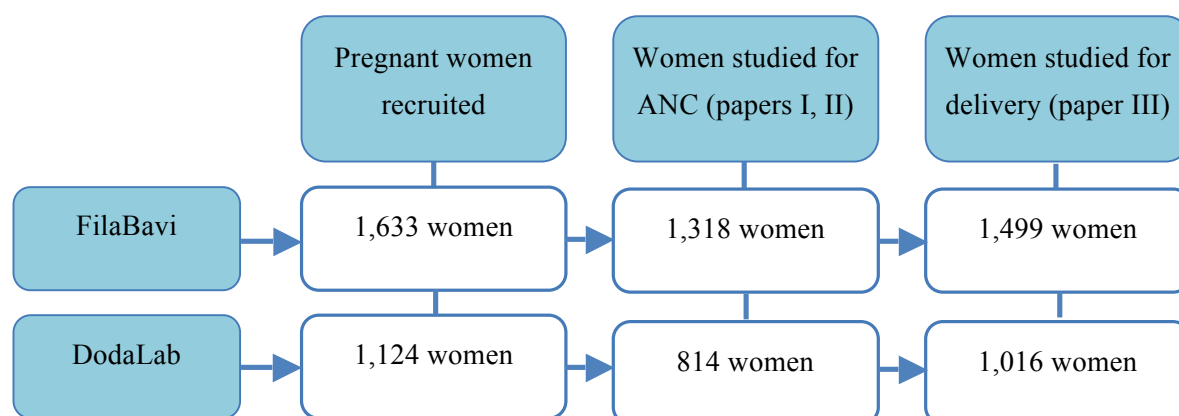


Figure 6. The recruitment and study of pregnant women

The numbers of women with only one antenatal interview were 202 in DodaLab (19.9%) and 181 in FilaBavi (12.1%). Migration is expected to occur more frequently in the urban than in the rural area. Among women who were excluded, two women in DodaLab (1%) and eight women in FilaBavi (4.3%) had no ANC. This difference is not statistically significant.

3.2. Data Collection

Data for the empirical studies were obtained through household interviews conducted by the HDSS surveyors. During the first interview, the surveyors obtained information about the women's obstetric history, i.e. information about last menstruation, pregnancies and parity,

experiences, if any of abortion, stillbirth, neonatal death, premature, previous CS, etc. and the situation of the current pregnancy. Women were also asked about the date of their first ANC visit, how many visits they used, where and by whom ANC was provided, what services were provided, and how much they had paid for ANC, before the first interview. The information about pregnancy status and ANC utilization were then updated in interviews every 3 months until the women gave birth, otherwise terminated their pregnancy or out-migrated. Each woman is supposed to have a pregnancy registration book. This is however, not always the case and the books can't be systematically used. Occasional information from the book was however obtained for control purposes.

The questionnaire used in the interviews had a list of all components in the MoH-recommended ANC package. Only information on whether blood or urine samples were at all taken was obtained. The women could not be expected to know the purpose i.e. what specific laboratory tests were performed.

Information regarding place of delivery, types of the birth attendants, modes of delivery, duration of stay at health facilities, and delivery cost were obtained from the mother within one month after delivery. Demographic and socioeconomic information about the women and their households were taken from the major household survey in the HDSSs in 2009.

A multi-stage supervision procedure was established to control the quality of the data collected within each HDSS. A field supervisor regularly observed the interviews, using a checklist and feedback was provided to the interviewer. Three percent of the women, selected randomly, were re-interviewed by field supervisors. There was a comparatively good correspondence between interview and re-interview data. The percentages of forms with some mismatch were 12% in DodaLab and 9% in FilaBavi, mostly regarding the date of last menstruation and the date of the interview. Data clerks re-checked all forms prior to data entry.

Two levels of non-response need to be considered: (i) The general non-response in the HDSS and (ii) the non-response in the specific study on pregnancy and delivery. The general non-response includes households who do not at all participate or refuse answering some questions in the questionnaires. The non-response in the specific study includes women who hide their pregnant or women who refuse to participate. Two point three percent of the households in DodaLab and 0.8% in FilaBavi declined to participate in the HDSSs. Another 0.7% households in DodaLab and 0.3% in FilaBavi refused to answer several questions in the routine questionnaires in the two sites, mostly questions on household income and expenditure. All pregnant women who were identified through the routine follow up surveys agreed to take part in the empirical studies. Six women in

DodaLab and three women in FilaBavi who wanted to hide their pregnancy participated in the project only after delivery. These women had however late identification of pregnancy and were therefore already excluded from the analysis for papers I and II.

3.3. The Andersen Health Seeking Behavior Model

Several studies of maternal health care and associated factors in high income countries [95, 96] and LMICs [36, 97, 98] have been conducted. The main focus in most studies has been the reproductive history and the socioeconomic characteristics of the mother. The personal behavior and beliefs of the mother as well as the characteristics of the health care system have received less attention.

Previous studies have found that women who belong to minority ethnic groups, who are less educated, who have lower socioeconomic status, who have more children, who have unexpected pregnancies and who were born or live in less developed regions are associated with inadequate numbers of ANC visits [32, 95, 99, 100]. There have been very few studies of associations between possibly explanatory factors and the actual content of ANC services [101-103]. The main finding from these studies is that ANC content was more strongly influenced by the characteristics of the provider than by the background of the women [103].

For some studies, the Andersen Health Seeking Behavior Model [104], a model for health care utilization behavior in general [105] has been used for the selection and analysis of variables [95, 102, 106, 107]. Table 2 shows an adapted version of the model. The Outcome component has been omitted since the present study does not involve outcomes like perceived health status, evaluated health and consumer satisfaction which were the concepts used in the original model.

The model shows the multiple influences on health services' use. The core of the model is population characteristics including predisposing factors, enabling resources and the needs for services of the woman, influenced by the external environment. The choices made by a person are predicted by the population characteristics and the external environment, directly and indirectly. This model structure was used for selection of variables and for the analysis in this thesis. Table 2 illustrates the model and the variables actually studied. Variables were selected based on literature review and discussions with colleagues. The information actually used in the present research is restricted to information available in the HDSSs as routine or ad hoc for the study.

Table 2. Conceptual Framework for Determinants of Antenatal and Delivery Care Utilization

Environment context	Population characteristics			Health behavior choices
	<i>Predisposing characteristics</i>	<i>Enabling resources</i>	<i>Woman needs</i>	
<u>External environment</u>	<u>Demographic characteristics</u>	<u>Family level</u>	<u>Obstetric history</u>	<u>ANC utilization</u>
-Urban – rural characteristics -Geographical access to health care	-Age -Marital status	-Economic status	-Experience with stillbirth, miscarriage, CS, etc.	-Number of visits -Timing of visit -Service contents -Adequate use
<u>Health care system</u>	<u>Social structure</u>	<u>Community level</u>	<u>Current pregnancy</u>	<u>Delivery care utilization</u>
-Public - private -Hospitals, CHCs, private clinics -Physicians -Midwives -Nurses	-Education -Occupation -Ethnicity -Household size -Household relatives <u>Culture and Beliefs</u> -Son preference -Technology preference	Socioeconomic condition	-Parity -High-risk pregnancy	Place of delivery Birth attendance Mode of delivery

3.4. Outcome Variables

3.4.1. Antenatal care

Almost all studies on ANC utilization in Vietnam used either a single indicator or a combination of two indicators: number of visits and timing of the first visit. Only one known study used an index that included service content to assess the quality of ANC [44]. This index put equal weights on all ANC services, although these inherently have different roles, and importance for ANC. The cut-off points for “early initiation” of ANC in previous studies were very different, like 2 months [108], 3 months [42], 4 months [44], and even 6 months [43].

In this study information regarding ANC utilization was obtained as the number of and initiation times for ANC visits as well as data on ANC service content. The present study used “first visit before three months” as the criterion for adequately early ANC as recommended by the MoH. It appears likely that all participants were aware of their pregnancy at that time. “At least three ANC visits” was used as the criterion for adequate number of ANC visits, also in accordance with national guidelines.

Questions were asked about all potential components of the recommended ANC package. To define adequate content of ANC, the services were classified into two categories: core and optional services.

Core services were defined as those services recommended for all pregnant women that were available at all primary healthcare facilities. These core services are:

- Measurement of mother weight and height
- Assessment of blood pressure
- Fetal examination, fundal height, abdominal circumference, heart rate assessment
- Urine test
- Tetanus vaccination
- Antenatal health counseling.

Other services, recommended for specific geographic areas or population groups or available only at some healthcare facilities, were classified as *optional services*. These services include:

- Vaginal examination
- Blood test
- Iron/folate supplement
- Malaria prevention
- Ultrasound scan.

In the thesis, adequate service content was defined as “all core services were provided at least once during the pregnancy”. Poor use or insufficient use means not using six core ANC services. Only these six core services are considered since they are recommended for all pregnant women and likely to be remembered by the women.

Overall adequate use of ANC was defined according to the criteria shown in Table 3: using ***enough visits*** (at least three) with ***early timing*** (first visit during first trimester) and ***sufficient services*** (at least six core services according to the national recommendations) [39]. The ANC use was considered not overall adequate if one or more of these three indicators was not satisfied.

Table 3. Definitions of Antenatal Care Adequacy

<i>Indicators</i>	<i>Inadequate use</i>	<i>Adequate use</i>
Adequate number of visits	Less than three visits	At least three visits
Early attendance by ANC	Initial visit after first trimester	Initial visit during first trimester
Sufficient use of ANC services	At least one core service never used	All core services used at least once
Overall adequate use	At least one indicator inadequate	All three indicators adequate

3.4.2. *Delivery care utilization*

The study used three indicators to describe the delivery:

- Place of delivery. Institutional delivery meaning delivery in health facilities, hospitals at different levels and CHC.
- Skilled birth attendance. *Skilled birth attendants* were defined according to WHO definition [3] and included physicians, midwives, nurses, and assistant physicians. Traditional birth attendants were not included in skilled birth attendants [85].
- Mode of delivery. Vaginal delivery using instruments or not, and CS. A CS was considered as elective if it was planned before the actual delivery started.

Some ad hoc definitions were also used in the thesis:

- *Technology preference* is taken to mean preference for birth in hospitals and delivery by CS and use of antenatal ultrasound. The available information does not allow differentiation between women and provider preference or combinations of these.
- *Expenditure* for ANC or delivery care was defined as the total cost per household for ANC or delivery care actually paid, i.e. excluding costs paid by health insurance.
- *Economic burden* was defined as the expenditure for ANC and delivery care as above expressed as a percentage of reported annual household income per capita.

3.5. Explanatory Variables and Associations

Table 2 shows the variables used to explain variation in ANC and delivery care utilization. The available demographic and socioeconomic information in both HDSSs were used as population characteristics of predisposing, enabling, and need factors. Some variables on external environment, healthcare behavior, ANC, and delivery care utilization and outcomes were also used as explanatory factors.

Demographic and socioeconomic characteristics were considered at individual, household,

and community levels. Obstetric characteristics were obtained in connection with the routine household surveys specifically for this research, including obstetric history as well as information about the current pregnancy.

High-risk pregnancy was defined as women meeting at least one of the following criteria: nulli-parous with 40 years or older; more than four previous births; any experience of previous spontaneous abortion, earlier CS delivery or earlier preterm delivery, stillbirth, or neonatal death; known high blood pressure, diabetes, epilepsy, or depression during pregnancy [109].

Household economic status was measured using a wealth index estimated by Principal Component Analysis of variables describing housing condition (type of the house, location, sanitation, and water source) and ownership of household assets. Wealth index scores were used to group households into terciles, the first called “poor”, the second called “middle” and the third called “rich”. Women were classified following the household level. In addition, *income per capita* was calculated as an average of the reported household annual income divided by the number of household members.

The community socioeconomic condition was classified differently in the two areas. In DodaLab, three communes were selected strategically with different socioeconomic levels, as determined by local authorities. In FilaBavi there are three types of geographical area: mountainous, highland, and lowland. These differ in reported income per capita and mean distances to the nearest health facility. In the economic analysis, these areas were considered as low-, middle-, and high-level, respectively.

The word *association* is frequently used in this text. In quantitative research there are associations at two “levels”, statistical association and causal association. The first means that some estimate e.g. correlation coefficient turns out to be statistically significant, the second means that the variables actually influence each other. Statistical associations might reflect causal associations but does not necessarily. To go from statistical to causal association, information and reasoning beyond the numbers are needed. Most associations presented here are statistical or to some extent taken to be causal through discussion.

3.6. Data Analysis

Data was entered into computers with the Access software application and analyzed using STATA software version 11.0. Standard statistical methods like Chi square test and t-test were used for comparisons between the two sites. Simple and multiple regression models were used to study the statistical associations between the explanatory and the outcome

variables. Bivariate analysis shows associations as they appear in the context of all other variables with their variations and co-variations. Multivariate analyses show the associations between one dependent and one independent variable when all other variables are fixed (commonly described as “adjusted”).

Some variables (e.g., age and parity, education, occupation, and economic status) might be strongly correlated and technically influence the results of regression analyzes that include all available variables. Highly correlated independent variables will cause collinearity, which can lead to spurious results. However, the results in this research project did not differ much in the models (e.g., with and without the occupation variable). There was a correlation between education and occupation, but it was not very strong. Another example is age and parity. There was as expected a correlation between age and parity, but it was not strong enough to cause problems if both variables were included.

3.7. Ethical Considerations

The establishment of the two HDSS was discussed with the local authorities and approved by the MoH. All participants were informed about the purpose of the study and their right to decline participation or to withdraw at any stage of the research project. The study was also approved by the Scientific and Ethical Committee of Hanoi Medical University. Verbal consent was obtained from all pregnant women. The pregnant women who refused participation in the project were not in any way discriminated. Personal information of the participants was encrypted and could be accessed only by researchers and data managers. All project information was used only for research purposes. Data was analyzed and presented anonymously. The women’s integrity was affected only minimally. Mothers were allowed to receive advice from obstetricians within the project for any problems they had during pregnancy or with ANC utilization. A small gift of 30,000 VND (less than two USD) was offered to each newborn baby as traditional lucky money.

4. EMPIRICAL RESULTS

4.1. Background Information

4.1.1. Information on the population (paper IV)

Within the two HDSSs, Kinh is the ethnic majority (99% in DodaLab and 95% in FilaBavi). The literacy among adults exceeds 95% in both sites, but the proportion of highly educated people is larger in DodaLab than in FilaBavi. The main occupations are office staff and business in DodaLab and farmer in FilaBavi. About three quarters of all persons in DodaLab have health insurance (this information is not available in FilaBavi). The percentage of households who own common assets in DodaLab is significantly higher than in FilaBavi. In 2009, the reported annual income per capita was about USD 1,100 in DodaLab and about one third of that amount in FilaBavi. Detailed information is given in paper IV.

4.1.2. Information on the pregnant women

Among the 2,515 deliveries, almost all women were married and half of them were pregnant with their first child. The mean age for nulliparous women was 24.0 years in the rural area and 27.0 years in the urban. Minority status was 5.5% of the rural women and 0.7% of the urban. Nearly 95% of the urban women had attained at least high school education. Most rural women had only secondary school education or less. The dominant occupations for the women were office staff in urban areas and farmer in rural areas. The percentages of women classified with high-risk pregnancy were 10.6% and 13.1%, respectively, in the urban and the rural areas. Detailed information is presented in the specific papers.

Stillbirths occurred in 0.6% of all deliveries in the urban area and 0.7% in the rural area. According to the reported date of last menstrual period, 17% of the urban women and 18% of the rural women gave birth before reaching 37 gestational weeks. SRB was 125 in the rural area and 127 in the urban area.

4.2. The Use of Antenatal and Delivery Care in Urban and Rural Areas

High proportions of women using ANC and delivery care were observed in both sites. Ninety-seven percent of the rural women and 99.8% of the urban women had at least one ANC visit. One hundred percent of the urban women and 99.7% of the rural women gave birth at health facilities and received skilled birth attendance. However, large disparities were observed between the two areas regarding the utilization of and expenditure for ANC

and delivery care.

4.2.1. Disparities in antenatal care (Paper I)

The two areas differed statistically significantly in the number of ANC visits, timing of first visit and content of ANC visits. Rural women attended ANC latter, used fewer visits and fewer services than urban women. Consequently, they had a lower level of overall adequate use of ANC than those in the urban area.

Figure 7 shows the percentages of women at different “levels” of ANC adequacy in the two sites.

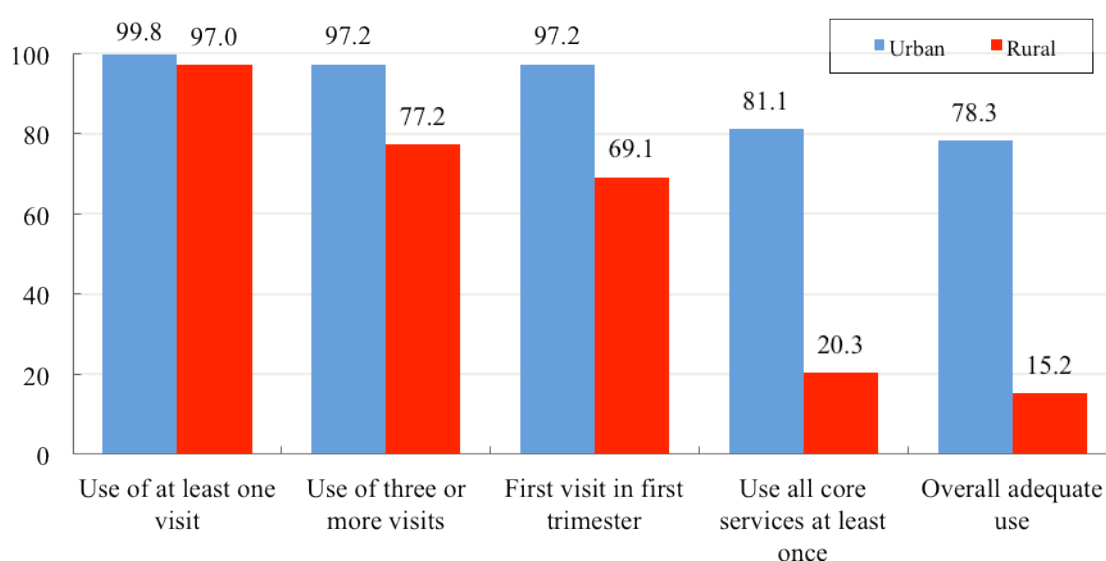


Figure 7. Percentages of ANC adequacy in the urban and the rural area

The difference between the two areas increased going from “use of at least one visit” to “overall adequate use”. The proportions of women who had at least three visits were 77.2% in the rural and 97.2% in the urban. The corresponding percentages of women who initiated ANC within the first trimester were 69.1% and 97.2%. Only 20.3% of rural women used all core services at least once, compared to 80.3% for urban women. Overall adequate use of ANC among rural women was less than one fifth of that in urban women mostly due to especially insufficient use of core services.

The mean number of ANC visits during pregnancy for rural pregnant women was 4.4 (95% CI: 4.2–4.5), compared to 7.7 (95% CI: 7.5–7.9) for urban women. Figure 8 illustrates the distribution of the number of ANC visits in the two areas.

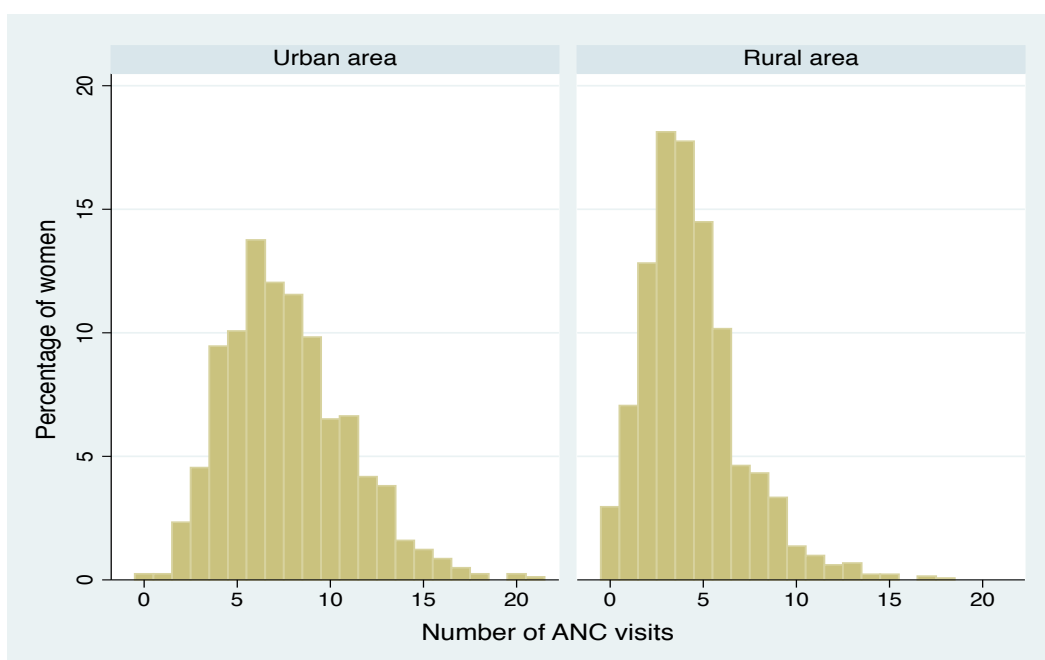


Figure 8. The distributions of number of ANC visits in the urban and rural areas

The percentages of women receiving specific services are shown in Figure 9.

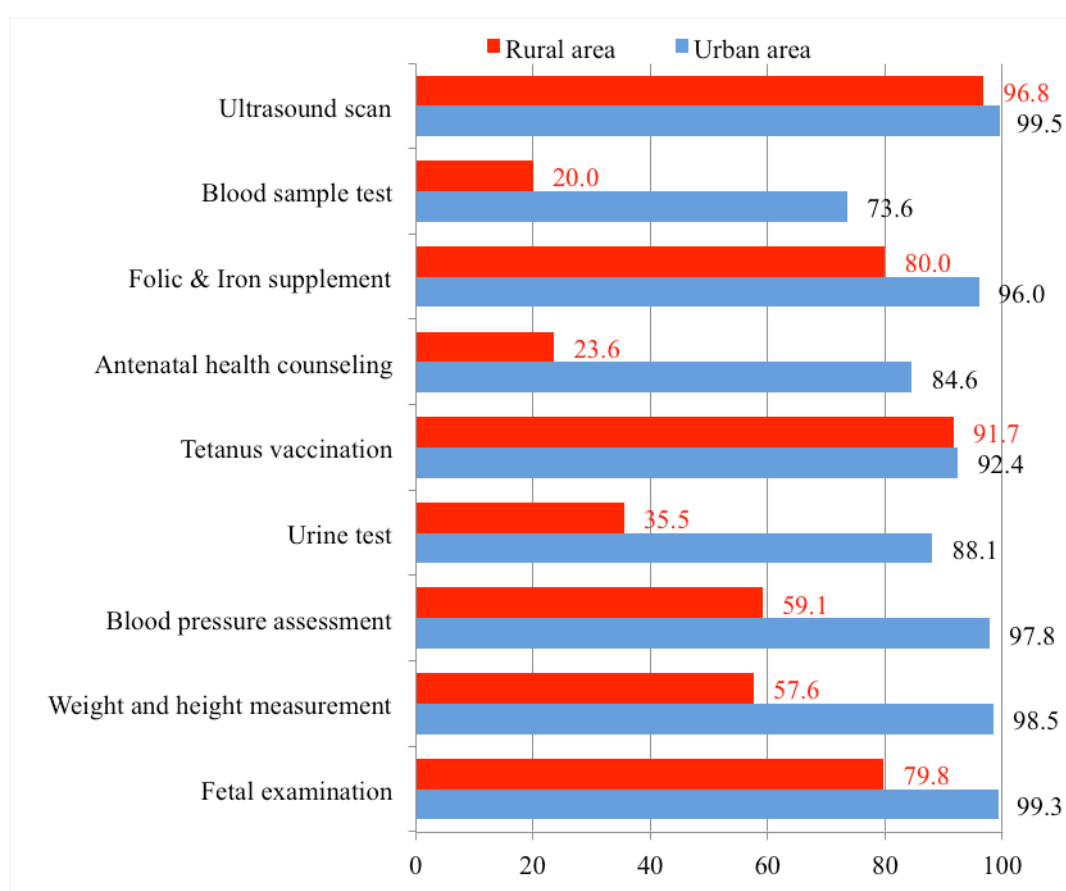


Figure 9. Percentages of women that received different ANC services at least once

The rural women had very poor services during pregnancy, often not receiving even simple and essential services like physical measurements, blood pressure assessment, and urine test. ANC counseling among rural women was only given to one fourth of that for urban women. Although many women did not receive the recommended core services, almost all women in both areas had at least one antenatal ultrasound examination. The women actually received ultrasound scans at more than 80% of all ANC visits. The average number of ultrasound scan during pregnancy was 3.5 for rural women and 6.0 urban women (Paper I).

4.2.2. Differences in providers for ANC and delivery care (Papers I and III)

Rural women accessed ANC mainly at primary health care facilities (68.3% at CHCs and 57.1% at district hospitals) and private clinics (64.0%). Most rural women gave birth at primary health facilities (54.6% at district hospitals and 33.7% at CHCs). In comparison, urban women accessed ANC at central and provincial hospitals (70.7% and 43.7%, respectively, and more than 90% gave birth in hospitals at these levels (Table 4).

Table 4. Percentages of Women Who Used Antenatal and Delivery Care at Different Facilities

<i>Health facilities</i>	<i>For ANC (*)</i>		<i>For delivery care</i>	
	<i>Rural (n=1,318)</i>	<i>Urban (n=814)</i>	<i>Rural (n=1,499)</i>	<i>Urban (n=1,016)</i>
CHC/Maternity home	68.3	8.6	34.3	2.4
District hospital	57.1	6.4	54.2	2.0
Provincial hospital	5.8	43.7	9.7	36.2
Central hospital	3.0	70.7	1.3	57.4
Private facility	18.6	58.5	0.3	2.1
Others	1.2	0.7	0.3	0
P	<0.05		<0.05	

** Note that women could use ANC at different facilities so the total percentage is over 100%.*

The urban and rural areas also differed regarding providers of ANC and delivery care. Physicians were the most common providers for ANC and delivery care in both sites, but assistant physicians, midwives, and nurses played greater roles in the rural area. Assistant physicians provided ANC for 29.9% and delivery care for 26.7% of rural women compared to 0.7% and 0.4% of urban women. Similarly, 22.0% of rural women and 4.4% of urban women received ANC from midwives and nurses; 31.4% and 7.3%, respectively, received midwife and nurse assistance during delivery.

4.2.3. Difference in mode of delivery (Paper III)

Figure 10 illustrates the difference in distribution of mode of delivery between the two areas. Vaginal delivery, not including instrumental delivery, was reported by 81.3% of the rural women and 57.0% urban women. CS was used three times as often for urban women as for rural women (38.5% versus 12.4%). About 60% of CS deliveries in the urban and 40% in the rural areas were reported as pre-planned by the mother.

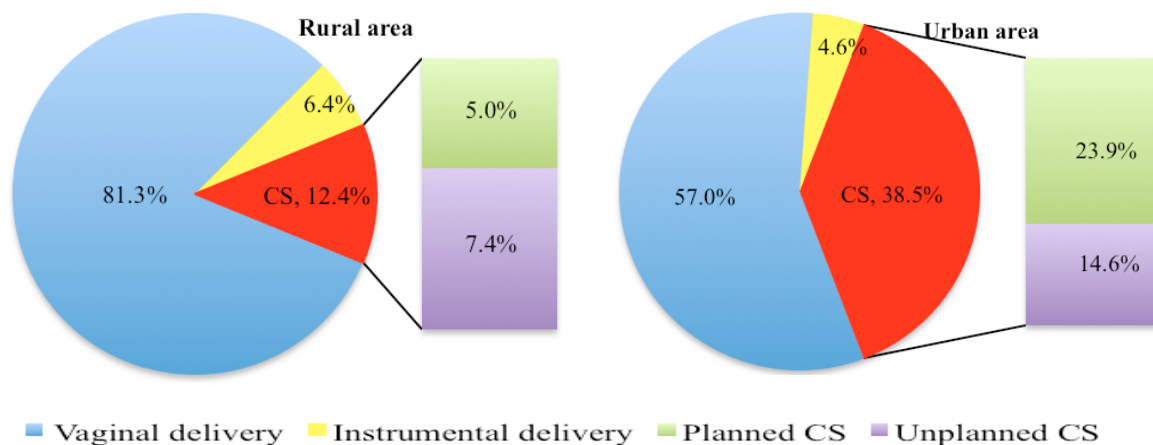


Figure 10. Types of Delivery in urban and rural areas

4.2.4. Cost difference for antenatal and delivery care (Papers I and III)

Table 5 shows that urban women spent an average USD 55 for ANC, seven times that spent by rural women. The expenditure for ANC among rural women with adequate ANC was 1.9 times that spent by women who received inadequate ANC. The corresponding ratio for urban women was 1.4.

Mean expenditure for delivery care was USD 178 in the urban area and USD 45 in the rural area. Expenditure for giving birth in hospitals was more than 4 times that for giving birth in other health facilities in the rural area and 3 times the expenditure in the urban area. The expenditure for CS compared to expenditure for vaginal delivery was about 5-fold in the rural area and 2-fold in the urban area.

Rural women spent 3.0% of the reported annual household income per capita for ANC and 19.0% for delivery care. The corresponding percentages for urban women were 6.1% and 20.6%. The economic burden was highest among rural women who gave birth in hospitals and rural and urban women who had a CS birth (Table 5).

Table 5. Expenditure and Economic Burden of Antenatal and Delivery Care

	<i>Rural</i>		<i>Urban</i>	
	<i>Expenditure, mean (USD, 95% CI)</i>	<i>Percent of income (95% CI)</i>	<i>Expenditure, mean (USD, 95% CI)</i>	<i>Percent of income (95% CI)</i>
Total ANC expenditure				
Adequate use	13.0 (11.1–14.8)	4.9 (3.9–5.8)	58.1 (54.4–61.9)	6.8 (6.2–7.4)
Inadequate use	6.7 (6.1–7.3)	2.6 (2.4–2.9)	40.5 (34.3–46.8)	4.8 (4.0–5.6)
<i>Average expenditure</i>	<i>7.7 (7.1–8.3)</i>	<i>3.0 (2.7–3.2)</i>	<i>54.5 (51.0–57.6)</i>	<i>6.1 (5.6–6.5)</i>
Delivery care expenditure by delivery place				
Hospitals	62.4 (57.1–67.8)	26.0 (21.9–30.0)	180.6 (167.6–193.7)	20.8 (18.2–22.3)
Others facilities	13.9 (13.1–14.8)	6.6 (5.9–7.3)	65.2 (45.3–85.0)	8.9 (6.0–11.8)
Delivery care expenditure by mode of delivery				
Caesarean section	150.8 (130.3–171.3)	64.7 (45.2–84.3)	259.0 (232.4–285.6)	28.1 (25.1–31.1)
Vaginal delivery	30.6 (28.6–32.6)	12.8 (11.9–14.0)	128.0 (117.2–138.8)	15.8 (12.3–19.2)
<i>Average expenditure</i>	<i>45.1 (41.4–48.7)</i>	<i>19.0 (16.4–21.7)</i>	<i>178.0 (165.2–190.8)</i>	<i>20.6 (18.0–22.9)</i>

Moreover, the economic burden of ANC and delivery care utilization was statistically significantly higher for poor women than for rich women. In the urban area, the poor women spent 7.5% of income for ANC, compared to 5.5% for the rich. The corresponding numbers in the rural area were 3.8% and 2.5%, respectively (paper II). Similarly, the poor women in the rural area spent 25.5% income for delivery compared to 16.8% among the rich women (paper III).

4.3. Factors associated with Antenatal and Delivery Care Utilization

4.3.1. Factors associated with antenatal care utilization and adequacy (paper II)

Table 6 shows that most socioeconomic variables in this study were statistically associated with at least one indicator of ANC utilization in one area. The logistic regression analyses were made separately for the two areas since the structures with respect to explanatory variable distributions can be expected to be quite different. Results are conventionally presented as crude odds ratios (OR) and adjusted, with respect to all other explanatory variables, odds ratios (OR) with 95% confidence intervals (CI). No selection of variables for the multiple regressions took place so “adjusted” means adjusted for all other explanatory variables. Each explanatory variable is represented by a set of dummy variables. The stars indicating statistical significance refer to the differences between the categories for the particular explanatory variable.

Table 6. Simple and Multiple Logistic Regression Models with Overall Adequate Use of ANC

	<i>Rural areas</i>			<i>Urban areas</i>		
	<i>Adequate use (%)</i>	<i>Crude OR (95%CI)</i>	<i>Adjusted OR (95% CI)</i>	<i>Adequate use (%)</i>	<i>Crude OR (95%CI)</i>	<i>Adjusted OR (95% CI)</i>
Education	***			*		
Secondary or less	10.7	0.25 (0.17–0.36)	0.57 (0.34–0.94)	62.5	0.42(0.23–0.78)	0.61 (0.29–1.31)
High school	14.0	0.34 (0.24–0.52)	0.70 (0.42–1.16)	77.9	0.89(0.62–1.29)	1.15 (0.73–1.82)
Post-high school	32.3	1	1	79.9	1	1
Occupation	***			*		
Employed	30.0	1	1	80.2	1	1
Self-employed	11.4	0.30 (0.22–0.42)	0.46 (0.30–0.71)	74.8	0.73(0.52–1.03)	0.89 (0.57–1.39)
Household economy	***					
Low	9.5	0.39 (0.26–0.58)	0.73 (0.46–1.16)	74.0	0.63(0.42–0.96)	0.69 (0.43–1.09)
Middle	11.4	0.63 (0.44–0.89)	0.88 (0.60–1.29)	78.1	0.79(0.52–1.19)	0.80 (0.52–1.23)
High	21.2	1	1	81.9	1	1
Community condition	***			**		
Low	10.3	0.40 (0.24–0.63)	0.54 (0.32–0.92)	73.7	0.67(0.52–1.13)	0.71 (0.47–1.07)
Middle	13.7	0.55 (0.39–0.76)	0.72 (0.50–1.04)	85.4	1.60(0.98–2.61)	1.61 (0.97–2.67)
High	22.6	1	1	78.5	1	1
ANC type						
Public only	15.8	1	1	76.5	1	1
Private only	5.2	0.29 (0.12–0.69)	0.26 (0.11–0.64)	62.5	0.51(0.26–0.99)	0.44 (0.22–0.88)
Public and private	17.4	1.12 (0.81–1.56)	0.94 (0.66–1.34)	83.7	1.57(1.09–2.28)	1.55 (1.05–2.27)

Note: *p* value for Chi square test of the null hypothesis that all true percentages are equal within a group (*: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$).

ANC = antenatal care, CI = confidence interval, OR = odds ratio.

Poorly educated, self-employed, and poor women initiated ANC later, used fewer visits, and received less adequate services compared to highly educated, employed, and wealthy women. Women who lived in poor communities were less likely to use an adequate number of ANC visits in the rural area and sufficient services in both sites. Consequently, these socioeconomic characteristics were important risk factors for not having overall adequate use of ANC, especially in the rural area.

Demographically, young rural women (less than 25 years of age) received less adequate services and less-adequate overall ANC than older women. Women in the minority ethnic group used fewer ANC visits in both areas and initiated ANC attendance later in the urban area. Less overall adequate use of ANC in minority group women has been observed in a previous study, where larger numbers of minority women were included [110]. This study does not include sufficiently many minority women for a conclusive result.

Multiparous women in the rural area initiated ANC later and had fewer ANC visits than nulliparous. Regardless of definition, the percentages of ANC adequacy among women with high-risk pregnancy did not differ significantly from the corresponding percentages for women with low risk. No associations between the studied obstetric factors and inadequate use of ANC were observed.

Exclusive use of ANC in the private sector was associated significantly with later access, insufficient use of core services, and overall inadequate access to ANC in both areas. Women who accessed ANC during the first trimester also accessed significantly more ANC visits and services.

Low-level education, self-employment, living in poor households or poor communities, and exclusive use of private sector ANC were all risk factors for inadequate ANC. Table 7 shows the numbers of women with 0 to 5 risk factors and the corresponding percentages of women with inadequate use of ANC. Women with all five risk factors were found only in the rural area. In both areas, the percentage of receiving inadequate ANC gradually increased with the number of risk factors, especially in the rural area. No women with five risk factors received adequate ANC.

Table 7. Percentages of women with inadequate ANC use by number of risk factors

<i>Risk factor</i>	<i>Rural</i>		<i>Urban</i>	
	<i>Number of women</i>	<i>Percent women with inadequate use</i>	<i>Number of women</i>	<i>Percent women with inadequate use</i>
None	152	65.8	237	15.2
1	304	81.9	312	20.8
2	432	87.0	169	26.0
3	341	89.7	78	32.1
4	85	97.7	18	38.9
5	4	100	0	-
<i>All</i>	<i>1,318</i>	<i>84.8</i>	<i>814</i>	<i>21.7</i>

4.3.2. Factors associated with hospital delivery and caesarean section (Paper III)

Table 8 shows the results of multiple logistic regressions with hospital delivery and CS as outcomes and potentially associated factors as explanatory variables. All odds ratios were adjusted for all other variables.

Table 8. Factors Associated with Hospital Delivery and Cesarean Section in the two areas (OR from the multiple regression models, 95% CI)

	<i>Rural</i>		<i>Urban</i>	
	<i>Hospital delivery</i>	<i>CS delivery</i>	<i>Hospital delivery</i>	<i>CS delivery</i>
Age group (years)				
<25	1	1	1	1
25–34	2.38 (1.80–3.14)**	2.28 (1.52–2.40)**	1.00 (0.29–3.51)	1.28 (0.82–1.98)
35+	5.72(3.27–10.00)***	5.60 (3.11–10.07)***	0.89 (0.16–4.87)	2.70 (1.49–4.91)**
Education				
Secondary or less	1	1	1	1
High school	1.47 (1.11–1.94)***	1.26 (0.84–1.88)	3.17 (1.06–9.46)*	1.62 (0.87–3.01)
Post-high school +	3.24 (1.97–5.32)***	1.38 (0.81–2.35)	4.41 (1.10–17.69)*	1.49 (0.77–2.88)
Occupation				
Employed	1.26 (0.85–1.85)	1.02 (0.64–1.63)	1.16 (0.40–3.56)	1.13 (0.80–1.61)
Self employed	1	1	1	1
Household wealth index				
Poor	1	1	1	1
Middle	0.83 (0.63–1.10)	0.77 (0.49–1.19)	1.98 (0.71–5.48)	1.42 (1.02–1.99)*
Rich	1.60 (1.16–2.21)**	1.37 (0.89–2.11)	3.71 (0.97–14.14)	1.30 (0.92–1.83)
Community condition				
Low	1	1	1	1
Middle	1.28 (0.95–1.74)	1.19 (0.74–1.90)	2.12 (0.67–6.66)	0.79 (0.57–1.10)
High	1.48 (1.01–2.18)*	1.56 (0.93–2.63)	1.51 (0.51–4.47)	0.63 (0.46–0.87)**
Parity				
Nulliparous	3.12 (2.35–4.13)***	1.40 (0.96–2.02)	1.46 (0.58–3.66)	0.95 (0.72–1.27)
Multiparous	1	1	1	1
Pregnancy risk				
High risk	1.86 (1.27–2.71)**	1.53 (1.01–2.36)*	1.54 (0.34–7.02)	1.67 (1.09–2.55)*
Low risk	1	1	1	1
ANC use				
Overall adequate	2.00 (1.37–2.90)***	1.84 (1.25–2.70)**	0.97 (0.39–2.37)	0.97 (0.72–1.31)
Inadequate	1	1	1	1
Sex of child				
Male	1.27 (1.01–1.61)*	0.97 (0.70–1.33)	1.33 (0.57–3.07)	1.65 (1.26–2.15)***
Female	1	1	1	1

Note: *p* values for logistic regression models: *: $p<0.05$; **: $p<0.01$; ***: $p<0.001$

In the rural area, comparatively older women and women who received overall adequate ANC were more likely to give birth in hospitals and to have CS. Delivery in hospitals was also more common among highly educated women, women living in wealthy households and wealthy communities, nulliparous women, women with high-risk pregnancy, and women expecting to give birth to a boy. Rural women with a high-risk pregnancy or women who used adequate ANC were more likely to give birth by CS. In the urban area, high education was associated with delivery in hospitals. CS birth was more common among women 35 years of age or older, women with high-risk pregnancy, women in wealthy households, and women who expected to give birth to a boy. Women in wealthy communes were also more likely to give birth by CS (Table 8).

5. DISCUSSION

This thesis aims primarily to describe the utilization of ANC and delivery care and to identify associated factors in a rural and an urban setting in Vietnam. The study results showed large differences in ANC and delivery care utilization between the two areas. The main features of the results were low level of overall adequate utilization of ANC in the rural area and a strong preference for technology in delivery care, particularly among urban women.

In the rural area, poor medical service content was the main reason for the low proportion of overall adequate ANC. Recommended core medical examinations were frequently not performed and prenatal ultrasound likely was overused. Low adequate utilization of ANC was statistically associated with low socioeconomic status and exclusive use of private health care.

Urban women sought ANC and delivery care at central and provincial hospitals and the frequency of birth by CS was high. These practices were more common among women with good socioeconomic condition. The likelihood for giving birth in high-level hospitals and to deliver through CS was also high among urban women who expected to deliver a boy.

The results from the two HDSSs, provides a fairly broad picture of ANC and delivery care in rural and urban settings that can be useful information for policy-making and intervention planning. However, the information is obtained only from the women. Generalization to other contexts in Vietnam can be accomplished only after appropriate judgments of similarities and dissimilarities.

5.1. Low Adequate Use of Antenatal Care in the Rural Area

This study was conducted in the Red River Delta region, which has the highest coverage of ANC and delivery care in Vietnam [102]. The estimates reported here are higher than the findings both in previous studies in Vietnam [42] and in other LMICs, such as Lao [111] and India [112].

To be effective, ANC must be adequate and in accordance with recommendations. Large differences in ANC adequacy were observed between the rural and urban areas. Living in the rural area was associated with later initiation of ANC, fewer ANC visits, and low frequency of core ANC medical services.

Timing of the first ANC visit is an important indicator of ANC adequacy.

Recommendations suggest that women initiate ANC as early as possible during pregnancy. Early ANC attendance translates into greater opportunities for an adequate number of visits and sufficient services. Delayed attendance among the rural women might result from women's lack of awareness about the importance of early ANC. Another reason might be the higher proportion of women with more than two children in the rural area than in the urban area [84]. Previous pregnancy could decrease the motivation for seeking ANC.

Besides later attendance, rural women sought ANC less often than urban women i.e. had fewer visits. This concurs with most previous studies [22, 113, 114], with the exception of one study in Guatemala in 2002 [98]. The percentage of women who used at least three antenatal visits in this thesis was higher compared to results from the national survey in 2002 (72.6% in the urban and 48.4% for the rural area) [42]. Although the average number of visits in both areas of this study exceeded the national recommendation, a substantial number of rural women still had fewer than three visits.

The main reason for low ANC adequacy among rural women was insufficient use of core ANC services. This might happen because health providers are not able to offer appropriate service or want to use some services before other. Women might not know which services they should use or they know but they don't follow recommendations or advice. The women can choose services but might be economically restricted since each service has a specific cost. The process of selecting services often means a discussion between the women and the provider.

There can be several reasons behind that a large percentage of rural women did not receive simple and cost-effective assessments such as weight, height, blood pressure measurement, and urine tests. Without these services, there is increased risk of not observing pregnancy complications (e.g., preeclampsia) [21]. Low household economic status in rural areas might be a barrier preventing women to obtain expensive services for example laboratory tests [102].

Antenatal counseling is an important component of ANC but was reported as the least frequent of core ANC services. Results from previous studies showed that ANC content emphasized biomedical assessments rather than counseling, health advice and promotion [103]. However, the use of antenatal counseling as reported by the mother can be underestimated due to recall bias or because it is not documented in the pregnancy registration book as a biomedical assessment [44].

The only ANC indicators officially reported to the MoH are "any use of ANC" and "use of at least three visits" [41]. The official annual national percentages of women using three or

more ANC visits during pregnancy have increased. It remains unknown whether ANC service content has improved accordingly. Poor content of ANC services might partly explain why infant mortality has not decreased during recent years. To improve the effect of ANC in general, and particularly in rural areas, the quality of the medical content of ANC must improve. For this it is necessary to improve women's awareness of the importance of core ANC services and to strengthen health workers' compliance to national ANC recommendations for core medical services and counseling.

5.2. Technology Preference in the Urban Area

The use of technology is a key issue in urban ANC and delivery care. Three components appear prominent: ultrasound scans during pregnancy, delivery care in high-level hospitals, and use of CS. According to Bowling [101], preference is "the expression of a value for alternative options for action after informed deliberation of risks and benefits". Decision to use a specific treatment should be made considering and understanding risks and benefits. To understand the observed frequent use of technology both patients and professional preferences need to be taken into account.

Ultrasound has been used in obstetric care since the late 1950s or early 1960s and was initiated as a pregnancy screening technique in Germany as early as the 1980s [115]. The role of ultrasound for prenatal detection of fetal malformations is uncontested [116], and it has made a dramatic impact on the practice of obstetrics [117]. Although there is no evidence for clinically significant benefits for maternal management and perinatal outcomes and poor knowledge about safety, ultrasound is used as a routine prenatal test in many countries [118, 119]. Specifically safety remains poorly understood [120, 121]. Nevertheless, the use of antenatal ultrasound has become increasingly common worldwide.

One study showed that 90% of all pregnant Swedish women viewed antenatal ultrasound scanning positively [122]. In the USA, routine antenatal ultrasound was performed in 67% of pregnancies with live births in 2002 [119], with an average of 2.7 scans during pregnancy [123]. In Canada, the average number of prenatal ultrasound scans during pregnancy has increased from 2.1 in 1996 to 3.2 in 2006 [124]. Empirical studies suggest that the majority of women welcome ultrasound, but social, economic and cultural aspects influence their attitudes and decisions [125]. Women generally view an ultrasound scan of their fetus as a positive experience that they cannot have with other medical services [117]. In a Nigerian study mothers most commonly reported that requesting prenatal ultrasound scans were for checking fetal viability (64.7%) and determining fetal gender (22.6%) [126].

In Vietnam, ultrasound examination was introduced in the 1990s and has now become a

pervasive technique in obstetrics. In the present research nearly 100% of all pregnant women used antenatal ultrasound. The averages of scans, 6.0 per urban woman and 3.5 for a rural woman suggest overuse that likely is to considerable extent explained by the general technical development and commercialization process in society. Today, ultrasound is an optionally recommended service in the current national guidelines. For this study there is no information on the reasons why ultrasound was made. Common belief is that a major interest is to know the sex of the fetus.

Ultrasound examination has high credibility among healthcare professionals and pregnant women [127], receiving more attention than core ANC services [128]. It is available in all hospitals and in most private clinics. Health workers often agree to women's requests for an ultrasound scan without any other ANC service. To achieve adequate use of ANC, both women and health workers must be informed that other recommended services are likely to be more important.

Another form of technology preference is delivery care at high-level health facilities, a preference associated with preference for delivery assistance by physicians. In this study, almost all women gave birth at health facilities and were assisted by health workers.

This concurs with the results of the National Health Survey 2002 in the Red River Delta region [42]. The national average of high-level delivery is lower [42], as is also the case and for other LMICs (e.g., Cambodia [129] and India [130]). In Vietnam, government policy says that low-risk pregnant women should give birth at the primary health care level. Basic care services for a normal delivery are available at almost all communal and district healthcare facilities [14]. However, there is no formal barrier against women giving birth at any health facility, as long as they can pay for it. In this study, most women in the urban area gave birth at secondary and tertiary hospitals and were supported by a physician. This could be viewed as an overuse of these hospital levels and physicians.

Centralization of birth to high-level hospitals has been reported from some high-income countries, even in rural areas [131, 132]. In urban Hanoi, delivery care has not been a function of CHCs for many years. Services at that level are not supposed to meet the perceived needs and preferences of the urban women. Preference for care at high-level health facilities is generally recognized as the main reason for patient overload at provincial and central hospitals in large Vietnamese cities. ANC and normal delivery contribute significantly to the overload in central obstetrics and gynecology hospitals, which now operate at more than 200% of their assumed capacity. In these hospitals, deliveries accounted for 56% of all in-patients. Two thirds of these deliveries were normal [133]. The choice to give birth in high-level hospitals can signify prestige, reflecting an ambition to

show the availability of economic resources sometimes, and is possibly often accompanied by the perception that high quality care is the same as high-level care, both institutionally and professionally.

In this study, women, who gave birth in hospitals often received more assistance from physicians than expected. This is the “high tech,” “doctor-centered” type of maternity care found in the US, Russia, Eastern Europe, and the urban areas of developing countries [134]. Notably though, physician birth attendants were also common in the rural area, where there is actually a shortage of physicians. In the Nordic countries, midwives assist most deliveries [135, 136], but increased use of SBA in LMICs is due mainly to the increased involvement of physicians [30]. Preference for physician attendance might further exacerbate the shortage of doctors at the primary health care level in Vietnam. Aside from efforts to improve the reputation of primary health care and promote delivery at this level, there is a need to strengthen the role of midwives in delivery care not least through education and information to mothers.

Giving birth more frequently in hospitals, urban women also had more CS deliveries (38.5%) than rural women. This percentage greatly exceeds the expectation for medical reasons (10%–15%) [137, 138]. Some reports indicate that CS has increased in many countries in concert with improved socioeconomic conditions and the development of medical technology [137, 139]. A large proportion of this increase is likely to result from women’s preference and to be without medical indication [137, 140]. Information on the reasons for CS in this study was reported by the women, which make it impossible to assess whether or not CS was medically indicated. Compared to vaginal delivery, medically indicated CS requires a longer hospital stay and is more expensive than CS without medical indication. However, the mean differences between cost and length of hospital stay for CS and vaginal delivery were smaller in the urban area than those in the rural area (Paper III), suggesting that a substantial fraction of CS in the urban area were performed without medical justification.

There are several possible reasons for woman’s request for CS: fear of pain, assumed benefit for the child, expected fast recovery and better sexual life after delivery [140–142]. Some women may wish to deliver the child on a “good day,” according to culture beliefs [143]. Maternal request for CS can be patient-driven [144], but physicians can influence women’s preference [145]. Physicians often describe CS to their patients as the safe mode of delivery that they prefer for themselves [146].

Physicians frequently seem prepared to agree to patient-requested CS. The percentages of obstetricians who are willing to agree to women’s CS requests ranged from 15% in Spain

and 19% in France to 75% in Germany and 79% in UK [147]. In a Nigerian study, 53.1% of obstetricians reported that they accept women's requests for CS, and 48.8% had performed at least one CS in response to maternal request [148]. Physicians may be motivated by fear of litigation [147], convenience or perceived cost-effectiveness [33, 142]. In Vietnam, CS not only saves time and reduces the pressure of obstetric patient overload, but also earns more money for the hospital [143].

CS increases some risks for maternal and neonatal illness and death [142], and increases the financial burden for households, health facilities, and society [33]. Information about risks related to CS may not be given carefully by providers through antenatal counseling [123]. Women preferring CS have been seen generally to be poorly informed and underestimating the risks of the procedure [35]. Increasing women's knowledge about the advantages and disadvantages of CS through communication during ANC should help reduce the number of CS without medical indications.

5.3. Role of Socioeconomic Condition in Antenatal and Delivery Care

5.3.1. Low socioeconomic condition in relation to low adequate use of antenatal care

Low percentage of overall adequate ANC in this research was statistically associated with low socioeconomic status. Low education, self-employment, and living in poor households were risk factors for at least one indication of inadequate ANC both in rural and urban areas.

Women with low levels of education usually have less knowledge about ANC and more difficulty accessing ANC [65, 149, 150]. Less-educated women in both settings had significantly lower overall adequate use of ANC. Low education associated significantly with inadequate utilization for all three indicators of ANC in the rural area and with two indicators in the urban area. Self-employment related significantly to low use for all three indicators of ANC and overall adequate use of ANC in the rural area but significantly only to fewer visits in the urban area. However, self-employment refers to different groups in the two areas, mostly farmers in the rural area and business and housework in the urban areas. Other occupational groups are small and have not been studied in detail.

Some studies have shown that economy may affect ANC utilization in LMICs [98, 150, 151]. One study in India, suggested that poor women had higher risk for overall inadequate ANC compared to rich women, due to fewer ANC visits and late initiation of ANC [151]. The Indian results showed higher expenditure for ANC compared to findings from a previous study in rural Vietnam, conducted in 2004 [83]. However, the economic burden for ANC was still lower in both India and Vietnam than in China [152]. As estimated in a previous study [65], financial constraints likely are important for women lacking overall

adequate ANC use with repeated visits and services. The results there suggest that cost may be a barrier against optimal use of ANC for economically disadvantaged groups.

The associations between community economic condition and utilization of ANC and delivery care in the two areas were weaker than at the household level, and community conditions showed significant relationships with some indicators of ANC adequacy only in the rural areas. Community types in the rural area differ regarding distances to the nearest healthcare facilities. This is possibly contributing to differences in the utilization of ANC and delivery care between communities.

5.3.2. Good socioeconomic conditions and technology preference

The results presented here point to associations between socioeconomic conditions and the use of technology in ANC and delivery care. Compared to poor women, wealthy women used more ANC at provincial and central hospitals and also received more ultrasound examination. Delivery in hospitals was more common among highly educated women, employed women, or women with good economic condition. Other studies in Vietnam have reported similar findings [153, 154].

Several factors may motivate the wish to give birth in secondary and tertiary hospitals in the urban area. Women often trust the professional qualifications of physicians, medical equipment, and infrastructure at such facilities more than at lower-level facilities [84, 133]. Urban high-level facilities are nearby [154], and women use them simply due to ease of access. Better socioeconomic conditions could also mean better awareness of high-level health facilities that are perceived as providing high-quality care. High-level hospitals offer more technological services. The cost for ANC and delivery care is a function of the number of visits and the services received, and therefore tends to be higher at high-level facilities. Wealthy women generally demand high quality healthcare services, and can afford care at health high-level facilities. Because government policy allows women to have only one or two children [50], they want the best possible delivery care. Many wealthy urban women are willing to pay for maternity services that are available only at central and provincial hospital.

Women with good economic conditions were more likely to deliver by CS. Associations between high education, good economy, and CS without medical indication have been reported earlier [97]. The reasons might resemble those for delivery at hospitals. CS can be perceived as better for both mother and child. CS usually costs more than vaginal delivery, and wealthier women can pay for it. The trend of increasing CS has been seen also in rural areas. The percentages of hospital delivery and CS increased in FilaBavi during 1999–2010 [153].

The present study also showed that women who lived in wealthier communities were more likely to give birth by CS. Good socioeconomic conditions at community level may increase the probability of CS due to the better availability and accessibility to health facilities [36].

5.4. Other Factors Possibly Associated with Antenatal and Delivery Care Utilization

Urban and rural areas differ in many ways, not only in individual household characteristics but also in the general contexts of the two settings. The contrast between low socioeconomic status and inadequate ANC in the rural area and good socioeconomic conditions and technology preference in the urban area is one way of illustrating those differences. However, there are also differences in ANC adequacy associated to economy within both settings. Many factors, known and unknown create or contribute to such differences in ANC.

5.4.1. Demographic characteristics

The present study observed no demographic characteristics that associated with overall adequate use of ANC. Maternal age associated only with ANC content. Young rural women (less than 25 years old) were less likely to have sufficient access to ANC core services. In the rural areas, the young group (i.e., 45.8% of all study participants) generally has less knowledge and experience with ANC than older women. Similar to findings in other studies, older rural women were more likely to give birth in hospitals [155] and to have CS [156, 157].

5.4.2. Obstetric factors

The risk for complications in a second pregnancy is usually much lower when the first pregnancy and birth were uncomplicated [109]. Earlier studies reported that multiparous women have fewer ANC visits than nulliparous women, possibly due to their previous pregnancies [84, 150]. Here, a significant association between high parity and insufficient use of core services was found. Urban women who had more than two childbirths used fewer services. No statistical evidence for later first visit attendance of ANC among multiparous women was found as has been reported from previous studies in Vietnam [65].

Normally, women with a high-risk pregnancy should use extensive ANC. They are or should be, more likely to give birth in hospital and in some cases through CS. This study could not confirm that this really happens. One reason can be that many women and ANC providers are not familiar with the concept of “high-risk pregnancy.” The low percentage of women who received antenatal counseling during ANC can imply that women at high risk

do not understand their situation and the special needs for ANC and delivery care, especially in the rural areas. The major responsibility for diagnosing high-risk must be given to the ANC provider who has the professional competence and should solicit enough information from the women to identify high-risk.

5.4.3. Healthcare system factors

After the official introduction of private healthcare services in 1989, the Vietnamese healthcare system combines public and private services. The private healthcare sector has developed rapidly during the last 20 years [71], and private providers are now an important source of health services, particularly in rural Vietnam [158]. The present study shows that the private sector is involved in ANC for more than 40% of urban women and almost 70% of rural women. However, the private sector contributions to delivery care were minimal (0.3% for the rural and 1.3% for the urban area) in contrast to findings from the national survey in 2002, which reported that 13.3% women were assisted by private birth attendants, mostly in rural areas [159]. The national survey's results are for the whole and shall be expected differ from those from Hanoi in this respect.

One study in Vietnam (2005) indicated that the availability and accessibility (but not cost or quality) of service are more important for the choice of the private sector [71]. For different reasons, pregnant women preferred to use high technology services such as ultrasound instead of ANC. The availability of this service, at reasonable cost, in both study settings might motivate pregnant women to use ANC but might also limit their use of other medical services. The availability of public sector services was strongly and negatively associated with birth attendance by private sector providers [159].

Similar to findings in a study in Brazil [160], women who used private sector ANC exclusively showed higher risk for receiving inadequate ANC in rural and urban areas. Exclusive use of private ANC did not associate significantly with late initial visit attendance or fewer visits but with insufficient use of services, suggesting poor service content and a low compliance with national guidelines, possibly due to weak regulation and control [71]. Therefore, the large percentage of private ANC among rural women might partly explain the low overall adequacy of ANC. Private ANC providers must increase their adherence to ANC guidelines, especially in rural areas.

Private providers are more available and often easier to access than public providers [71]. Pregnant women sometimes only want an ultrasound scan. Very few CHCs offer ultrasound scans, but they are easy to get at private health facilities. Women with low education most

often used public ANC and highly educated women used private ANC. Private ANC is provided at higher cost than public (Paper I) but has lower adequacy (Paper II). Our results suggest that women prefer private ANC because of the accessibility of ultrasound, but are not aware of the importance of overall adequacy and thus in a sense pay more for less.

To improve ANC adequacy in the rural areas, the quality of care, especially in the private sector, should be improved and women should be encouraged to access ANC through public primary healthcare facilities. Overall, policymaking, planning, and implementation should focus on the low adequate use of ANC by disadvantaged groups in rural areas.

To some extent, the difference in the health services environment between urban and rural areas might explain the differences in ANC and delivery care utilization. In the rural area, demographic and socioeconomic factors play a significant role whereas the health-seeking behavior might be more important for urban pregnant women. High proportions of CS birth and hospital delivery among urban women might signify prestige.

Vietnam presents almost no legal barriers for people seeking healthcare services in any institution. Practically, reimbursement of costs for people with health insurance is not strong enough and many patients cannot use high-level health facilities [161]. When necessary, people can go to any health care facilities as long as they can pay for the services. In fact, people currently pay only part of the actual cost of health care services they receive at public facilities. There is a government co-payment. As the national economy strengthens, more and more people will be able to afford high-quality healthcare services, possibly explaining why technology preference was more common among wealthier women.

The inequality in ANC and delivery care between settings does not necessarily mean inequity. Health inequality has been defined as differences in health status or in the distribution of health determinants between different population groups [162]. Inequality is considered inequitable when they are deemed unjust and unfair [163]. Urban rural differences exist everywhere and total elimination of these differences is not feasible. The goal for policy recommendations, and implications drawn from this research project, is simply to attempt narrowing the gap between the two areas. The current situation with preference for technology, CS etc. in the urban area is likely to occur in the rural area when economic conditions improve. In a context where the healthcare system fails to meet the growing needs of the people, overuse of high-level health facilities means not only waste of household and community resources but also impedes the ability of poor people to access these services when needed.

5.4.4. Cultural and traditional belief values

The use of health services in general and maternity care in particular has been shown to be influenced by cultural factors and traditional values [147, 154], especially women' autonomy [164-167]. This has also been studied in Vietnam [83, 84]. The issue of culture and tradition was not directly addressed in this research, except that sex ratio at birth was observed to be high possibly due to cultural son preference behavior.

The use of health services in general and maternity care in particular, has been shown to be influenced by cultural factors and traditional values, especially women autonomy [164-167]. Studies in rural Vietnam showed that maternal health care utilization was influenced also by cultural norms that impeded their autonomy in relation to childbearing. The low use of delivery care was associated with disadvantaged position of women in family where she had to comply with the decision of her husband and parents-in-law [83]. Cultural barriers, such as the importance of maintaining self-control until having gained trust in health care providers was another reported barrier preventing female migrants from accessing reproductive health care services [168].

The importance of having a son might be reflected in delivery practice and the more frequent use of CS for boys. The increased frequency of hospital delivery and CS birth in FilaBavi during 1999–2010 was mainly seen for male babies [153]. Together with the development of technology, the phenomenon of sex selection has been reported [169]. Son preference and sex selection were more common among wealthier families in the Red River region, where the present study was conducted [78].

In Vietnam, spiritual thinking suggests that children born at a good time will have a brighter and luckier future. This belief is likely to have influenced the choice of form and time of birth. A community study in Hanoi (2008) showed that 30.3% of pregnant women gave birth by CS. Of those, 14% chose CS birth because they could select the date and time for childbirth [170].

In this research project, hospital delivery and CS were more common among women who delivered a boy. More than 80% of the pregnant women in the present study reported that they knew the sex of the fetus before delivery. The percentage is likely to be even higher in reality, even though doctors are not allowed to inform pregnant women about the sex of the fetus. The preferences of hospital delivery and CS for boys can be expressions of the son preference behaviour in Vietnam. Women might believe that hospital delivery and CS are good for the child and, therefore, should be preferred selectively for boys.

5.5. Methods and Methodology

5.5.1. Using a combined indicator of antenatal adequacy

Many studies have investigated ANC in both high-income countries and LMICs using single indicators to measure the number of antenatal visits and the timing of a woman's initial visit. No standard method to assess ANC content has been defined. Very few studies have examined ANC content, even in high-income countries. Studies on ANC adequacy using all three indicators are rare. Only one such study has been identified in Vietnam [102].

Simple indicators of any use or initiation of ANC, total number of visits, and ANC content, are essential. Combined indicators are needed since several dimensions might be difficult to communicate. Combining the simple indicators strictly seen means loss of information but might be necessary. Although many combined indicators have been developed, they are either too complicated or can be applied only to developed countries.

The only previous study of ANC in Vietnam used the criteria of first visit within the first four months, at least 3 visits and 10–13 recommended services for adequate use [102]. Strictly ANC content cannot be judged adequate unless women receive all available services. Using information from mothers, the number of services will often be underestimated due to recall bias. Also, assuming the same importance for all services, as in the previous study, was not reasonable because some services are not recommended for all pregnant women [39].

The present study used an indicator that combined three single indicators defined in accordance with national ANC recommendations. To reduce recall bias, we used only six core medical services. Study participants may not know and remember if they receive a long list of services during ANC [102]. It should therefore be noted that the term “using all core services at least once” as applied in the thesis does not reflect fully what happened during each ANC visit. In addition, as in most studies of ANC utilization in community, women don't really know what kind of laboratory examination was done during ANC visits.

5.5.2. Conducting the study in health and demographic surveillance sites

Many LMICs lack functioning health information systems. Therefore, HDSS can offer a solution to obtaining good information for planning health policy and action. Systems of strategically located HDSSs within a target area, e.g. country or province, can be useful in low and middle but likely also in high-income countries [171].

HDSS provides a platform for community health research and offers several research advantages. The well-described context can provide rich contextual baseline information.

Sampling frames are available for both random and strategic samples [54, 172]. The HDSS platform facilitates triangulation from different sources: quantitative population studies, qualitative studies, information from healthcare institutions, etc. The most important advantage of a HDSS is the ability to conduct a longitudinal study to determine trends of health and healthcare systems in the dynamic context of demography, socioeconomics, and culture. The amount of information obtained is larger than e.g. in repeated cross-sectional studies. HDSS research offers a clear advantage because a well-functioning HDSS assumes good contacts with local authorities that will facilitate feedback of results to decision makers [54, 173].

DodaLab was established to fulfil the need for an urban HDSS in Hanoi. The Dong Da district was selected because it is relatively typical, both economically and socially, of urban Hanoi and because local health leaders and authorities supported the project. Starting the urban DodaLab site was comparable to the establishment of a rural HDSS in FilaBavi [93]. Some experiences from FilaBavi were used to develop DodaLab. However, in some senses the development of a new site is more complicated in an urban area where population density is higher, temporary migration is more frequent, and the people are busier and sometimes less friendly toward interviewers. It is more difficult to identify and access households and interview people. The risk of refusal to participate is higher in the urban context.

Some key issues for research can be identified in an urban HDSS, including urbanization and its effects on health and well-being. DodaLab, together with FilaBavi, provides a suitable infrastructure for health policy and systems research in general and priority health problems in particular. It is especially important for health problems that require longitudinal follow-up (e.g., chronic and non-communicable diseases as well as maternal and child health). Establishment of DodaLab allows the study of health and health care in an epidemiological transition period with rural and urban areas at different stages.

One of these opportunities has been to conduct parallel cohort studies of pregnant women and newborns in both urban and rural settings. The children born by the women in this research are currently (2012) followed for growth, illness, etc. Follow up is intended to continue until the infants reached the age of 5 years.

5.5.3. Internal and external validity

In empirical research, internal validity means that observations, measurements, and estimates correctly describe reality. To ensure internal validity of the study, procedures and tools were designed, tested, and adapted to local language and context. The fieldworkers,

familiar with the context, were trained carefully. A manual for field work was developed and used for training as well as data collection. A multistage supervision procedure was established to control the quality of collected data.

In this research, a reasonably good correspondence has been observed in this multi-check system. Minor mismatches on reported dates e.g. of last menstruation are acceptable in major community studies. The results from HDSS showed that the proportion of preterm births based on date of the last menstruation is normally higher than that based on ultrasound [174].

Almost all previous studies on ANC utilization in Vietnam were cross-sectional surveys that obtained data retrospectively at delivery (i.e., with risk for 9-month recall bias) [42-44]. The 3-month recall in these two cohorts was shorter than a 9-month pregnancy, and the sample size was large enough to establish statistically significant differences in ANC utilization and adequacy between the two study areas. However, the difference in sample size between sites means that the importance of statistical significance differs between areas and p-values cannot be used to compare the strength of associations between areas.

Statistical generalization from observations in a random sample to the entire population from which the sample was drawn is the only form of generalization that allows quantification of uncertainty in terms of probability (e.g., constructing confidence limits). In this sense, results from a HDSS cannot be generalized outside the study site.

External validity of the HDSS research results is necessary to claim that they can be useful outside the HDSS. A chain of external generalization is needed from DodaLab to the entire Dong Da district and from there to urban districts in Hanoi and possibly other cities. The problem is the same for external generalization from FilaBavi to rural districts in Hanoi and to other provinces in the country.

A conclusion made for the researched context might be generalized to another context or to a wider context than the researched based on similarity between the contexts. There is no strict (quantitative) way to measure such similarity. Any decision must be openly subjective, with well-declared assumptions, and the target context for generalization must be specified.

In addition, the need for external validity and generalization will be different in different situations. Public health is usually interested in policy formation and intervention planning. Simple estimates (e.g., IMR) are unique, and generalization to a similar district is of little interest. More complex results (e.g., conclusions about factors influencing IMR) should be more important for contexts outside the researched context.

Smaling (2004) described three approaches for generalization, inductive, communicative, and analogical generalization. In the inductive form, the researcher most often assumes that induction is possible based on theoretical propositions [175]. This is the theoretical or theory-borne generalization [176].

Communicative generalization refers to a procedure where the researcher, the users of the results, and possibly other actors communicate to obtain a shared understanding of how generalization can or cannot be formulated. As suggested by Smaling [175], the analogic form is the most formalized approach and uses specified criteria for generalization. Using any approach, generalizing from one context to another requires information about certain key characteristics in both contexts. National surveys might be used to define the rules of demographic, economic, social, and other similarities between districts. Each generalization must include a specific analysis [176].

The results from the two HDSSs, provides a fairly broad picture of ANC and delivery care in rural and urban settings that can be useful information for policy-making and intervention planning. However, the information is obtained only from the women. Generalization to other contexts in Vietnam can only be accomplished after an appropriate judgment of similarities and dissimilarities.

It is not possible to widely generalize the results of the current study to a provincial or national level. Different contexts differ in many respects. Furthermore, broad generalizations are hardly useful for local policy, strategy, and intervention. Even in its rural parts, Hanoi can be expected to have one of the best situations in Vietnam. However, the disparities between the urban and rural areas within Hanoi suggest the general existence of urban rural differences in the utilization of ANC and delivery care.

A weakness of the present study is that it is limited to the information reported by mothers. The obtained information was about services which women received during the last three months, not in each visit and they did not know the tests that were done on their blood and urine samples. Also the women's opinions and satisfaction were not explored as outcome variables for the utilization of ANC and delivery care. Although the Health Seeking Behavior Model was used to select and analyze variables, the research focused much on person, household, and population characteristics. The influence of availability and quality of health services, which obviously differ between rural and urban areas, were not studied. Also the views of health providers, public and private e.g. on technology use are still to be investigated. To obtain better understanding, future in-depth studies must involve providers and other stakeholders. The responsibility for ANC and delivery care to be rationally designed and used rests with both health care providers and pregnant women.

6. CONCLUSIONS AND IMPLICATIONS

6.1. Conclusions

The establishment of the DodaLab urban HDSS and the existing rural site, FilaBavi, offered an opportunity to study pregnant women in two areas. Considering not only the number and timing of ANC visits but also the content of ANC visits, this research project extends the knowledge about ANC adequacy in both rural and urban contexts in Vietnam.

ANC coverage is high in both areas, but we identified large disparities in content adequacy between areas and between the different socioeconomic groups within the areas. ANC was inadequate in the rural area, mainly due to poor service content (e.g., the neglect of core services such as blood pressure measurement and antenatal counseling). The main risk factors for ANC, especially in rural areas, include low-level education, self-employment, poor economic conditions, and exclusive use of private ANC. In contrast to low utilization of core services, antenatal ultrasound is likely to be overused and the average number of scans was high even in low-risk pregnancies.

This research revealed women's preference for technology during ANC and delivery care, resulting in ANC and delivery in high-level hospitals and CS without medical indication, particularly in the urban area. Technology preferences were associated with good economic condition and son preference.

Many decisions are not made only by the women. The reason for poor or insufficient use can be both that providers are not able to provide full services or that the woman does not wish some services. Providers and women alike might not be fully aware of recommendations. Both parties can have specific motives to advocate certain services. The pregnant women with relatives and friends as well as ANC providers share the responsibility for a positive development. All parties involved must be targeted to improve knowledge, attitudes and practices.

6.2. Practical Implications

Given the differences between urban and rural areas, the national maternal healthcare program should develop different strategies for rural and urban areas. In rural areas, which are characterized by inadequate provision and utilization of ANC, government should focus on improving the quality of ANC through core ANC services, especially among poor women. In urban areas, where this study observed a strong technology preference, the government program should maintain its high standards while working to reduce

unnecessary use of high level care and technology in ANC and delivery care. Generally, monitoring of ANC programs should focus on indicators of content quality and the number of antenatal visits.

Efforts must be made to improve women's and health providers' awareness about ANC and delivery care. Women need more information about the importance of core ANC services, the limited benefits of antenatal ultrasound, and the risks and benefits of CS birth. Health workers must increase adherence to the national ANC recommendations regarding ANC content for core services and ultrasound, especially in the private sector. Hospitals must improve their adherence to national guidelines for CS. In both cases, both positive and negative motivation techniques should be considered.

6.3. Future Research

In Vietnam's quickly expanding economy and urbanization, the problems observed regarding ANC and delivery care in the urban setting might spill over into rural areas unless corrective measures are taken. Effective interventions require in-depth studies to develop the current understanding about women's opinions, expectations, and experiences regarding ANC. Future studies should also examine the attitudes and influence of health providers on women's choices of technology. The possible association between CS births and son preference, related to culture, requires further exploration. Future research must extend beyond numbers and use the competencies and methods of several scientific disciplines. The present study describes the current situation and identifies some problems. To move further towards improvement there must also be a deeper insight.

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Tran

Khanh

Toan

REFERENCES

1. WHO: **Health topics: Maternal health.** Available at http://www.who.int/topics/maternal_health/en/. In.: WHO; 2011.
2. UN: **End poverty millennium development goals 2015. Make it happen: Goal 5 - Improve maternal health.** In.; 2008.
3. WHO: **Fifty-Seventh World Health Assembly. Provisional agenda item 12.10 A57/13.** In. Geneva: WHO; 2004.
4. Save the Children: **Women on the Front Lines of Health Care: State of the World's Mothers 2010** In. Connecticut, USA: Save the Children; 2010.
5. Zanconato G, Msolomba R, Guarenti L, Franchi M: **Antenatal care in developing countries: the need for a tailored model.** *Semin Fetal Neonatal Med* 2006, **11**(1):15-20.
6. WHO: **Trends in maternal mortality: 1990 to 2010. WHO, UNICEF, UNFPA and The World Bank estimates.** In. Geneva: WHO; 2012.
7. WHO: **World Health Statistics 2012.** In: *WHO Library Cataloguing-in-Publication Data.* Geneva: World Health Organisation; 2012.
8. Lawn JE, Cousens S, Zupan J: **4 million neonatal deaths: when? Where? Why?** *Lancet* 2005, **365**(9462):891-900.
9. Althabe F, Bergel E, Cafferata ML, Gibbons L, Ciapponi A, Aleman A, Colantonio L, Palacios AR: **Strategies for improving the quality of health care in maternal and child health in low- and middle-income countries: an overview of systematic reviews.** *Paediatr Perinat Epidemiol* 2008, **22** Suppl 1:42-60.
10. WHO: **The World Health Report 2005: Make every mother and child count.** In. Geneva; 2005.
11. UNICEF: **Levels and Trends in Child Mortality. Report 2010. Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation.** In., Special edition Celebrating 20 Years of the Convention on the Rights of the Child edn. New York; 2010.
12. WHO: **Trends in maternal mortality: 1990 to 2008. Estimates developed by WHO, UNICEF, UNFPA and The World Bank.** In. Geneva: WHO; 2010.
13. Vietnam Ministry of Health: **Joint Annual Health Review 2010.** In. Hanoi: Ministry of Health (MoH); 2011.
14. Vietnam Ministry of Health: **National plan on safe motherhood in Vietnam 2003-2010.** In. Edited by (MoH) MoH, vol. 5792/2003/QD-BYT: Medical Publishing House, Hanoi; 2003: 45-56.
15. Bullough C, Meda N, Makowiecka K, Ronsmans C, Achadi EL, Hussein J: **Current strategies for the reduction of maternal mortality.** *Bjog* 2005, **112**(9):1180-1188.

16. Mehta S, Zupan J: **The Mother-Baby Package - an Approach to Implementing Safe Motherhood.** *Int J Gynecol Obstet* 1995, **50**:S113-S120.
17. Bergsjø P: **What Is the Evidence for the Role of Antenatal Care Strategies in the Reduction of Maternal Mortality and Morbidity?** *Studies in Health Services Organisation and Policy* 2001, **17**:35-54.
18. WHO: **Beyond the Numbers: Reviewing maternal deaths and complications to make pregnancy safer.** In. Geneva: WHO; 2004.
19. Adegoke AA, van den Broek N: **Skilled birth attendance-lessons learnt.** *Bjog* 2009, **116 Suppl 1**:33-40.
20. Darmstadt GL, Bhutta ZA, Cousens S, Adam T, Walker N, de Bernis L: **Evidence-based, cost-effective interventions: how many newborn babies can we save?** *Lancet* 2005, **365**(9463):977-988.
21. Health Evidence Network: **What is the effectiveness of antenatal care?** In. Copenhagen: WHO Regional Office for Europe; 2005.
22. WHO, UNICEF: **Antenatal Care in developing Countries: Promises, Achievements and Missed Opportunities: An Analysis of Trends, Levels, and Differentials: 1990-2001.** In. Geneva, New York: WHO & UNICEF; 2003.
23. Backe B: **Overutilization of antenatal care in Norway.** *Scand J Public Health* 2001, **29**(2):129-132.
24. Hildingsson I, Waldenstrom U, Radestad I: **Women's expectations on antenatal care as assessed in early pregnancy: number of visits, continuity of caregiver and general content.** *Acta Obstet Gynecol Scand* 2002, **81**(2):118-125.
25. Raatikainen K, Heiskanen N, Heinonen S: **Under-attending free antenatal care is associated with adverse pregnancy outcomes.** *BMC Public Health* 2007, **7**:268.
26. WHO: **The WHO Antenatal Care Randomised Controlled Trial- Manual for implementation of the new model.** In: *WHO programme to map best reproductive health practices.* Geneva; 2002.
27. Houweling TA, Ronsmans C, Campbell OM, Kunst AE: **Huge poor-rich inequalities in maternity care: an international comparative study of maternity and child care in developing countries.** *Bull World Health Organ* 2007, **85**(10):745-754.
28. Sarker M, Schmid G, Larsson E, Kirenga S, De Allegri M, Neuhaan F, Mbunda T, Lekule I, Muller O: **Quality of antenatal care in rural southern Tanzania: a reality check.** *BMC Res Notes* 2010, **3**:209.
29. Naariyong S, Poudel KC, Rahman M, Yasuoka J, Otsuka K, Jimba M: **Quality of Antenatal Care Services in the Birim North District of Ghana: Contribution of the Community-Based Health Planning and Services Program.** *Matern Child Health J* 2011.

30. Stanton C, Blanc AK, Croft T, Choi Y: **Skilled care at birth in the developing world: progress to date and strategies for expanding coverage.** *J Biosoc Sci* 2007, **39**(1):109-120.
31. WHO: **Skilled Care at Every Birth.** In: *Report and Documentation of the Technical Discussions held in conjunction with 42nd Meeting of Consultative Committee for Programme Development and Management (CCPDM).* Dhaka, Bangladesh, 5-7 July 2005: World Health Organisation, Regional Office for South-East Asia, New Delhi; 2005.
32. Ny P, Dykes AK, Molin J, Dejin-Karlsson E: **Utilisation of antenatal care by country of birth in a multi-ethnic population: a four-year community-based study in Malmo, Sweden.** *Acta Obstet Gynecol Scand* 2007, **86**(7):805-813.
33. Souza JP, Gulmezoglu A, Lumbiganon P, Laopaiboon M, Carroli G, Fawole B, Ruyan P: **Caesarean section without medical indications is associated with an increased risk of adverse short-term maternal outcomes: the 2004-2008 WHO Global Survey on Maternal and Perinatal Health.** *BMC Med* 2010, **8**:71.
34. WHO: **Caesarean section without medical indication increases risk of short-term adverse outcomes for mothers.** In. Edited by WHO/RHR/HRP/10.20. Geneva: WHO; 2010.
35. Gamble J, Creedy DK, McCourt C, Weaver J, Beake S: **A critique of the literature on women's request for cesarean section.** *Birth* 2007, **34**(4):331-340.
36. Leone T, Padmadas SS, Matthews Z: **Community factors affecting rising caesarean section rates in developing countries: an analysis of six countries.** *Soc Sci Med* 2008, **67**(8):1236-1246.
37. Carroli G, Villar J, Piaggio G, Khan-Neelofur D, Gulmezoglu M, Mugford M, Lumbiganon P, Farnot U, Bersgjo P: **WHO systematic review of randomised controlled trials of routine antenatal care.** *Lancet* 2001, **357**(9268):1565-1570.
38. Villar J, Ba'aqueel H, Piaggio G, Lumbiganon P, Miguel Belizan J, Farnot U, Al-Mazrou Y, Carroli G, Pinol A, Donner A *et al*: **WHO antenatal care randomised trial for the evaluation of a new model of routine antenatal care.** *Lancet* 2001, **357**(9268):1551-1564.
39. Vietnam Ministry of Health: **National Guideline on reproductive health services. Issued together with Decision No 3367/QD-BYT of Minister of Health on 12/09/2002.** In., vol. 3367/QD-BYT: Medical Publishing House, Hanoi; 2003: 45-56.
40. Vietnam Ministry of Health: **National Guideline on reproductive health services. Issued together with Decision No. 4620/QD-BYT of Minister of Health on 25/11/2009.** In., vol. 4620/QD-BYT: Medical Publishing House, Hanoi; 2009: 45-56.
41. Vietnam Ministry of Health: **The Heath Statistical Year Book 2009.** Hanoi: Medical Publishing House; 2011.

42. Vietnam Ministry of Health, Vietnam General Statistics Office: **Results of the National Health Survey 2001-2002**. Hanoi: Medical Publishing House; 2003.
43. National Committee for Population and Family Planning: **Demographic and Health Survey 2002**. In. Hanoi; 2002.
44. Trinh LT, Michael John D, Byles J: **Antenatal care adequacy in three provinces of Vietnam: Long An, Ben Tre, and Quang Ngai**. *Public Health Rep* 2006, **121**(4):468-475.
45. Toan NV, Hoa HT, Thach NT, Hojer B, Persson LA: **Utilization of reproductive health services in a mountainous area in Vietnam**. *Southeast Asian J Trop Med Public Health* 1996, **27**(2):325-332.
46. UN Vietnam: **Achieving the MDGs with Equity**. Available at http://www.un.org.vn/en/publications/un-wide-publications/cat_view/130-un-viet-nam-joint-publications/210-mdgs-joint-un-publications.html. In.; 2010.
47. Vietnam Prime Minister: **Decision No. 2013/QĐ-TTg of November 14, 2011, approving Vietnam's strategy for population and reproductive health during 2011-2020**. In. Hanoi: Prime Ministry Office; 2011.
48. Gammeltoft T, Nguyen HT: **The commodification of obstetric ultrasound scanning in Hanoi, Viet Nam**. *Reprod Health Matters* 2007, **15**(29):163-171.
49. Lumbiganon P, Laopaiboon M, Gulmezoglu AM, Souza JP, Taneepanichskul S, Ruyan P, Attygalle DE, Shrestha N, Mori R, Nguyen DH *et al*: **Method of delivery and pregnancy outcomes in Asia: the WHO global survey on maternal and perinatal health 2007-08**. *Lancet* 2010, **375**(9713):490-499.
50. Guilmoto CZ, Hoang X, Van TN: **Recent increase in sex ratio at birth in Viet Nam**. *PLoS One* 2009, **4**(2):e4624.
51. Pham BN, Adair T, Hill PS: **Maternal socioeconomic and demographic factors associated with the sex ratio at birth in Vietnam**. *J Biosoc Sci* 2010, **42**(6):757-772.
52. UNFPA: **Sex ratio at birth imbalances in Vietnam: Evidence from the 2009 Census**. In. Hanoi: UNFPA Vietnam Country Office; 2010.
53. Carrel M, Rennie S: **Demographic and health surveillance: longitudinal ethical considerations**. *Bull World Health Organ* 2008, **86**(8):612-616.
54. Baiden F, Hodgson A, Binka FN: **Demographic surveillance sites and emerging challenges in international health**. *Bull World Health Organ* 2006, **84**(3):163-164.
55. Pena R, Perez W, Melendez M, Kallestall C, Persson LA: **The Nicaraguan Health and Demographic Surveillance Site, HDSS-Leon: a platform for public health research**. *Scand J Public Health* 2008, **36**(3):318-325.
56. D'Souza S: **A population laboratory for studying disease processes and mortality-the Demographic Surveillance System, Matlab Comilla, Bangladesh**. *Rural Demogr* 1981, **8**(1):29-51.

57. INDEPTH Network: **INDEPTH Sites**. In.: Available at http://www.indepth-network.org/index.php?option=com_content&task=view&id=50&Itemid=136; Accessed on 16th June 2011.
58. APHRC: **The Nairobi Urban Health and Demographic Surveillance System**. In: <http://wwwaphrcorg/insidepage/?articleid=470>. African Population and Health Research Center, Nairobi; Accessed on 16th June 2011.
59. Huong DL, Minh HV, Vos T, Janlert U, Van do D, Byass P: **Burden of premature mortality in rural Vietnam from 1999-2003: analyses from a Demographic Surveillance Site**. *Popul Health Metr* 2006, **4**:9.
60. Fantahun M, Berhane Y, Hogberg U, Wall S, Byass P: **Young adult and middle age mortality in Butajira demographic surveillance site, Ethiopia: lifestyle, gender and household economy**. *BMC Public Health* 2008, **8**:268.
61. World Bank: **Vietnam growing healthy: A review of Vietnam's health sector**. In: *Government Fiscal Year*. Hanoi, Vietnam: Worl Bank; 2001: 217.
62. Sepehri A, Sarma S, Simpson W, Moshiri S: **How important are individual, household and commune characteristics in explaining utilization of maternal health services in Vietnam?** *Soc Sci Med* 2008, **67**(6):1009-1017.
63. Swenson IE, Thang NM, Nhan VQ, Tieu PX: **Factors related to the utilization of prenatal care in Vietnam**. *J Trop Med Hyg* 1993, **96**(2):76-85.
64. Trinh LT, Dibley MJ, Byles J: **Antenatal care procedures and information reported by women in three rural areas of Vietnam**. *Southeast Asian J Trop Med Public Health* 2007, **38**(5):927-935.
65. Trinh LT, Dibley MJ, Byles J: **Determinants of antenatal care utilization in three rural areas of Vietnam**. *Public Health Nurs* 2007, **24**(4):300-310.
66. Vietnam General Statistics Office: **Vietnam national census of population and housing in 2009: main results**. In. Hanoi: Statistical Publishing House; 2010.
67. UNDP: **Vietnam at a glance**. In: *Country profile*. Hanoi: <http://www.undp.org.vn/undp/about-viet-nam/viet-nam-at-a-glance/?&languageId=1>; Accessed on 20 September, 2010.
68. Ha NT, Berman P, Larsen U: **Household utilization and expenditure on private and public health services in Vietnam**. *Health Policy Plan* 2002, **17**(1):61-70.
69. Vietnam Ministry of Health: **Summary of the basic information of the health sector in Vietnam (in Vietnamese)**. Available at <http://203.162.20.210/homebyt/vn/tkth/upload/shared/files/VietnamcountryprofileVN2.pdf>
70. Lonnroth K, Uplekar M: **Invest in breaking the barriers of public-private collaboration for improved tuberculosis care**. *Bull World Health Organ* 2005, **83**(7):558-559.

71. Tuan T, Dung VT, Neu I, Dibley MJ: **Comparative quality of private and public health services in rural Vietnam.** *Health Policy Plan* 2005, **20**(5):319-327.
72. Vietnam General Statistics Office: **Statistical Yearbook of Vietnam 2010.** Hanoi: Statistical Publishing House; 2011.
73. Tat S, Barr D: **Healthcare in the New Vietnam: comparing patients' satisfaction with outpatient care in a traditional neighborhood clinic and a new, western-style clinic in Ho Chi Minh City.** *Soc Sci Med* 2006, **62**(5):1229-1236.
74. Sepehri A, Chernomas R, Akram-Lodhi H: **Penalizing patients and rewarding providers: user charges and health care utilization in Vietnam.** *Health Policy Plan* 2005, **20**(2):90-99.
75. Xu K, Carrin G, Rivera AMA, Phuong NTK, Long NH, Bayarsaikhan D: **Health service utilization and the financial burden on households in Vietnam: the impact of social health insurance. Discussion paper number 6.** In. Edited by Policy EaIf: WHO; 2006.
76. Dung P, Cuong D: **Impact of user fees and health insurance on equity in financing, access to, and utilization of health service.** In. Hanoi, Vietnam: Ministry of Health, Central Commission for Science and Education, Viet Name Sweden Health Cooperation Program; 2002.
77. The Vietnamese National Assembly: **Law on Health Insurance.** In: 25/2008/QH12. Edited by The National Assembly. Hanoi: The National Political Publishing House; 2008.
78. Belanger D: **Son preference in a rural village in North Vietnam.** *Stud Fam Plann* 2002, **33**(4):321-334.
79. Croll EJ: **Amartya Sen's 100 Million Missing Women.** *Oxford Development Studies* 2001, **29**(3):225-244.
80. UNFPA: **Son preference in Vietnam: Ancient desires, advancing technologies.** In: *Qualitative research report to better understand the rapidly rising sex ratio at birth in Viet Nam.* Hanoi: UNFPA Vietnam Country Office; 2011.
81. The Institute for Social Development Studies: **New Common Sense': Family-Planning Policy and Sex Ratio in Vietnam.** In: *4th Asia Pacific Conference on Reproductive and Sexual Health and Rights 29-31 October 2007; Hyderabad, India.* Hanoi UNFPA Vietnam Country Office; 2007.
82. Galanti GA: **Vietnamese family relationships: a lesson in cross-cultural care.** *West J Med* 2000, **172**(6):415-416.
83. Duong DV, Binns CW, Lee AH: **Utilization of delivery services at the primary health care level in rural Vietnam.** *Soc Sci Med* 2004, **59**(12):2585-2595.

84. Graner S, Mogren I, Duong le Q, Krantz G, Klingberg-Allvin M: **Maternal health care professionals' perspectives on the provision and use of antenatal and delivery care: a qualitative descriptive study in rural Vietnam.** *BMC Public Health* 2010, **10**:608.
85. WHO: **Reduction of maternal mortality : a joint WHO/UNFPA/UNICEF/World Bank statement.** In. Geneva; 1999.
86. Vietnam Council of Ministers: **Decree on some regulations on population and family planing.** In. Hanoi: Council of Ministers Office; 1988.
87. Central Committee of Vietnam Communist Party: **Resolution 04/NQ/HNTW on population and family planning policies.** In. Hanoi: Central Committee of Vietnam Communist Party 1993.
88. Standing committee of the national assembly: **Ordinance on Population.** In: *06/2003/PL-UBTVQH11 on 9/1/2003.* Edited by National Assembly Office. Hanoi; 2003.
89. Vietnam Prime Minister: **Decree on regulations for implementing of admended article 10 of the Ordinance on Population.** In. Hanoi: Prime Ministry Office; 2010.
90. Vietnam Prime Minister: **Decree on sanctioning administrative violations in regulations on population and children.** In. Hanoi: Prime Ministry Office; 2006.
91. Tiep BTM: **Impacts of changes on age structure of population in economic development in Vietnam.** *Population and Development* 2011, **11**(128).
92. Pham BN, Hall W, Hill PS, Rao C: **Analysis of socio-political and health practices influencing sex ratio at birth in Viet Nam.** *Reprod Health Matters* 2008, **16**(32):176-184.
93. Chuc NT, Diwan V: **FilaBavi, a demographic surveillance site, an epidemiological field laboratory in Vietnam.** *Scand J Public Health Suppl* 2003, **62**:3-7.
94. Toan TK: **Preliminary Results from the baseline survey of DodaLab HDSS in 2007.** In. Hanoi: Hanoi Medical University; 2008.
95. Beeckman K, Louckx F, Putman K: **Determinants of the number of antenatal visits in a metropolitan region.** *BMC Public Health* 2010, **10**:527.
96. Hollowell J, Oakley L, Kurinczuk JJ, Brocklehurst P, Gray R: **The effectiveness of antenatal care programmes to reduce infant mortality and preterm birth in socially disadvantaged and vulnerable women in high-income countries: a systematic review.** *BMC Pregnancy Childbirth* 2011, **11**:13.
97. Ronsmans C, Holtz S, Stanton C: **Socioeconomic differentials in caesarean rates in developing countries: a retrospective analysis.** *Lancet* 2006, **368**(9546):1516-1523.
98. Simkhada B, Teijlingen ER, Porter M, Simkhada P: **Factors affecting the utilization of antenatal care in developing countries: systematic review of the literature.** *J Adv Nurs* 2008, **61**(3):244-260.

99. Ciceklioglu M, Soyer MT, Ocek ZA: **Factors associated with the utilization and content of prenatal care in a western urban district of Turkey.** *Int J Qual Health Care* 2005, **17**(6):533-539.
100. Mekonnen Y, Mekonnen A: **Factors influencing the use of maternal healthcare services in Ethiopia.** *J Health Popul Nutr* 2003, **21**(4):374-382.
101. Peoples-Sheps MD, Hogan VK, Ng'andu N: **Content of prenatal care during the initial workup.** *Am J Obstet Gynecol* 1996, **174**(1 Pt 1):220-226.
102. Trinh LT: **Antenatal care in three provinces of Vietnam: Long An, Ben Tre, and Quang Ngai.** The University of Newcastle; 2005.
103. Gifford BD: **Quality care in a medicaid managed care program: adequacy of prenatal care for teens in Chicago.** *Public Health Nurs* 2001, **18**(4):236-242.
104. Andersen RM: **Revisiting the behavioral model and access to medical care: does it matter?** *J Health Soc Behav* 1995, **36**(1):1-10.
105. Birch S, Haas M, Savage E, Van Gool K: **Targeting services to reduce social inequalities in utilisation: an analysis of breast cancer screening in New South Wales.** *Aust New Zealand Health Policy* 2007, **4**:12.
106. Glei DA, Goldman N, Rodriguez G: **Utilization of care during pregnancy in rural Guatemala: does obstetrical need matter?** *Soc Sci Med* 2003, **57**(12):2447-2463.
107. Ivanov LL: **Use of a Western theoretical model to investigate the relationships among characteristics of pregnant women, utilization, and satisfaction with prenatal care services in St. Petersburg, Russia.** *Public Health Nurs* 2000, **17**(2):111-120.
108. Rosen MG, Merkatz IR, Hill JG: **Caring for our future: a report by the expert panel on the content of prenatal care.** *Obstet Gynecol* 1991, **77**(5):782-787.
109. Dangal G: **High-Risk Pregnancy.** *The Internet Journal of Gynecology and Obstetrics* 2007, **7**:1.
110. Goland E, Hoa DT, Malqvist M: **Inequity in maternal health care utilization in Vietnam.** *Int J Equity Health* 2012, **11**(1):24.
111. Manithip C, Sihavong A, Edin K, Wahlstrom R, Wessel H: **Factors Associated with Antenatal Care Utilization Among Rural Women in Lao People's Democratic Republic.** *Matern Child Health J* 2010.
112. Chandhiok N, Dhillon BS, Kambo I, Saxena NC: **Determinants of antenatal care utilization in rural areas of India : A cross-sectional study from 28 districts (An ICMR task force study).** *J Obstet Gynecol India* 2006, **56**(1):47-52.
113. Paredes I, Hidalgo L, Chedraui P, Palma J, Eugenio J: **Factors associated with inadequate prenatal care in Ecuadorian women.** *Int J Gynaecol Obstet* 2005, **88**(2):168-172.
114. Kishk NA: **Knowledge, attitudes and practices of women towards antenatal care:**

- rural-urban comparison.** *J Egypt Public Health Assoc* 2002, **77**(5-6):479-498.
115. Berkowitz RL: **Should every pregnant woman undergo ultrasonography?** *N Engl J Med* 1993, **329**(12):874-875.
 116. Fadda GM, Capobianco G, Balata A, Litta P, Ambrosini G, D'Antona D, Cosmi E, Dessole S: **Routine second trimester ultrasound screening for prenatal detection of fetal malformations in Sassari University Hospital, Italy: 23 years of experience in 42,256 pregnancies.** *Eur J Obstet Gynecol Reprod Biol* 2009, **144**(2):110-114.
 117. Filly RA, Crane JP: **Routine obstetric sonography.** *J Ultrasound Med* 2002, **21**(7):713-718.
 118. LeFevre ML, Bain RP, Ewigman BG, Frigoletto FD, Crane JP, McNellis D: **A randomized trial of prenatal ultrasonographic screening: impact on maternal management and outcome. RADIUS (Routine Antenatal Diagnostic Imaging with Ultrasound) Study Group.** *Am J Obstet Gynecol* 1993, **169**(3):483-489.
 119. Sfakianaki K.A: **Routine prenatal ultrasonography as a screening tool.** <http://www.uptodate.com/contents/routine-prenatal-ultrasonography-as-a-screening-tool>. Accessed 12 December 2011. In., vol. 2011: Wolters Kluwer; 2011.
 120. Westin S, Bakketeig LS: **Unnecessary use of ultrasound in pregnancy should be avoided. Probably safe, but new evidence suggests caution.** *Scand J Prim Health Care* 2003, **21**(2):65-67.
 121. Sheiner E, Abramowicz JS: **Clinical end users worldwide show poor knowledge regarding safety issues of ultrasound during pregnancy.** *J Ultras Med* 2008, **27**(4):499-501.
 122. Ladfors L, Eriksson M, Mattsson LA, Kyleback K, Magnusson L, Milsom I: **A population based study of Swedish women's opinions about antenatal, delivery and postpartum care.** *Acta Obstet Gynecol Scand* 2001, **80**(2):130-136.
 123. Siddique J., Lauderdale D. S., van derWeele TJ., D. LJ: **Trend in prenatal ultrasound use in the United States: 1995 to 2006.** *Med Care* 2009, **47**(11):1129-1135.
 124. You JJ, Alter DA, Stukel TA, McDonald SD, Laupacis A, Liu Y, Ray JG: **Proliferation of prenatal ultrasonography.** *Cmaj* 2010, **182**(2):143-151.
 125. Zechmeister I: **Foetal images: the power of visual technology in antenatal care and the implications for women's reproductive freedom.** *Health Care Anal* 2001, **9**(4):387-400.
 126. Enakpene CA, Morhason-Bello IO, Marinho AO, Adedokun BO, Kalejaiye AO, Sogo K, Gbadamosi SA, Awoyinka BS, Enabor OO: **Clients' reasons for prenatal ultrasonography in Ibadan, South West of Nigeria.** *BMC Womens Health* 2009, **9**:12.

127. Graner S, Klingberg-Allvin M, Duong le Q, Krantz G, Mogren I: **‘Normal foetal movements make me happy’: a qualitative study on pregnant women’s perception on signs and symptoms during pregnancy and maternal health care in rural Vietnam.** In. Umea; 2010.
128. Akhan SE, Nadirgil G, Tecer A, Yuksel A: **The quality of antenatal care in Turkey and the role of ultrasonography in the antenatal care system.** *Arch Gynecol Obstet* 2003, **268**(1):9-14.
129. Liljestrand J, Moore J, Tholandi M: **Active management of the third stage of labor and eclampsia management as critical components of skilled care during birth in Cambodia.** *Int J Gynaecol Obstet* 2010, **111**(2):188-189.
130. Pathak PK, Singh A, Subramanian SV: **Economic inequalities in maternal health care: prenatal care and skilled birth attendance in India, 1992-2006.** *PLoS One* 2010, **5**(10):e13593.
131. Mungall I: **Trend towards centralisation hospital services and its effect on access to care for rural and remote communities in the UK.** *Rural and remote health* 2005, **5**(390 (Online)).
132. Abodunrin OL, Bamidele JO, Olugbenga-Bello AI, Parakoyi DB: **Preferred Choice of Health Facilities for Healthcare among Adult Residents in Ilorin Metropolis, Kwara State, Nigeria.** *International Journal of Health Research* 2010, **3**(2):8.
133. Le QC, Tran TMO, Khuong AT, Duong HL: **Hospital overload in Hanoi and Ho Chi Minh City – An assessment and recommendations.** In. Hanoi: Health Strategy and Policy Institute; 2007.
134. Wagner M: **Global midwifery--traditional and official--and humanization of birth.** *Midwifery Today Int Midwife* 2007(83):55-57.
135. Backe B: **[Antenatal care in Norway--many unnecessary check ups].** *Tidsskr Nor Laegeforen* 2002, **122**(20):1989-1992.
136. Hogberg U: **Midlevel providers and the Fifth Millennium Goal of reducing maternal mortality.** *Sex Reprod Healthc* 2010, **1**(1):3-5.
137. Mazzone A, Althabe F, Liu NH, Bonotti AM, Gibbons L, Sanchez AJ, Belizan JM: **Women's preference for caesarean section: a systematic review and meta-analysis of observational studies.** *Bjog* 2011, **118**(4):391-399.
138. Betran AP, Merialdi M, Lauer JA, Bing-Shun W, Thomas J, Van Look P, Wagner M: **Rates of caesarean section: analysis of global, regional and national estimates.** *Paediatr Perinat Epidemiol* 2007, **21**(2):98-113.
139. Scioscia M, Vimercati A, Cito L, Chironna E, Scattarella D, Selvaggi LE: **Social determinants of the increasing caesarean section rate in Italy.** *Minerva Ginecol* 2008, **60**(2):115-120.

140. O'Connell MP, Lindow W: **Caesarean section controversy. Further research is needed on why rates of caesarean section are increasing.** *Bmj* 2000, **320**(7241):1074.
141. Sufang G, Padmadas SS, Fengmin Z, Brown JJ, Stones RW: **Delivery settings and caesarean section rates in China.** *Bull World Health Organ* 2007, **85**(10):755-762.
142. Collard TD, Diallo H, Habinsky A, Hentschell C, Vezeau TM: **Elective cesarean section: why women choose it and what nurses need to know.** *Nurs Womens Health* 2008, **12**(6):480-488.
143. Nghi T: **Caesarean section is a threat for mothers and babies (in Vietnamese).** Available at <http://nld.com.vn/85253P0C1002/sinh-mo-de-doa-ba-me-va-thai-nhi.htm>. In.; 2011.
144. Irvine LM: **Maternal request for caesarean section: is it obstetrician driven?** *J Obstet Gynaecol* 2001, **21**(4):373-374.
145. Jacquemyn Y, Ahankour F, Martens G: **Flemish obstetricians' personal preference regarding mode of delivery and attitude towards caesarean section on demand.** *Eur J Obstet Gynecol Reprod Biol* 2003, **111**(2):164-166.
146. Hantoushzadeh S, Rajabzadeh A, Saadati A, Mahdanian A, Ashrafinia N, Khazardoost S, Borna S, Maleki M, Shariat M: **Caesarean or normal vaginal delivery: overview of physicians' self-preference and suggestion to patients.** *Arch Gynecol Obstet* 2009, **280**(1):33-37.
147. Habiba M, Kaminski M, Da Fre M, Marsal K, Bleker O, Librero J, Grandjean H, Gratia P, Guaschino S, Heyl W *et al*: **Caesarean section on request: a comparison of obstetricians' attitudes in eight European countries.** *Bjog* 2006, **113**(6):647-656.
148. Chigbu CO, Ezenyeaku CC, Ezenkwele EP: **Obstetricians' attitudes to caesarean delivery on maternal request in Nigeria.** *J Obstet Gynaecol* 2010, **30**(8):813-817.
149. Titaley CR, Dibley MJ, Roberts CL: **Factors associated with underutilization of antenatal care services in Indonesia: results of Indonesia Demographic and Health Survey 2002/2003 and 2007.** *BMC Public Health* 2010, **10**:485.
150. Shariff A, Singh G: **Determinants of Maternal Health Care Utilization in India: Evidence from a Recent Household Survey.** In. Edited by no.85 S. New Dehli: National Council of Applied Economic Research; 2002.
151. Pallikadavath S, Foss M, Stones RW: **Antenatal care: provision and inequality in rural north India.** *Soc Sci Med* 2004, **59**(6):1147-1158.
152. Qian Long, Tuohong Zhang, Elina Hemminki, Kun Huang, Sengbin Xiao, Tolhurst R: **Utilisation contents and cost of prenatal care under a rural health insurance (New Co-operative Medical System) in rural China: lessons from implementation.** *BMC Health Serv Res* 2010, **10**(310).

153. Nguyen Thu H, Eriksson B, Tran TK, Nguyen Thi Kim C, Ascher H: **Birth weight and delivery practice in a rural district in northern Viet Nam during a 12 year period of rapid economic development (Manuscript)**. In. Hanoi.; 2012.
154. Gabrysch S, Campbell OM: **Still too far to walk: literature review of the determinants of delivery service use**. *BMC Pregnancy Childbirth* 2009, **9**:34.
155. Hemminki E, Heino A, Gissler M: **Should births be centralised in higher level hospitals? Experiences from regionalised health care in Finland**. *Bjog* 2011, **118**(10):1186-1195.
156. Kringeland T, Daltveit AK, Moller A: **What characterizes women in Norway who wish to have a caesarean section?** *Scand J Public Health* 2009, **37**(4):364-371.
157. Chu KH, Tai CJ, Hsu CS, Yeh MC, Chien LY: **Women's preference for cesarean delivery and differences between Taiwanese women undergoing different modes of delivery**. *BMC Health Serv Res* 2010, **10**:138.
158. Khe ND, Toan NV, Xuan LT, Eriksson B, Hojer B, Diwan VK: **Primary health concept revisited: where do people seek health care in a rural area of Vietnam?** *Health Policy* 2002, **61**(1):95-109.
159. Do M: **Utilization of skilled birth attendants in public and private sectors in Vietnam**. *J Biosoc Sci* 2009, **41**(3):289-308.
160. Ribeiro ER, Guimaraes AM, Bettiol H, Lima DD, Almeida ML, de Souza L, Silva AA, Gurgel RQ: **Risk factors for inadequate prenatal care use in the metropolitan area of Aracaju, Northeast Brazil**. *BMC Pregnancy Childbirth* 2009, **9**:31.
161. Ekman B, Liem NT, Duc HA, Axelson H: **Health insurance reform in Vietnam: a review of recent developments and future challenges**. *Health Policy Plan* 2008, **23**(4):252-263.
162. **Health Impact Assessment (HIA)-Glossary of terms used**. Available at <http://www.who.int/hia/about/glos/en/index1.html>
163. Macinko JA, Starfield B: **Annotated Bibliography on Equity in Health, 1980-2001**. *Int J Equity Health* 2002, **1**(1):1.
164. Mistry R, Galal O, Lu M: **"Women's autonomy and pregnancy care in rural India: a contextual analysis"**. *Soc Sci Med* 2009, **69**(6):926-933.
165. Ou L, Chen J, Hillman K: **Health services utilisation disparities between English speaking and non-English speaking background Australian infants**. *BMC Public Health* 2010, **10**:182.
166. Senarath U, Gunawardena NS: **Women's autonomy in decision making for health care in South Asia**. *Asia Pac J Public Health* 2009, **21**(2):137-143.
167. Woldemicael G: **Do women with higher autonomy seek more maternal health care? Evidence from Eritrea and Ethiopia**. *Health Care Women Int* 2010, **31**(7):599-620.

168. UNFPA: **Socio-cultural influences on the reproductive health of migrant women: A review of literature in Vitenam**. In. Hanoi: UNFPA Vietnam Country Office; 2011.
169. Belanger D, Oanh KT: **Second-trimester abortions and sex-selection of children in Hanoi, Vietnam**. *Popul Stud (Camb)* 2009, **63**(2):163-171.
170. Nguyen TTT, Nguyen HD: **Caesarean section and related factors in Gia Lam and Hoan Kiem districts, Hanoi 2007**. *Medical and Pharmatical Information Journal* 2008, **2008**(11):23-25.
171. Chandramohan D, Shibuya K, Setel P, Cairncross S, Lopez AD, Murray CJ, Zaba B, Snow RW, Binka F: **Should data from demographic surveillance systems be made more widely available to researchers?** *PLoS Med* 2008, **5**(2):e57.
172. P Byass YB, A Emmelin, D Kebede, T Andersson, U Högberg, S Wall: **The role of demographic surveillance systems (DSS) in assessing the health of communities**. *Public Health* 2002, **116**(3):145-150.
173. Chuc NTK, Dung PH: **Filabavi Demographic Surveillance Site: Preliminary Data**. Hanoi: The Medical Publishing House; 2003.
174. Graner S, Klingberg-Allvin M, Phuc HD, Huong DL, Krantz G, Mogren I: **Adverse perinatal and neonatal outcomes and their determinants in rural Vietnam 1999-2005**. *Paediatr Perinat Epidemiol* 2010, **24**(6):535-545.
175. Smaling A: **Inductive, analogical and communicative generalization**. *International Journal of Qualitative Methods* 2003, **2**(1):52-67.
176. Yin RK: **Case Study Research. Applied social research methods series**. London: Sage Publications; 2008.