Perinatal Health and Maternal Care in Rural China

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ABSTRACT

Background and context
Since the economic reforms of 1978, China has been acclaimed as a remarkable economy, achieving 9% annual growth per head for more than 25 years. However, China’s health sector has not fared well. The population health gains slowed down and health disparities increased. In the field of health and health care, significant progress in maternal care has been achieved. However, there still remain important disparities between the urban and rural areas and among the rural areas in terms of economic development. The excess female infant deaths and the rapidly increasing sex ratio at birth in the last decade aroused serious concerns among policy makers and scholars. Decentralization of the government administration and health sector reform impacts maternal care. Many studies using census data have been conducted to explore the determinants of a high sex ratio at birth, but no agreement has been so far reached on the possible contributing factors. No study using family planning system data has been conducted to explore perinatal mortality and sex ratio at birth and only few studies have examined the impact of the decentralization of government and health sector reforms on the provision and organization of maternal care in rural China.

Objectives
The general objective of this study was to investigate the state of perinatal health and maternal care and their determinants in rural China under the historic context of major socioeconomic reforms and the one child family planning policy. The specific objectives of the study included: 1) to study pregnancy outcomes and perinatal health and their correlates in a rural Chinese county; 2) to examine the issue of sex ratio at birth and its determinants in a rural Chinese county; 3) to explore the patterns of provision, utilization, and content of maternal care in a rural Chinese county; 4) to investigate the changes in the use of maternal care in China from 1991 to 2003.

Materials and Methods
This study is based on a project for evaluating the prenatal care programme in Dingyuan county in 1999-2003, Anhui province, China and a nationwide household health survey to describe the changes in maternal care utilization. The approaches used included a retrospective cohort study, cross sectional interview surveys, informant interviews, observations and the use of statistical data. The data sources included the following: 1) A cohort of pregnant women followed from pregnancy up to 7 days after birth in 20 townships in the study county, collecting information on pregnancy outcomes using family planning records; 2) A questionnaire interview survey given to women who gave birth between 2001 and 2003; 3) Various statistical and informant surveys data collected from the study county; 4) Three national household health interview survey data sets (1993-2003) were utilized, and reanalyzed to described the changes in maternity care utilization. Relative risks (RR) and their confidence intervals (CI) were calculated for comparison between parity, approval status, infant sex and township groups. The chi-square test was used to analyse the disparity of use of maternal care between and within urban and rural areas and its trend across the years in China.

Results
There were 3697 pregnancies in the study cohort, resulting in 3092 live births in a total population of 299463 in the 20 study townships during 1999-2000. The average age at pregnancy in the cohort was 25.9 years. Of the women, 61% were childless, 38% already had one child and 0.3%
had two children before the current pregnancy. About 90% of approved pregnancies ended in a
live birth while 73% of the unapproved ones were aborted.

The perinatal mortality rate was 69 per thousand births. If the 30 induced abortions in which the
gestational age was more than 28 weeks had been counted as perinatal deaths, the perinatal
mortality rate would have been as high as 78 per thousand. The perinatal mortality rate was
negatively associated with the wealth of the township. Approximately two thirds of the perinatal
deaths occurred in the early neonatal period. Both the still birth rate and the early neonatal death
rate increased with parity. The risk of a stillbirth in a second pregnancy was almost four times that
for a first pregnancy, while the risk of early neonatal deaths doubled. The early neonatal mortality
rate was twice as high for female as for male infants. The sex difference in the early neonatal
mortality rate was mainly attributable to mortality in second births. The male early neonatal
mortality rate was not affected by parity, while the female early neonatal mortality rate increased
dramatically with parity: it was about six times higher for second births than for first births. About
82% early neonatal deaths happened within 24 hours after birth, and during that time, girls were
almost three times more likely to die than boys. The death rate of females on the day of birth
increased much more sharply with parity than that of males.

The total sex ratio at birth of 3697 registered pregnancies was 152 males to 100 females, with 118
and 287 in first and second pregnancies, respectively. Among unapproved pregnancies, there were
almost 5 live-born boys for each girl.

Most prenatal and delivery care was to be taken care of in township hospitals. At the village level,
there were small private clinics. There was no limitation for the provision of prenatal and postnatal
care by private practitioners. They were not permitted to provide delivery care by the county
health bureau, but as some 12% of all births occurred either at home or at private clinics; some
village health workers might have been involved. The county level hospitals served as the referral
centers for the township hospitals in the county. However, there was no formal regulation or
guideline on how the referral system should work. Whether or not a woman was referred to a
higher level hospital depended on the individual midwife's professional judgment and on the
clients' compliance. The county health bureau had little power over township hospitals, because
township hospitals had in the decentralization process become directly accountable to the
township government.

In the township and county hospitals only 10-20% of the recurrent costs were funded by local
government (the township hospital was funded by the township government and the county
hospital was funded by the county government) and the hospitals collected user fees to balance
their budgets. Also the staff salaries depended on fee incomes by the hospital. The hospitals could
define the user charges themselves. Prenatal care consultations were however free in most
township hospitals. None of the midwives made postnatal home visits, because of low profit of
these services.

The three national household health survey data showed that the proportion of women receiving
their first prenatal visit within 12 weeks increased greatly from the early to middle 1990s in all
areas except for large cities. The increase was much larger in the rural areas, reducing the urban-rural difference from more than 4 times to about 1.4 times. The proportion of women that received antenatal care visits meeting the Ministry of Health’s standard (at least 5 times) in the rural areas increased sharply from 12% in 1991-1993 to 36% in 2001-2003. In rural areas, the proportion increase was much faster in less developed areas than in developed areas. The hospital delivery rate increased slightly from 90% to 94% in urban areas while the proportion increased from 27% to 69% in rural areas. The fastest change was found to be in type 4 rural areas, where the utilization even quadrupled. The overall difference between rural and urban areas was substantially narrowed over the period. Multiple logistic regression analysis shows that time periods, residency in rural or urban areas, income levels, age group, education levels, delivery history, occupation, health insurance and distance from the nearest health care facilities were significantly associated with hospital delivery rates.

Conclusions

1. Perinatal mortality in this study was much higher than that for urban areas as well as any reported rate from specific studies in rural areas of China. Previous studies in which calculations of infant mortality were not based on epidemiological surveys have been shown to underestimate the rates by more than 50%.
2. Routine statistics collected by the Chinese family planning system proved to be a reliable data source for studying perinatal health, including still births, neonatal deaths, sex ratio at birth and among newborns. National Household Health Survey data proved to be a useful and reliable data source for studying population health and health services. Prior to this research there were few studies in these areas available to international audiences.
3. Though perinatal mortality rate was negatively associated with the level of township economic development, the excess female early neonatal mortality rate contributed much more to high perinatal mortality rate than economic factors. This was likely a result of the role of the family planning policy and the traditional preferences for sons, which leads to lethal neglect of female newborns and high perinatal mortality.
4. The selective abortions of female foetuses were likely to contribute most to the high sex ratio at birth. The underreporting of female births seemed to have played a secondary role. The higher early neonatal mortality rate in second-born as compared to first-born children, particularly in females, may indicate that neglect or poorer care of female newborn infants also contributes to the high sex ratio at birth or among newborns. Existing family planning policy proved not to effectively control the steadily increased birth sex ratio.
5. The rural-urban gap in service utilization was on average significantly narrowed in terms of maternal healthcare in China from 1991 to 2003. This demonstrates that significant achievements in reducing inequities can be made through a combination of socio-economic development and targeted investments in improving health services, including infrastructure, staff capacities, and subsidies to reduce the costs of service utilization for the poorest. However, the huge gap which persisted among cities of different size and within different types of rural areas indicated the need for further efforts to support the poorest areas.
6. Hospital delivery care in the study county was better accepted by women because most of women think delivery care was very important while prenatal and postnatal care were not.
Hospital delivery care was more systematically provided and promoted than prenatal and postnatal care by township hospital in the study area. The reliance of hospital staff income on user fees gave the hospitals an incentive to put more emphasis on revenue generating activities such as delivery care instead of prenatal and postnatal care, since delivery care generated much profits than prenatal and postnatal care.

Recommendations

1. It is essential for the central government to re-assess and modify existing family planning policies. In order to keep national sex balance, the existing practice of “one couple one child” in urban areas and “at-least-one-son” a couple in rural areas should be gradually changed to a two-children-a-couple policy throughout the country. The government should establish a favourable social security policy for couples, especially for rural couples who have only daughters, with particular emphasis on their pension and medical care insurance, combined with an educational campaign for equal rights for boys and girls in society.

2. There is currently no routine vital-statistics registration system in rural China. Using the findings of this study, the central government could set up a routine vital-statistics registration system using family planning routine work records, which could be used by policy makers and researchers.

3. It is possible for the central and provincial government to invest more in the less developed and poor rural areas to increase the access of pregnant women in these areas to maternal care services. Central government together with local government should gradually provide free maternal care including prenatal and postnatal as well as delivery care to the women in poor and less developed rural areas.

4. Future research could be done to explore if county and the township level health care sector and the family planning system could be merged to increase the effectiveness and efficiency of maternal and child care.

5. Future research could be done to explore the relative contribution of maternal care, economic development and family planning policy on perinatal and child health using prospective cohort studies and community based randomized trials.

Key words: perinatal health, perinatal mortality, stillbirth, neonatal death, sex selective abortion, sex ratio at birth, family planning, son preference, maternal care, prenatal care, postnatal care, equity, China
LIST OF ORIGINAL PUBLICATIONS

The present thesis is based on the following articles


The articles above will be referred to in the text by their Roman numbers I-IV
ABBREVIATIONS

CD = Caesarean Delivery
CI = Confidence Interval
CMS = Cooperative Medical System
ENDR = Early Neonatal Death Rate
FNI = Farmers' net annual income per capita.
GDP = Gross Domestic Product
KAP = Knowledge, Attitude and Practice
MCH = Maternal and Child Health
MOH = Ministry of Health
NHHS = National Household Health Survey
OR = Odds Ratio
RR = Relative Risk
SRB = Sex Ratio at Birth
PNMR = Perinatal Mortality Rate
VD = Vaginal Delivery
DEFINITIONS

APPROVED PREGNANCY
Approved pregnancy implies that the woman has been given permission to become pregnant/keep a pregnancy by local family planning officials. Unapproved pregnancy is just the opposite (Hemminki et al. 2005).

NEONATAL DEATH
Neonatal deaths may be subdivided into early neonatal death, occurring in the first seven days of life and late neonatal deaths, occurring after the seventh but before the 28th day of life (WHO 2006).

PERINATAL MORTALITY RATE
The sum of the number of fetal deaths of 22 or more weeks gestation plus the number of newborns dying during the first week of life divided by the sum of the number of live births plus the number of fetal deaths of 22 or more weeks gestation for the same geographic area (for a specified time period, usually a calendar year is used) and multiplied by 1000 (WHO 2006).

SEX RATIO AT BIRTH
Sex ratio at birth (SRB) is defined as the number of male live births for every 100 female live births (Tuljapurkar et al. 1995).

STILLBIRTH
Stillbirth can be sub-classified according to the gestational age, typically into early stillbirth (20-28 weeks’ gestation) and late stillbirth (after 28 weeks’ gestation) (Smith and Fretts 2007).
1. **INTRODUCTION**

Maternal and child health are of great public health importance and increasingly attracting the attention of both scholars and policy makers. Globally, approximately 600,000 women die each year from the complications of pregnancy and childbirth. One woman dies every minute from pregnancy related causes. About 90% of these deaths occur in Sub-Saharan Africa and Asia (UNFPA 2003). Of the over 130 million babies born every year, more than 10 million die before their fifth birthday, 8 million infants die before their first birthday, over 4 million in the first four weeks of life. Three million of these deaths occur in the early neonatal period. Moreover, it is estimated that more than 3.3 million babies are stillborn. Worldwide, there are over 6.3 million perinatal deaths a year, almost all of which occur in developing countries (WHO 2006; Lawn et al. 2005).

The Millennium Development Goals (MDGs) represent a commitment to address global poverty and ill health (Haines A and Cassels A 2004). The fourth goal (MDG-4) commits the international community to reducing mortality in children aged younger than 5 years by two-thirds between 1990 and 2015. A decade before the target date of 2015, many are already predicting the goal will not be met (Travis et al. 2004). One of the challenges is the slow progress in reducing global neonatal mortality. Between 1980 and 2000, child mortality after the first month of life--i.e., from month 2 to age 5 years--fell by a third, whereas the neonatal mortality rate (NMR) was reduced by only a quarter. Estimates for 2000 (Zupan and Aahman 2005) show that 38% of all deaths in children younger than age 5 years happen in the first months of life. Deaths in the first week of the life have shown the least progress. In 1980, only 23% of deaths occurred in the first week of life; by the year 2000 this figure had risen to an estimated 28% (Lawn et al. 2005). Reducing neonatal deaths is, therefore, an essential step towards reducing under-five mortality.

Neonatal deaths and stillbirths stem from poor maternal health, inadequate care during pregnancy, inappropriate management of complications during pregnancy and delivery, poor hygiene during pregnancy and the first critical hours after birth, and lack of newborn care (WHO 2006). The three-delay model---delay in recognition of illness, delay in seeking and accessing care and delay in the provision of care once at a health facility has helped in understanding maternal and infant deaths (Thaddeus and Maine 1994).

The sex ratio at birth (SRB) -- 105-106 boys to 100 girls -- is a natural phenomenon (Bromen and Jockel 1997; David and Gottlieb 1998). More boys than girls are born in the world. It is well known that mortality rates for boys in the early neonatal period are higher than those for girls. However, many societies prefer sons, and the strong preference for boys observed in some settings is also reflected in neonatal mortality: neonatal mortality among girls may be up to one third higher than that registered among boys, thus countering the biological difference observed in societies without strong gender preference (Nielse et al. 1997).

During the late 1970s, China launched social and economic reforms and the one child per family planning policy. The reforms and the one child policy brought about big changes in many aspects
of the society. After the one child family planning policy was announced in 1979, sex ratios at
birth in China rose steadily from around 107 boys for every 100 girls in early 1980s to 113 in 1990
and 117 in 2000 (Gu and Roy 1996; Plafker 2002; Hesketh and Zhu 2006). China has a major
share of the world’s “missing girls”. Many commentators predict that much more excess men than
women in the society will lead to increased levels of antisocial behaviors and violence, and will
ultimately present a threat to the stability and security of society (Coale and Banister 1994;
Banister 2004; Park and Cho 1995; Zeng et al. 1993; Tu 1993; Ma 2004; Li 1995; Tuljapurkar et
al. 1995). Three factors are assumed to be responsible for the increase in the reported sex ratio at
birth (1): underreporting of female births or adoption, (2) prenatal sex determination and
sex-selective abortion of female fetuses, (3) excessive female infant death (Hull 1990; Johansson
and Nygren 1991; Tu 1993; Zeng 1993). Although most scholars asserted that the first two factors
are the major contributors, some scholars (Aird 1990; Banister 1992) speculate that the high
reported sex ratio at birth and at very young ages in China in the 1980s was mainly the result of
excess female infanticide (Chu 2001).

There is no agreement on the relative contributions of these factors on SRB (Chu 2001; Johansson
and Nygreen 1991; Parch and Cho 1995; Zeng et al. 1993; Tu 1993; Li 1993). One reason for this
may be that almost all studies in this area utilized census data, reproductive health survey, or
fertility survey data for their analyses. In addition, the original purposes of these surveys were not
toward understanding the determinants of sex ratio at birth. There were few evidence-based
studies that have examined the determinants of SRB, and only one of these studies directly
interviewed the women and focused on the contributing factors of SRB (Chu 2001). So far, no
study has employed daily family planning records to explore the determinants of increasing SRB.

Since the economic reforms of 1978, China has been acclaimed as a remarkable economy,
achieving 9% annual growth per head for more than 25 years (National Bureau of Statistics 2007).
However, China’s health sector has not fared well. The population health gains slowed down and
health disparities increased (Sen 1989; Sen 1992). For the first 30 years after the establishment of
the People’s Republic of China there was a rapid increase in life expectancy from 40 years to 70
years. But the pace of life expectancy gains in the 1990s was slower in China than in other Asian
countries at similar levels of income and life expectancy (World Bank 2005). Disparities in
income and wealth between the urban and rural areas, between the eastern and western regions
and between households have widened substantially after the socio-economic reform launched
during the late 1970s (Dollar 2007). Significant differences in health status arose between
population groups. Among the 31 Chinese provinces ranked by gross domestic product (GDP) per
head, there is a clear gradient in life expectancy, which increases with prosperity (National Bureau
of Statistics 2006). Infant mortality rates in rural areas are almost two times greater than those in
urban areas (Li and Feldman 1996). Further, among rural areas, infant mortality rates are nearly
five times higher in the poorest rural counties than in the wealthiest counties ---123 versus 26 per
1000 live births, respectively (MOH et al. 2006).

There also exist disparities in the use of maternal care between the eastern and western regions,
between the urban and rural areas and between poor and rich rural areas. For example, hospital
delivery rate in Guizhou, one of China’s poorest provinces, was 39%, compared with 99.5%,
99.4% in Beijing and Shanghai, respectively (Fang and Kaufman 2008). In 1998, women in the urban areas had on average 6.4 prenatal visits in comparison to 3.2 visits in rural areas. Further, while 92% of urban women gave birth in hospitals and 61% attended postnatal care classes, respectively only 41% and 50% of rural women did so (Center for Health Statistics 2004). Among rural areas, the hospital delivery rate in richest rural areas was 70% and this indicator in poorest rural areas was only 12%. The studies on prenatal care have focused on the timing and frequency of prenatal care (Anson 2004; Center for Health Statistics 2004; Yan 2002) and relatively little information is available about the organization, funding, and actual content of maternal care, especially in the less developed rural areas. Only a few nationwide studies have been conducted to explore the equity in use for maternal care.

There is not conclusive definition of perinatal health so far. The concept of perinatal health has evolved with time and varies from countries/regions to countries/regions (Hemminki 2009; Lack et al. 2003; WHO 1992; WHO 2006; Zeitlin et al. 2010). Perinatal health can be measured by various indicators from aspects of neonatal health and maternal health to population characteristics and health care services (Zeitlin et al. 2010).

This study consisted of two parts: perinatal health and use of maternal care. For the first part (Paper I, Paper II), the main aim of the study was to explore the level of perinatal health, sex ratio at birth and their determinants; The second part (Paper III, PaperIV) of the study examines the provision and utilization of maternal care and the issues of equity in the use of maternal care.

The data for the first part of the study were from the project “Evaluation of prenatal care program in rural China” conducted in Dingyuan County, Anhui province, in eastern China, and funded by the Academy of Finland. The data of the second part of the study were both from the above project and from the project “Structural hinders to and promoters of good maternal care in rural China, acronym CHIMACA”, which was funded by the European Commission.
2. BACKGROUND AND CONTEXT

2.1 A brief introduction to the People’s Republic of China

The People’s Republic of China was founded by the Communist Party in 1949. China is the country with the largest population in the world with a population over 1.3 billion in 2009, accounting for up to 22 percent of the total world population. China covers 9.6 million square kilometres and comprises five autonomous regions and twenty-nine provinces including Taiwan, as well as Hong Kong and Macao, which are now collectively known as a “Special Administrative Region”. China consists of 56 nationalities, among which the Han Ethnic Group is the largest, making up 94% of the Chinese population.

2.2 Economic reform

In the past three decades, China has experienced great changes. The changes include the family planning policy, economic reform and the subsequent decline in social and health services and revival of a traditional gender role ideology (Li 2004).

Mao Ze Dong’s death in 1976 brought an end to the Cultural Revolution. The power vacuum was filled by Deng Xiao Ping. He realized that reform was essential to China’s future survival and growth. The socialist system was replaced by a market system, which essentially allowed more rapid economic growth at the whim of market forces while accepting less equality. The communes were dismantled, and families could sell surplus produced in the newly opened free markets. The agricultural commune was quickly replaced by household production, profit-making village and township enterprises were set up, and state-owned enterprises (SOE) were granted substantial financial autonomy (Hesketh and Zhu 1997).

As the old tax base shrunk, government revenues declined as a share of GDP, and the central government’s control over the remaining revenues diminished. Local governments not only continued to be responsible for health, but also became responsible for finding revenues to fund health care. These changes had dramatic and unintended consequences for the health sector. The breakup of the communes led to the almost total collapse of the health insurance Cooperative Medical Scheme (Hsiao 1984; Liu 2004). Less than 10% of the rural population was covered by insurance schemes from the late 1980s to 2000 (Tang 2008).

Since the economic reform and open door policy was announced in the late 1970s, China has experienced dramatic changes in every sector of society. It has achieved 9% annual growth per head for more than 25 years (National Bureau of Statistics 2007). Its gross domestic product in 2009 reached 33.54 trillion Yuan or 4.9 trillion U.S dollars, making it the fourth largest economy in the world. From 1978 to 2000, China's GDP per capita increased from less than 400 U.S dollars...
to more than 800 U.S dollars. But since 2000 the growth rate has picked up pace. In 2003, the GDP per capita surpassed 1000 U.S dollars. In 2008, it reached 3000 U.S dollars (People’s Daily Online 2009). In 2005, China’s Gini coefficient, an indicator of income distribution difference, was estimated at more than 0.48 (for comparison, the US Gini coefficient was 0.45 in 2004) (Tang 2008). Along with economic development have come social challenges. The gap between rich and poor has widened.

2.3 Health care system reform

Before the 1980s, the Chinese health care system was originally a highly centralized one. It was typical of the type found in centrally planned economies whereby health care was a part of comprehensive social welfare provided by the state (Ramesh and Wu 2009; Bloom and Gu 1997; Hsiao 1995). There were three social insurance schemes for the majority of the population: A Government Insurance Scheme (GIS) for government employees, a Labor Insurance Scheme (LIS) for the urban population, and a Cooperative Medical System (CMS) for the rural population. The GIS was financed from the government budget and covered all current, retired and disabled government employees as well as teachers and university students. Members neither paid premiums nor charges except for certain services and drugs. The LIS was financed by state-owned enterprises out of their welfare fund equivalent to 11–14% of total wages. Its members received health services for free, and their dependents could claim reimbursement for up to 50% of their medical costs. The CMS was operated at the village level, and financed through rural welfare funds and members contributions. The scheme provided 90% of rural populations with access to basic care and covered 50–70% of their total medical expenditure (Liu et al. 1998; Gu and Tang 1995). The county-township-village three-tier health care system contributed much to rural primary health care (Liu and Yi 2004). During this period, the population had almost universal access to decent primary and hospital care as well as pharmaceuticals (Yip and Hsiao 2001).

After the early 1980s, health care systems in rural areas experienced transformations along with the changes of the country's administrative system and economic policy. The transformations were characterized by the disintegration of the rural CMS, by the decentralization of responsibility for township hospitals from county to township governments, by official permission for private practice, by the implementation of the personal responsibility system in health institutions, by the health security reform, and by the development of health insurance in rural areas (Liu et al. 1991; Bloom and Gu 1997; Hsiao 1995). The institutional and economic foundation of China’s health system was weakened by the economic reforms. The dismantling of collective farms during the 1980s led to the demise of the Cooperative Medical Schemes (CMS), leaving the vast majority of the rural population without any form of health insurance coverage. At the end of the 1970s, 90% of the rural population had access to reasonable quality care and some protection against catastrophic expenses, but within a decade the proportion has shrunk to 5% (Ramesh and Wu, 2009). From late 1980s to 2000, less than 10% of the rural population was covered by an insurance scheme (Tang et al. 2008).

Since the 1980s, government health expenditure has declined both as a share of total health
expenditure and total government expenditure. The budget provided to public health facilities was insufficient to cover their fixed costs and public health facilities had to resort to filling the gap by charging patients (Zheng and Hiller 1995). A fee-for-service system was introduced. The out-of-pocket health spending became the main form of health finance in rural China. This particularly affected the rural poor, deterring them from accessing health care (Huong et al. 2007).

2.4 Health care system in rural China

In rural areas, the health care system (as well as maternal care system) is organized into three levels of care: the county, township and village levels. The tertiary care is mainly provided at county level hospitals (county hospital, the hospital of traditional Chinese medicine and specialized hospitals such as the maternal and child health care station/hospitals). The secondary care is provided by either township hospital or county-level hospitals. The primary care is provided in the village clinics as well as township hospitals. In parallel, there are three levels of family planning services: at county institutes, township service stations and village service posts. The family planning institutes are in charge of the implementation of the national family planning policy by giving all married women regular mandatory pregnancy tests. The family planning staff also offer maternal care consultations and do simple obstetric examinations during the routine pregnancy test sessions. Some of family planning institutes at the county and township levels also provide delivery services (Wu et al. 2008).

2.5 One child family planning policy

The reforms of the late 1970’s in China touched upon nearly every aspect of Chinese citizens’ lives. In addition to economic reforms, far-reaching social reforms were implemented during this period. One such social reform, known as the one-child one-family policy, commonly called the one-child policy, was officially introduced in 1979 as a set of rules and regulations governing the approved size of Chinese families. Details of what the one child policy involved and how it was to be implemented have varied at different times. The government has frequently changed the characteristics of the one child policy. However, the basic goal of the policy was to reduce the burgeoning Chinese population. It was also a response to the threat that the country’s massive demographic growth cast on the future of economic development and of the living conditions of the people (Kane and Choi 1999; Festini and Martino 2004).

The regulations governing the one child policy include restrictions on family size, late marriage and childbearing, and the spacing of children (in cases in which second children are permitted). Despite its name, the one-child rule applies to a minority of the population; for urban residents and government employees, the policy is strictly enforced, with few exceptions. In rural areas—where around 70% of the population lives—a second child is generally allowed after five years if the first is a girl. A third or more children are allowed for some ethnic minorities (Hemminki et al. 2005; Hesketh and Zhu 1997; Qu and Hesketh 2006; Wu et al. 2006). The policy is underpinned by a system of rewards and penalties, which are largely meted out at the discretion of local officials and...
hence vary widely. They include economic incentives for compliance and substantial fines, confiscation of belongings, and dismissal from work for noncompliance (Hesketh 2005).

China’s one child policy is one of the most controversial social policies ever implemented. Although the policy has led to reduced fertility rate, helping to raise the living standards of most people in China, it has been heavily criticized for violating human rights with many negative social consequences (Greenhalgh and Bongaarts 1987). The main criticism of the policy though is undoubtedly its stimulus of sex discrimination. The coercion of women to undergo sterilization, abortion, or insertion of IUDs has also been reported (Johnson 1996; Maureen et al. 1999; Kane and Choi 1999; Bernman 1999; Hemminki et al. 2005; Wu et al. 2006).

2.6 Traditional culture of son preference

A preference for sons over daughters is not peculiar to China, but widespread in many Asian countries, for example, India, and South Korea (Gu and Roy 1995; Park and Cho 1995; Lena 1999). In these countries, it is thought that only sons can continue the family line, and sons—rather than daughters—are responsible for their parents in illness and old age. Peasants with limited savings and without pensions needed children to support them in old age. As married daughters moved into their husbands’ families, a son - and preferably more than one - was essential (Banister 1987). The acceptance of the one child per family policy on the part of the people has been reported as difficult as the rule seems to conflict with the deep rooted Confucian tradition that emphasizes the importance of numerous offspring, in order to pass on the responsibility of supporting the old people and carrying on the family line.

Prenatally son preference is realized through sex determination and sex selective abortion and postnatally through neglect and abandonment of female children, which leads to higher female mortality (Poston et al. 1994; Hesketh and Zhu 2006), through girl adoption, and a refusal to report female births. Since prenatal sex determinations and induced abortions became available in mid 1980s, they have made a major contribution to the high sex ratio seen in many Asian countries. Son preference is only one indirect factor contributing to imbalance in the sex ratio (Ding and Hesketh 2006). It is rather the combination of sex selective technology and a small family culture or policy that has caused the high SRB (Gu and Roy 1995). When large family size is the norm and access to contraception is limited, son preference has little influence on sex ratio because couples continue bearing children, largely irrespective of the gender of the children (Park and Cho 1995). When the fertility rates are low, by choice or coercion, female births must be prevented to allow for the desired number of sons within the family size norm (Hesketh and Zhu 2006).

In societies with strong son preference, too many girls, if not aborted, face orphanages or second class lives concealed from the world and reduced chances of schooling and health care (Kane and Choi 1999). The discrimination against daughters leads to neglect of their health care or nutrition, resulting in higher female mortality (Wu et al. 2003). A number of studies have shown that unequal access to health care is the most important factor influencing girls’ health (Murthi et al. 1995; Hill et al. 1995). This is especially the case in societies where health care costs have to be
borne by the family (Chen et al. 1981; Hazarika 2000; Li 2004). As prenatal sex determination in China only began to be available in about 1985, the resulting large cohorts of “surplus” young men are only now reaching productive age. Although the consequences of this male surplus are largely speculative, it is not in dispute that over the next 20 years in large parts of Asia there will be an excess of males. These men may remain single and may be unable to have families, in societies where marriage is regarded as virtually universal and social status and acceptance depend, in large part, on being married and creating a new family (Hesketh and Zhu 2006). Many commentators predict that this situation may lead to increased levels of antisocial behaviors and violence, and may ultimately present a threat to the stability and security of society (Park and Cho 1995; Zeng et al. 1993; Tu 1993; Ma 2004; Li 1995; Tuljapurkar et al. 1995).
3. LITERATURE REVIEW

This review of previous literature focuses on peer-reviewed articles and will include reports from population-based cross-sectional surveys and cohort studies of perinatal health and use of maternal care and their determinants. The review of the determinants focuses on non-clinic factors, covering social-economic and cultural factors. Due to limited articles related to perinatal mortality in rural China, infant mortality was used as a proxy of perinatal mortality. The studies included were restricted to only those conducted in China, and included articles published between 1980 and 2010. The studies covering only urban China were excluded but those encompassing both rural and urban areas in China were included. Qualitative studies were not covered in this review.

The electronic database, MEDLINE, was used to trace articles for the literature review. Papers in English or those in Chinese but with an English abstract and indexed in MEDLINE were included. First, the titles and abstracts of the papers were examined, and then the full texts of relevant articles were subsequently retrieved for further assessment. In addition, books, reports, statistics in Chinese reporting nationwide studies were also included. There were three topics for the review: determinants of perinatal health, determinants of sex ratio at birth and determinants of the use of maternal care. The following key words were used in different combinations for reviewing the topic on the determinants of perinatal/infant mortality and sex ratio at birth: perinatal health, reproductive health, perinatal mortality rate (PNMR), infant mortality, neonatal mortality, early neonatal mortality rate (ENMR) child mortality, sex ratio, sex ratio at birth (SRB), one child family planning policy/one child policy, birth policy, son preference, gender disparity, gender inequality, sex imbalance, sex selective abortion, induced abortion, infanticide, adoption, underreporting of female birth, missing girls, China, rural area. The key words used in different combination for reviewing the determinants of use of maternal care included: maternal health care/maternal care, maternal health services, maternity care, prenatal care, antenatal care, postnatal care, perinatal care, delivery care, obstetric care, women’s health services, reproductive health care or services, China, rural areas, access variables or socio-economic or demographic characteristics (access, utilization, provision, financing, funding, equity, inequality, determinant, socioeconomics, income). Additionally the lists of references of retrieved articles were perused for more relevant literature, some of which were also included in this literature review.

Measures of the use of maternal health care included: 1) attendance at antenatal care classes in the first trimester of pregnancy; 2) frequency of antenatal visits; and 3) delivery in a medical setting or use of a skilled health worker at delivery. Measures of perinatal health and sex ratio at birth included: 1) perinatal mortality or infant mortality; 2) underreporting of female birth or adoption; 3) sex selective abortion, and 4) infanticide.

The criteria used to assess quality of included studies covered: 1) studies addressed a clearly focus question; 2) characteristics of the study population were clearly described; 3) outcomes were clearly defined; and 4) data collection tools were defined. The studies that did not meet these criteria were excluded. The numbers of studies excluded are given in connection with each section.
The level, trend and determinants of perinatal health and sex ratio at birth, and the determinants of use of maternal health care were thoroughly reviewed. Usually the determinants of perinatal health and health care are divided into the socioeconomic (including cultural) and biomedical factors. This review focuses only on the socio-economic determinants. The reason is that these determinants are more preventable than the others and of high value for future intervention.

Infant mortality by time, provinces, areas (urban/rural), and gender from reviewed literature are summarized in Tables 1, 2, and 3. The SRB by time, provinces, areas (urban/rural), and birth order are summarized in Tables 5 and 6. The authors, publication year, study design, year of data collection, study questions, and data analysis of the reviewed literature are summarized in Tables 4, 7, and 8. The main results and conclusions of reviews are described in the text.

3.1 Infant and perinatal mortality in China

3.1.1 The level of infant mortality

Although China’s infant mortality decreased steadily from 42.8 per 1000 live birth in 1980 to 38.0 in 1990 and 32.2 in 2000 (Table 1), there was a big difference in infant mortality between rural and urban areas and among provinces. The gap in infant mortality between the urban and rural areas and between poor and rich regions widened with time. The gender disparity in infant mortality increased remarkably after the early 1980s. In 1981, male infant mortality in both rural and urban areas was higher than females, but in 1989 female infant mortality became higher than males in both rural and urban areas (Table 2). In 1981, there were only 4 out of 31 provinces where the female infant mortality was higher than male infant mortality, but the figure increased to 19 provinces in 1989 and 27 provinces in 2000. Furthermore, gender disparities in infant mortality were widened in most provinces between 1981 and 2000, and the gap between female and male infant mortality escalated after the late 1980s, especially in the regions of mid and south China, although overall infant mortality also decreased with time in these regions. Though our study province is located in eastern China, the gap between female and male infant mortality also escalated after the late 1980s in a similar manner as the regions of mid and south China (Table3). Gender differences in infant mortality were relatively lower in the regions where minority population dominate, such as Tibet, Inner-Mongolia, Ningxia, Qinhai, Xinjiang, but female infant mortality over male infant mortality also increased with time in these regions (Table 3).

<table>
<thead>
<tr>
<th>Year</th>
<th>National child death monitoring data</th>
<th>Census data</th>
<th>WHO world health report</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>42.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1981</td>
<td>37.3</td>
<td>35.5</td>
<td>-</td>
</tr>
<tr>
<td>1985</td>
<td>37.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1990</td>
<td>38.0</td>
<td>32.9</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1 Infant mortality in China, by selected year for 1980-2000 (%)

### Table 2  China's infant mortality by area and infant gender in 1981 and 1989

<table>
<thead>
<tr>
<th>Areas</th>
<th>1981 Male</th>
<th>1981 Female</th>
<th>SRIM 1</th>
<th>1989 Male</th>
<th>1989 Female</th>
<th>SRIM 2</th>
<th>SRIM 2 - SRIM 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban area</td>
<td>23.1</td>
<td>20.8</td>
<td>1.11</td>
<td>20.0</td>
<td>21.2</td>
<td>0.95</td>
<td>-0.17</td>
</tr>
<tr>
<td>Rural area</td>
<td>37.9</td>
<td>36.1</td>
<td>1.05</td>
<td>35.3</td>
<td>40.7</td>
<td>0.87</td>
<td>-0.18</td>
</tr>
</tbody>
</table>

Adapted from the reference of Li and Feldman (1996).

SRIM (Sex ratio of infant mortality): The ratio of male infant mortality rate over female infant mortality rate.

### Table 3  China's infant mortality by province and infant gender in 1981, 1989 and 2000

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>16.6</td>
<td>15.3</td>
<td>1.09</td>
<td>13.3</td>
<td>12.7</td>
<td>1.05</td>
<td>0.97</td>
</tr>
<tr>
<td>Tianjing</td>
<td>20.9</td>
<td>19.1</td>
<td>1.09</td>
<td>16.2</td>
<td>15.6</td>
<td>1.04</td>
<td>0.90</td>
</tr>
<tr>
<td>Hebei</td>
<td>22.9</td>
<td>19.8</td>
<td>1.16</td>
<td>17.3</td>
<td>17.8</td>
<td>0.98</td>
<td>1.50</td>
</tr>
<tr>
<td>Shandong</td>
<td>31.7</td>
<td>30.6</td>
<td>1.04</td>
<td>30.1</td>
<td>31.4</td>
<td>0.88</td>
<td>1.52</td>
</tr>
<tr>
<td>Inner-Mongolia</td>
<td>44.1</td>
<td>38.5</td>
<td>1.15</td>
<td>43.9</td>
<td>46.5</td>
<td>0.94</td>
<td>3.00</td>
</tr>
<tr>
<td>Liaoning</td>
<td>23.7</td>
<td>20.4</td>
<td>1.16</td>
<td>24.4</td>
<td>23.1</td>
<td>1.06</td>
<td>9.4</td>
</tr>
<tr>
<td>Jilin</td>
<td>21.2</td>
<td>18.5</td>
<td>1.14</td>
<td>25.6</td>
<td>24.4</td>
<td>1.05</td>
<td>15.6</td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>38.7</td>
<td>30.5</td>
<td>1.27</td>
<td>30.1</td>
<td>26.1</td>
<td>1.15</td>
<td>9.5</td>
</tr>
<tr>
<td>Shanghai</td>
<td>21.3</td>
<td>17.3</td>
<td>1.23</td>
<td>18.8</td>
<td>17.6</td>
<td>1.07</td>
<td>4.1</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>31.9</td>
<td>34.2</td>
<td>0.98</td>
<td>22.9</td>
<td>25.0</td>
<td>0.92</td>
<td>10.9</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>33.4</td>
<td>38.1</td>
<td>0.88</td>
<td>23.8</td>
<td>28.4</td>
<td>0.84</td>
<td>10.1</td>
</tr>
<tr>
<td>Anhui</td>
<td>28.4</td>
<td>32.6</td>
<td>0.87</td>
<td>29.2</td>
<td>33.9</td>
<td>0.86</td>
<td>21.7</td>
</tr>
<tr>
<td>Fujian</td>
<td>23.1</td>
<td>21.9</td>
<td>1.06</td>
<td>26.0</td>
<td>28.9</td>
<td>0.90</td>
<td>14.5</td>
</tr>
<tr>
<td>Jiangxi</td>
<td>46.7</td>
<td>46.5</td>
<td>1.01</td>
<td>41.7</td>
<td>52.9</td>
<td>0.79</td>
<td>25.9</td>
</tr>
<tr>
<td>Shandong</td>
<td>20.0</td>
<td>20.1</td>
<td>1.00</td>
<td>17.4</td>
<td>22.7</td>
<td>0.77</td>
<td>12.7</td>
</tr>
<tr>
<td>Henan</td>
<td>20.2</td>
<td>20.9</td>
<td>0.97</td>
<td>21.3</td>
<td>26.1</td>
<td>0.82</td>
<td>15.7</td>
</tr>
<tr>
<td>Hubei</td>
<td>41.4</td>
<td>37.8</td>
<td>1.10</td>
<td>33.2</td>
<td>35.3</td>
<td>0.94</td>
<td>14.8</td>
</tr>
</tbody>
</table>

Adapted from the reference of Li and Feldman (1996).
SRIM (Sex ratio of infant mortality): The ratio of male infant mortality rate over female infant mortality rate.

Data for 1981 and 1989 were adapted from the reference (Li and Feldman 1996) and the data for 2000 were adapted from the reference (Attane 2009).

Note: The order of provinces is listed by geographic region from north China, north east China, east China, mid China, South China, South west China, northwest China.

3.1.2 The determinants of perinatal and infant mortality

Using the specified criteria to search for the determinants of perinatal mortality in rural China, no relevant article was found. However, considering that neonatal mortality accounts for about two thirds of infant mortality in China (Dankert and Van 1991), infant mortality was then used as a proxy of perinatal mortality, which gave 24 citations through Medline. Of these, 6 studies were included and 18 were excluded as a result of irrelevant study questions or inappropriate outcome measures: hospital based survey (7), no relevant data (6), article duplication in different languages (2), one in English and the other in Chinese (2), and my own studies which need not be cited since they are part of this study (1). The results of this section of review are summarized in Table 4.

Two studies (Li and Feldman 2004; Ren 1995) assessed the impact of son preferences and one child policy on excess female infant deaths. One study (Li and Feldman 2004), using data from a survey of deaths of children less than 5 years old conducted in 1997 in a county in Shaanxi Province, China, found that excess female child mortality in this county is probably caused primarily by discrimination against girls in curative health care rather than in preventive health care or food and nutrition. It is argued that the excess mortality of girls is caused fundamentally by the strong son preference in traditional Chinese culture, but exacerbated by the government-guided family planning programme and regulations. Another study (Ren 1995), using retrospective reports on infant and child mortality from the 1985 and 1987 In-Depth Fertility Surveys in Shaanxi, Liaoning and Guangdong provinces of China, showed that female infants and children...
mortality have higher than expected mortality rates, suggesting that son preference may lead to discriminatory practices against females. The study also reveals that the one-child policy of the late 1970s has a strong influence on the survivorship of female infants and children.

Two studies (Li et al. 2008; Huang et al. 1997) which were conducted in the remote provinces with relative more minority populations, showed that infant mortality in minority nationalities was higher than those of the Han Chinese, giving infant mortality rates of 53.6 for Han Chinese and 77.7 for the 22 largest minority nationalities per 1000 live birth in the Yunan province (Li et al. 2008) and 103, 148, 161 and 145 per 1000 live birth for Han, Miao, Bouyei and other ethnic groups, respectively in the Guizhou province (Huang et al. 1997). In addition, mother’s education, prenatal care, hospital delivery, economic development were found to be negatively associated with infant mortality (Li et al. 2008), whereas location of birth, the kinds of birth attendants and utilization of health facilities were associated with infant survival (Huang et al. 1997).

Dankert et al. 1991), using the 1985 In-depth Fertility Survey data examined the socio-economic and socio-demographic determinants of infant mortality, showed that male mortality was considerably higher than female mortality in the neonatal and postnatal period, and at ages 1-5 years. This finding was contrary to that reported in other studies (Li and Feldman 2004; Ren 1995; Chen et al. 2007). The explanation for this difference is that girls might be under reported at birth, and those not reported had higher mortality rates than those reported. Birth weight place of residence and mother’s education were important determinants of mortality in that study, while age of mother and parity were less important.

Another study (Chen et al. 2007) assessed the effects of social-economic conditions and the interaction between son preference and China’s one child policy on the use of maternal care services and their effects on infant mortality in rural China, using the 2001 National Family Planning and Reproductive Health Survey data. Infant mortality in ethnic minorities was higher than those for the Han majority in that study. Whereas mother’s education and use of prenatal care were negative associated with infant death, daughters of higher parity with no brothers had higher mortality. This suggests that son preference and the one child policy have an impact on the excess female mortality rate.

Table 4 Socio-economic determinants of perinatal and infant mortality

<table>
<thead>
<tr>
<th>Authors’ publication year</th>
<th>Study design</th>
<th>Participants/data, year</th>
<th>Study questions</th>
<th>What factors controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Li S et al. 2004</td>
<td>Sampling survey</td>
<td>815 child deaths under 5 children in Shaanxi province, 1997</td>
<td>Gender differences in child mortality</td>
<td>Major factors controlled</td>
</tr>
<tr>
<td>Ren 1995</td>
<td>In-depth fertility survey</td>
<td>42102 live births and 2437 deaths before age, 5 in</td>
<td>Effect of sexual inequality on the differential</td>
<td>Major factors controlled</td>
</tr>
</tbody>
</table>
3.2 Sex ratio at birth in China

The issues of interest related to increased sex ratio at birth in China include the level, trend, regional variation, mechanisms, determinants of SRB and its consequences. Except for the mechanisms and consequences of increased SRB, other aspects were thoroughly reviewed, which are summarized in Tables 5, 6 and 7 and described in the text.

Sex ratio at birth, SRB is defined as the number of male live births for every 100 female births. In
the absence of manipulation, the SRB is remarkably consistent across populations, with 105-107 male births for every 100 female births (Hesketh and Zhu 2006). SRB changes little with parity (the number of children a mother has borne) (Tuljapurkar et al. 1995).

3.2.1 The level and distribution of sex ratio at birth

The reported sex ratio at birth in China was very close to 106 during the 1960s, 1970s, and early 1980s (Hemminki et al. 2005; Johansson and Nygren 1991; Zeng et al. 1993) (Table 5). But since the mid 1980s, the ratio increased steadily from 108.3 in 1984 to 111.3 in 1990, 115.6 in 1995 and 116.9 in 2000. Sex ratio at birth varies with birth order, so that the higher the birth order, the higher the SRB. Although in early 1980s, SRB increased only slightly with birth order, a sharp increase was observed in 2000, being close to normal at first birth, but increased to 51.9 in the second birth and 159.4 in the third birth (Table 5).

The SRB also varies from province to province with a big disparity between rural and urban areas (Table 6). The areas with highest SRB were located in the mid and southern China, including Guangdong, Hainan, Hunan etc. The SRB in our study province (Anhui province) ranked at fourteenth high in 1989 but rose to the top 4 in 2000 among all provinces (Table 6). The top four SRB in these four provinces was over 130 in 2000. The areas with lower SRB (below or around 107) were located in remote areas, dominated by minorities who are exempted from the one child policy, including Tibet, Xinjiang, Inner Mongolia, Ningxia, and others. Table 6 shows that there might be some link between gender disparity of infant mortality and SRB: the higher the gender disparity of infant mortality in the provinces, the higher the sex ratio at birth.

Table 5 Reported sex ratio at birth in China by birth order and selected years

<table>
<thead>
<tr>
<th>Year</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th+</th>
<th>All births</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>107.3</td>
</tr>
<tr>
<td>1981</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>107.0</td>
</tr>
<tr>
<td>1982</td>
<td>106.6</td>
<td>105.0</td>
<td>109.4</td>
<td>111.9</td>
<td>107.2</td>
</tr>
<tr>
<td>1983</td>
<td>107.5</td>
<td>107.2</td>
<td>108.2</td>
<td>109.3</td>
<td>107.7</td>
</tr>
<tr>
<td>1984</td>
<td>102.1</td>
<td>113.6</td>
<td>112.6</td>
<td>122.2</td>
<td>108.3</td>
</tr>
<tr>
<td>1985</td>
<td>106.1</td>
<td>116.1</td>
<td>114.3</td>
<td>121.5</td>
<td>111.2</td>
</tr>
<tr>
<td>1986</td>
<td>105.2</td>
<td>116.8</td>
<td>123.2</td>
<td>124.7</td>
<td>112.1</td>
</tr>
<tr>
<td>1987</td>
<td>106.7</td>
<td>112.6</td>
<td>118.9</td>
<td>121.2</td>
<td>110.8</td>
</tr>
<tr>
<td>1989</td>
<td>104.9</td>
<td>120.9</td>
<td>124.6</td>
<td>131.7</td>
<td>113.8</td>
</tr>
<tr>
<td>1990</td>
<td>105.2</td>
<td>121.0</td>
<td>127.0 (3rd+)</td>
<td>-</td>
<td>111.3</td>
</tr>
<tr>
<td>1991</td>
<td>110.8</td>
<td>122.6</td>
<td>124.4 (3rd+)</td>
<td>-</td>
<td>116.1</td>
</tr>
<tr>
<td>1992</td>
<td>106.7</td>
<td>125.7</td>
<td>126.7 (3rd+)</td>
<td>-</td>
<td>114.2</td>
</tr>
<tr>
<td>1993</td>
<td>105.6</td>
<td>130.2</td>
<td>126.1 (3rd+)</td>
<td>-</td>
<td>114.1</td>
</tr>
</tbody>
</table>
Table 6 China’s Sex ratio at birth and the ratio of male infant mortality rate over female infant mortality rate by provinces in 1989 and 2000

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Guizhou</td>
<td>103.4</td>
<td>0.92</td>
<td>107.3</td>
<td>0.79</td>
<td>99.4</td>
<td>105.6</td>
</tr>
<tr>
<td>Tibet</td>
<td>103.6</td>
<td>1.33</td>
<td>102.7</td>
<td>1.03</td>
<td>112.4</td>
<td>102.9</td>
</tr>
<tr>
<td>Xinjiang</td>
<td>104.1</td>
<td>1.09</td>
<td>106.1</td>
<td>0.72</td>
<td>106.6</td>
<td>107.1</td>
</tr>
<tr>
<td>Shanghai</td>
<td>104.1</td>
<td>1.07</td>
<td>110.6</td>
<td>0.93</td>
<td>103.9</td>
<td>110.5</td>
</tr>
<tr>
<td>Qinghai</td>
<td>104.6</td>
<td>1.18</td>
<td>110.4</td>
<td>0.94</td>
<td>115.3</td>
<td>105.7</td>
</tr>
<tr>
<td>Beijing</td>
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<td>1.05</td>
<td>110.6</td>
<td>0.97</td>
<td>106.1</td>
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</tr>
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<td>108.7</td>
<td>0.78</td>
<td>103.9</td>
<td>104.3</td>
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<td>109.7</td>
<td>1.12</td>
<td>105.5</td>
<td>109.9</td>
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<td>111.2</td>
<td>0.98</td>
<td>106.0</td>
<td>110.8</td>
</tr>
<tr>
<td>Gansu</td>
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<td>114.8</td>
<td>0.74</td>
<td>106.6</td>
<td>111.4</td>
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<td>108.5</td>
<td>0.89</td>
<td>105.2</td>
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<tr>
<td>Province</td>
<td>SRIM</td>
<td>Sex Ratio</td>
<td>SIR</td>
<td>1989 SRB</td>
<td>2000 SRB</td>
<td></td>
</tr>
<tr>
<td>------------</td>
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<td>127.9</td>
<td>0.64</td>
<td>108.9</td>
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</tr>
<tr>
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<td>130.3</td>
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<td>0.54</td>
<td>111.1</td>
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<td>Henan</td>
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<td>118.5</td>
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<td>113.0</td>
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</tr>
<tr>
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<td>113.9</td>
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<td>107.5</td>
<td></td>
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<tr>
<td>China</td>
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<td>116.9</td>
<td></td>
<td>108.9</td>
<td>112.8</td>
<td></td>
</tr>
</tbody>
</table>

Note: The order of the province is listed from low SRB to highest SRB of 1989.

SRIM (Sex ratio of infant mortality): The ratio of male infant mortality rate over female infant mortality rate.

The data on 1989 was adapted from the reference of Gu and Roy (1996).
The data on 2000 was adapted from the reference of Zhejiang Statistics, 2002 (5): 40-41.

### 3.2.2 The determinants of sex ratio at birth

Using the specified criteria, 34 potentially relevant articles were found for the topic of the determinants of increased sex ratio at birth China. Of these, 11 studies were included while 23 were excluded as a result of irrelevant study questions or inappropriate outcome measures (9), irrelevant data (6), article duplication in different languages (4), studies conducted in other countries (2), and my own studies (2).

Ten out of the 11 studies included used national census or national fertility or population survey data (Table 7). Two studies used the 1990 census data only (Li 1993; Tu 1993); four studies used census data in combination with national sampling fertility and contraception survey or/and population sampling survey data (Zeng et al. 1993; Gao 1993; Ansley 1994; Wei et al. 2009); and four studies used national sampling fertility and contraception survey or/and population sampling survey data (Johansson and Nygren 1991; Xu and Guo 1991; Qiao 2004; Wei et al. 2005); The last study used “kinship networking” survey data (Chu 2001). No population based cohort study on sex ratio from pregnancy to 7 days after birth has been conducted in China.

The studies by Tu (1993) (using the 1990 census data) and Zeng et al. (1993) (using both the 1990 census data and the fertility and contraception survey) reported that both underreporting of female births and sex selective abortion were the main causes of increased SRB, ruling out the possibility that female infanticide and abandonment are the main contributors (Table 7).

Xu and Guo (1991) and Johansson and Nygren (1991), using the national sampling survey data, and Gao (1993) using the combination of census data and the national sampling survey data, all
reached the same conclusion that under reporting of female birth is the primary cause of increased SRB. However, while Gao (1993) did not explore the contribution of sex selective abortion to increased SRB, Xu and Guo (1991) and Johansson and Nygren (1991) did not think that sex selective abortion was the major cause of increased SRB, because medical technology was not widely available in rural China in the 1980s. Nevertheless, Johansson and Nygren (1991) estimated that under reporting of adopted female children might have accounted for about half of the missing girls, and they reported that excess female infant death might also contribute to some of the increase in SRB (Table 7).

Two studies (Li 1993 and Ansley 1994) conducted in the early 1990s and three studies (Qiao 2004; Wei et al. 2005; Wei 2009) conducted after 2000, all using the national census and sampling survey data, concluded that sex selective abortions is the primary cause of increased SRB. Ansley (1994) added that the somewhat restoration of infanticide and the increase in adoption of girls also contributed to increased SRB. However, Wei et al. (2009) asserted that underreporting of female girls is not a major contributor and infanticide is very rare (Table 7).

The study by Chu (2001) utilized the “kinship networking survey”, which is quite different from the other studies. The author trained local rural residents and then let them interview their relatives, neighbors, their relatives’ neighbors or their neighbors’ relatives. In total, 820 local residents were interviewed. The study concluded that sex selective abortion and underreporting of female births or girls are major contributors of SRB, and that female infant abandonment or infanticide is extremely rare (Table 7).

**Table 7 Determinants of increased sex ratio at birth in China from early 1980 to early 2000**

<table>
<thead>
<tr>
<th>Authors And publication year</th>
<th>Study design</th>
<th>Participants /data, year</th>
<th>Study questions</th>
<th>What factors controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tu 1993</td>
<td>Census</td>
<td>1990</td>
<td>Causes of the increased SRB in 1980s</td>
<td>Major factors controlled</td>
</tr>
<tr>
<td>Gao 1993</td>
<td>Census; And Retrospective survey</td>
<td>1990; 2‰ fertility survey, 1988;</td>
<td>Main factors of increased high SRB</td>
<td>Part factors controlled</td>
</tr>
<tr>
<td>Xu and Guo</td>
<td>Retrospective</td>
<td>2 ‰ fertility</td>
<td>The causes of</td>
<td>Factors not controlled</td>
</tr>
</tbody>
</table>
### 1991
- **Johansson and Nygren 1991**
  - **Survey:** Fertility survey and cross-sectional survey
  - **Year:** 1988; fertility survey, 1988; and 1% population survey, 1987
  - **Cause:** Causes of the increased SRB
  - **Part factors controlled:**

### 1994
- **Ansley 1994**
  - **Survey:** Census and birth cohort study
  - **Year:** 1953, 1964, 1982, 1990; and 2% fertility survey, 1988
  - **Cause:** Death causes of females in population cohorts born from the late 1930s to the present
  - **Part factors controlled:**

### 1993
- **Li 1993**
  - **Survey:** Census
  - **Year:** 1990
  - **Cause:** If the prenatal sex selective abortion is the primary cause of high SRB
  - **Major factors controlled:**

### 2004
- **Qiao 2004**
  - **Survey:** Cross-sectional survey and retrospective survey
  - **Year:** National population survey, 1997; fertility survey, of 15213 women, 1997
  - **Cause:** Indirect and direct causes of increased SRB
  - **Major factors controlled:**

### 2005
- **Wei et al. 2005**
  - **Survey:** Cross-sectional survey
  - **Year:** 39586 reproductive age women, 2001
  - **Cause:** Impact of sex selective abortion on high SRB
  - **Major factors controlled:**

### 2009
- **Wei 2009**
  - **Survey:** Census and cross-sectional survey
  - **Year:** 1990 and 2000; 1% population sample survey, 2005
  - **Cause:** Impact of sex selective abortion on trends and geographical patterns of the SRB
  - **Not clear from the paper:**

### 2001
- **Chu 2001**
  - **Survey:** “Kinship networking” survey
  - **Year:** 820 married women, 2000
  - **Cause:** Is prenatal sex selective abortion the primary cause of high SRB?
  - **Part factors controlled:**

### 3.3 Determinants of use of maternal care in rural China

Of the 21 articles retrieved on the topic of the determinants of maternal health care, only 9 studies met the inclusion criteria and were included for review. Most of these studies divided the determinants of maternal care into three levels: individual, household and community characteristics. The focus of most of these studies was on socio-economic and socio-demographic...
factors including China’s family planning policy and the culture of son preference. The review on determinants of the use of maternal care is summarized in Table 8.

Three studies explored the impact of China’s one child family policy and son preference on the use of maternal care (Doherty et al. 2001; Li 2004; Short and Zhang 2004; Chen 2007). Doherty et al. (2001), using the China Health and Nutrition Survey data, addressed the effect of China's one-child policy on prenatal and obstetric care utilization, investigating whether or not the one-child policy's financial penalties were associated with the avoidance of obstetric care by pregnant women with unapproved pregnancies. They found out that the one-child policy's economic and social costs caused women to forego seeking modern obstetric care services, thus representing a significant deterrent to the utilization of prenatal care. Additionally, their results indicated that unapproved status of a pregnancy was strongly negatively associated with the use of obstetric care. However, higher prices were not consistently found to be a significant deterrent to the use of obstetric care.

The study by Li (2004), carried out in Yunnan Province, examined the determinants of prenatal and obstetric care utilization within the context of recent social and economic changes in contemporary rural China: to test the general hypothesis that gender inequality (women's status and son preference) and the state's family planning policy have a significant influence on the utilization of maternal and child care. The results demonstrated that the extent to which the husband shares housework and childcare, as an important indicator of rural Chinese women's position within the family, is positively associated with the likelihood that a woman receives prenatal examinations, stops heavy physical work before birth, and gives birth under aseptic conditions. Also, a woman's exposure to the larger world beyond the village increases her chances of giving birth with the assistance of a doctor or health worker. Son preference is an impeding factor for maternal and child health care utilization. Already having a son in the family reduces the chances that the mother will stop heavy physical work before birth for a subsequent pregnancy. Female infants with older sisters are the least likely to receive immunizations. Women with "outside the plan" pregnancies are less likely than those with "approved" pregnancies to receive prenatal examinations, to stop strenuous work before birth, and to deliver under aseptic conditions. Lastly, this study concluded that the family planning policy has a negative impact on women and their families, whose fertility and son preferences conflict with the birth control policy.

Chen (2007) used nationally representative data from the 2001 National Family Planning and Reproductive Health Survey to assess the effects of socio-economic conditions and the interaction between son preference and China's one-child family planning policy on the use of maternal health care services and their effects on infant mortality in rural China. The results showed that while the use of maternal health care services has continued to increase over time, large gaps still exist in the use of these services and in infant survival by mother's education, community income, and parity.

Short and Zhang (2004), using data from the nationally representative 1997 Demographic and Reproductive Health Survey, indicated that the target-based population policy may well have exerted downward pressure on use of maternity services. The study found a negative relationship between parity and the use of maternal care services, and women whose previous pregnancies
ended in the live birth of girls were more likely than those who had boys to obtain formal delivery assistance. In addition, the study demonstrated that regional and especially community characteristics were important for the use of maternity services.

Anson and Hannappel (1999) and Bogg L et al. (2002) explored the effects of socio-economic, social-demographic and cultural factors on the use of maternal care. The study by Anson and Hannappel (1999) was conducted in rural Hebei provinces and explored the degree to which patrilocality served to maintain the traditional patriarchal stratification among women in the household by examining women's health patterns and utilization of health services and variation in health. It was shown that utilization of health services is not dependent on women's position in the household. This was contrary to the study by Bogg et al. (2002), but primarily on per-capita income. Health patterns seem to indicate that mothers of the head of the household still have a considerable power to define their roles and share of household work. The authors concluded that old patriarchal values are intertwined with values of equality in current rural China. The study by Bogg et al. (2002) was conducted in three provinces of central China and examined the association of socio-economic variables with the utilization of essential maternal health services and linked to health sector reforms in China with a focus on cost recovery. The authors reported that antenatal

Table 8 Determinants of maternal health care utilization in rural China

<table>
<thead>
<tr>
<th>Authors, publication year</th>
<th>Study design</th>
<th>Participants/data, year</th>
<th>Study questions</th>
<th>What factors controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doherty et al. 2001</td>
<td>Longitudinal household survey</td>
<td>15745 women in eight provinces, 1989, 1991 and 1993</td>
<td>If the one child policy’s financial penalties is associated with the avoidance of obstetric care by the women with unapproved pregnancies</td>
<td>Major factors Controlled</td>
</tr>
<tr>
<td>Li J 2004</td>
<td>Cross-sectional survey</td>
<td>1062 women, in rural Yunnan between 1991 and 1993</td>
<td>Do gender inequality and the family planning policy have an influence on MCH care utilization</td>
<td>Major factors Controlled</td>
</tr>
<tr>
<td>Chen et al. 2007</td>
<td>Cross-sectional survey</td>
<td>The mothers of 19872 infants born, 1989, 2001</td>
<td>Do socio-Economic conditions and son preference</td>
<td>Major factors Controlled</td>
</tr>
<tr>
<td>Authors</td>
<td>Study Type</td>
<td>Sampling Method</td>
<td>Study Population</td>
<td>Primary Question</td>
</tr>
<tr>
<td>-------------------</td>
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<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Anson and Haanappel 1999</td>
<td>Cross-sectional household survey</td>
<td>3859 women in rural Hebei, 1996-1998</td>
<td>Does patrilocality has impact on women's utilization of health services?</td>
<td>Major factors Controlled</td>
</tr>
<tr>
<td>Bogg et al. 2002</td>
<td>Retrospective household survey</td>
<td>5756 households in six counties in three provinces of central China, 1995</td>
<td>Are socio-economic variables associated with utilization of maternal health services?</td>
<td>Major factors Controlled</td>
</tr>
<tr>
<td>Chen et al. 2009</td>
<td>Quasi-experimental design</td>
<td>635 women in 5 counties receiving an intervention from 1998-2005</td>
<td>Could the Basic Health Services Project improve the use of maternal health care and health?</td>
<td>Major factors controlled</td>
</tr>
<tr>
<td>Liu et al. 2006</td>
<td>Prospective cohort study</td>
<td>195796 women who delivered single live births in 11 counties and 2 cities during 1997 to 2000</td>
<td>Is use of preconceptional health care associated with initiation of prenatal care?</td>
<td>Major factors Controlled</td>
</tr>
<tr>
<td>Short and Zhang 2004</td>
<td>Cross-sectional survey (China Demographic and Reproductive Health Survey)</td>
<td>4485 married women in rural areas having had live birth, 1988-1997</td>
<td>Use of maternity services and its determinants</td>
<td>Major factors controlled</td>
</tr>
</tbody>
</table>

Service utilization continued to be improved in 1990-95, but only in relation to the number of visits, which were pre-paid if the woman was participating in a maternal pre-payment scheme or covered by another health insurance scheme. Significant decreases were seen in the utilization of skilled attendance at delivery and hospital delivery. This study confirmed a strong association between utilization of delivery services and financing variables, such as amount of savings in the
bank, maternal pre-payment schemes and health insurance. It also showed that out-of-pocket and fee-for-service payments for maternity care constituted barriers to the utilization of these services.

Chen et al. (2009) utilized a quasi experimental design to evaluate the part of China Basic Health Services Project (Health VIII) which began in 1998 with aim of improving health status in 97 poor rural counties located in 10 provinces through strengthening the health system and assisting the development of affordable and sustainable services and funding arrangement. The study showed that increased hospital delivery rates in the intervention group was higher than that of control group after 8 years of intervention, but the effectiveness was only moderate. The factors influencing the use of hospital delivery included age of pregnant women, family income, health insurance statues, number of prenatal visits, etc.

Also, Zhang et al. (2004) utilized a quasi experimental design to evaluate the effects of the training of maternal and child care providers on maternal care utilization. The project was implemented by the State Family Planning Commission and the Ministry of Health and showed that the mothers in the intervention group received more prenatal care than those in control group (mean number of obstetric visits: 6.64 vs. 5.64, P<0.05). The number of items of examination taken in the intervention group was more than that in the control group (6.71 versus 5.67, P<0.05). The authors concluded that the training of maternal and child health care providers had a significant impact on improving their service skills and quality; consequently, the women covered by this service could receive better maternal and child health care.

A prospective cohort study (Liu et al. 2006) conducted in 11 counties and 2 cities between 1997 and 2000 assessed whether women having pre-conceptional health care utilization were more likely to have early initiation of prenatal care than were women not having pre-conceptional health care utilization. The study showed that women having pre-conceptional health care utilization were 2.6 times more likely to have early initiation of prenatal care compared with women not having pre-conceptional health care utilization.
4. OBJECTIVES OF THE STUDY

Prior to the present study, reliable data on perinatal mortality from rural China were not available in the international literature and almost all earlier studies published in Chinese were hospital-based surveys or cross-sectional interviews (Wei and Cui 1992; Yao et al. 1991; Zhang et al. 1991; Xu 1995; Zhu and Er 1996). Studies on Chinese sex ratio at birth have commonly used data from population censuses that relied on face-to-face interviews (Gu and Roy 1996; Li and Zhu 1996; Hull 1990; Tu 1993; Merli and Raftery 2000). Data collected by such interviews may, however, be biased due to the following reasons: it is illegal to have many children, prenatal sex determination, and infanticide (Hemminki et al. 2005). The relative contributions of three factors (sex selective abortion, underreporting of female births and infanticide) on increased sex ratios at birth were not determined. Similarly, prior to this study, nationwide studies on use of maternal care have not been available in the international literature. The previous studies on prenatal care in China have focused on timing and frequency of prenatal care (Anson 2004; Xu et al. 2003; Yan 2002) and relatively little information could be found in the studies about how maternal care has been organized and funded and what has been the actual content of the visits, especially in less developed rural areas.

4.1 General objective

The main objective of this work was to study the state of perinatal health and maternal care and their determinants in rural China in the historic context of major socioeconomic reforms and the one child family planning policy.

4.2 Specific objectives

1) To study pregnancy outcomes and perinatal health and their correlates in a rural county in Anhui Province in the early 2000s (I, II)

2) To investigate the issue of sex ratio at birth and its reasons in a rural county in Anhui Province in the early 2000s (II)

3) To examine the provision, utilization, and content of maternal care in a rural county in Anhui Province in the early 2000s (III, IV)

4) To assess the changes in the use of maternal care in China 1993-2003 (IV).
5. MATERIALS AND METHODS

5.1 Study settings

The data for this study come from two sources: from the National Household Health Survey (NHHS) and from the project “evaluation of prenatal care programme in rural China” conducted in Dinyuan County of Anhui Province.

The study county, Dingyuan, is situated in a rural area of Anhui Province, in eastern China. The total area of the county is about 3000 square kilometres, mostly of flatland. In terms of national GDP rankings the study county is a typical less developed rural area in China. Most of the population in this county (nearly 900000) is engaged in farming. The healthcare system in the county consists of county hospitals and decentralised township and village-level healthcare services. The local family-planning system is also organised at three levels. The county level authorities supervised the national policy, but its implementation mainly took place at township and village levels.

5.2 Study design

The study designs of this thesis include a retrospective cohort study (I, II), a cross sectional interview survey (III, IV), and use of statistical data (I, II, III).

First, a study titled “Evaluation of prenatal care programme in rural China” was carried out in Dingyuan County, Anhui Province. Within this evaluation study, three types of data were collected and used in this thesis, which include: 1) a cohort of pregnant women followed from pregnancy registration to 7 days after birth in 20 townships in the study county in 1999-2002, collecting information before, during, and after the intervention; pregnancy outcomes were ascertained from family planning records; 2) an interview survey carried out in 2000-2003 among women who had given birth in 2001 and 2003 in the same townships and 3) to prepare for the intervention study, various other statistical and qualitative data were collected from the study county.

Secondly, we used three sets of National household health interview surveys data (1993-2003), and reanalyzed them to describe the changes and distribution in utilization of maternity care.

5.3 Data collection

In the first study described above, twenty townships (10 interventions and 10 controls) out of a total of 55 were selected — on the basis of having sufficient health facilities and staff — for a controlled trial on the introduction of systematic prenatal care in the area. The selected townships
were representative of the study county in terms of socioeconomic background: The farmer net annual income per capita in the 20 study townships was 270 USD, and in the whole county it was about 260 USD.

In the following sections the different data and methods from the both the Dingyuan project and from the NHHS used in this study are described.

5.3.1 Routine work record from family planning sector (I, II)

A trained local field research assistant abstracted the data on pregnancies and their outcomes from the original hand-written work records (Appendix 1) of the village family planning workers of the 20 study townships. The records included data on all women who had a positive pregnancy test result and on the pregnancy outcome so that each outcome could easily be linked to the respective woman. The data collection occurred at the township level where the records of each village were brought each month for the compilation of statistics. The subsequent outcomes of the pregnancies of the 1999 cohort were followed up in family planning records in 1999 or 2000.

In early 2004 the local research assistant also went back to the original family planning records of the 20 study townships to examine if any new births had retroactively been recorded into the pregnancy records of 1999. A total of 267 previously unreported pregnancies and their outcomes were found to have been entered in the study township family planning records. Data on these 267 pregnancies were the additional data set to the original cohort and together with the original data formed the supplemented cohort.

5.3.2 Local government documents, statistics and 2000 census (I, II, III)

In 2000, a nationwide population census was made in China. The census data of the study county was collected during the period of November 1, 1999 to October 31, 2000, counting the numbers of men and women by age and locality.

In 2004 we gained access to the census data of the study county (aggregated by township) and the region. The region consisted of the study county and three other counties and three cities. Using the raw census data, we calculated the sex ratios at birth, for under 1-year olds, for 1-to-4-year olds and 5-to-9-year olds.

In early 2004, we went back to the original family planning records of the 20 study townships to examine if any new births had retroactively been recorded into the pregnancy records of 1999. A total of 267 previously unreported pregnancies and their outcomes were found to have been entered in the study township FP records. Data on these 267 pregnancies were the additional data
set to the original cohort and together with the original data formed the supplemented cohort.

The statistics of health facilities and obstetrical staff were collected from the county health bureau. The document “Management method of systematic maternal care in rural areas” issued by the Ministry of Health of China in 1989 (MOH 1989) was used to compare the provision and utilization of maternal care in the study townships with the national norms. This document does not cover the issues involved in financing maternal care or whether the care should be free for users.

The socioeconomic data were collected from the county statistical bureau.

5.3.3 Community-based structured questionnaire survey of service users (III)

About 10, 20 and 30 percent of villages in the ten control townships were randomly selected to be surveyed in October-December in 2001, 2002 and 2003, respectively. All women who had given birth within 12 months prior to the three knowledge, attitude and practice (KAP) survey periods in these villages were approached for an interview. During that time, there were 722 women who were eligible for the study according to the records kept by the local family planning system.

Interviewers were recruited from among local health workers (not midwives or family planning workers). They were trained to conduct interviews by a researcher.

The structured questionnaire (Appendix 2) used in the survey included 64 questions covering infant outcomes, infant health and women’s knowledge, attitudes, and practices relevant to prenatal, delivery, and postnatal care. The interviews were conducted at the participants’ homes. If the mother was not at home at the time of the survey, the father or some other family member responded on her behalf. Mothers with dead infants were not approached for interviews.

5.3.4 Observation and interview of health care providers (III)

The director and vice director of the county health bureau, the directors of the county maternal and child health care station, the directors of the county hospital and the directors of the 10 study township hospitals were interviewed in their offices using a semi-structured questionnaire (Appendix 3 and 4) concerning the provision and organization of services, the characteristics of the township hospital, the availability of equipment and staff, the funding of the hospital and the level of providers’ income in mid-2000 and mid-2003 by one of the researchers.

The field research assistant observed the implementation of maternal care trial in all the study townships and reported her findings to the researchers regularly. The observation activities
included site visits to all study township hospitals and family planning service stations, to all county level hospitals including maternal and child health care institutes, and to some randomly selected village family planning posts and health clinics. The observations covered study settings, activities, and services provided by both the health care and the family planning facilities.

5.3.5 National household health surveys (NHHS) (IV)

Data were drawn from three National Household Surveys (NHHS) conducted in 1993, 1998, and 2003 under the supervision of the Chinese Ministry of Health, covering both urban and rural populations in China. In NHHS a four-stage stratified random sampling procedure was used to select the households. The sampling method and sample size was almost the same for the three household surveys. In each survey, 95 counties/cities were taken as samples. Five townships/streets were taken from each sample county or street. The total households selected were 57000 (the population was 193689 in the 2003 survey, 216101 in the 1998 survey and 215163 in the 1993 survey). The selected households represent 1 per 5000 households of the country.

The surveys used standardized questionnaires including general demographic and socioeconomic information on sampled households and their members, perceived needs of and demands for health care, and use of and expenditure on health services. One section in the questionnaires focused on reproductive health and the health care of married women aged between 15 and 49 years old and provided data about the history of women’s pregnancy-related activities. It is reasonable to infer that these data were comparable across years.

Ten indicators of socioeconomic development were used to categorize more than 2400 cities and counties in China into seven strata (large, middle and small cities\(^1\), and four types of rural areas with different levels of socioeconomic development). The quality of the data collected from the surveys has been shown to be satisfactory in terms of representativeness of the sample and reliability of the data. For example, the structure of the study population sampled in the 1993 survey was very similar to that of the population data derived from the Chinese population census in 1990 (Tang et al 2006, MOH 2004).

In the study, we selected those who had live births within the 24 months prior to the survey from all married women aged between 15 and 49 interviewed in each NHHS data collection round, and analyzed their maternal healthcare use with regard to their demographic characteristics and their place of residence. The women who gave birth from June 1991 to May 1993, January 1996 to December 1997, and September 2001 to August 2003 in selected households were interviewed. The number of women interviewed was 4972 (825 from urban

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\(^1\) The population of a large city was above 1 million, and a small city was categorized as less than 0.3 million. The size of a city tends to be indicative of a higher level of economic development and a greater allocation of healthcare resources.
and 4147 from rural areas), 3910 (696 from urban and 3214 from rural areas) and 3289 (608 from urban and 2681 from rural areas) in the three surveys respectively. The total response rate for the interview was 100%. If the selected household was not available for interview when visited, the next neighbouring household was approached instead.

The indicators of healthcare used in our analysis were: the proportion of first prenatal visits within 12 weeks of gestation; the proportion of the frequency of prenatal care visits meeting national MOH standards; the hospital delivery rate; the proportion of delivery out of hospital attended by trained staff in rural areas; and the proportion of postnatal visits. The Ministry of Health stipulates that pregnant women should: have at least 5 prenatal visits in rural areas and 8 visits in urban areas; have their first prenatal visit before 13 weeks of gestation; and have at least 3 postnatal visits (within 42 days of delivery) in both rural and urban areas (MOH 1985).

5.4 Data analysis

The informant interview data were analysed using the induction approach.

The data were entered into the computer using EPI-INF O (version 6.04) software and analysed using SPSS 8.0 for Windows.

In study I and II, relative risks (RR) and their confidence intervals (CI) (Gardner et al. 1989) were calculated for comparison between parity, approval status, infant sex and township groups. In study III, frequency and proportion were used to compare the differences in maternal care use between different parities. In Study IV, the chi-square test was used to analyze the difference in use of maternal care between and within urban and rural areas and its trend across the years in the study.
6. MAIN RESULTS

6.1 Pregnancy and perinatal outcomes of registered pregnancies in 1999-2000 in the study county (I)

There were 3697 pregnancies in the cohort, resulting in 3092 live births in a total population of 299,463 in the 20 study townships in 1999-2000. The average age at pregnancy in the cohort was 25.9 years. Eighty-five percent of the women were younger than 30 years. Of the women, 61% were childless, 38% already had one child and 0.3% had two children before this pregnancy.

Fifteen percent of pregnancies ended in abortion, 43% of them spontaneously and 57% by induction. Two percent of pregnancies ended in stillbirth and 84% in a live birth (Figure 1).

Figure 1  Flow chart of follow-up and outcomes of the study cohort in 1999-2000 in the study county

The proportion of both stillbirths and of spontaneous abortions among second births was almost three times higher than that for first births, and the proportion of induced abortions increased 20-fold from first to second pregnancies. Only 66% of second pregnancies ended in a live birth (Table 9). The approval status was a significant determinant of pregnancy outcome: 90% of
approved pregnancies ended in a live birth while 73% of unapproved ones were aborted. Among approved pregnancies, 80% of abortions were registered as spontaneous, but among unapproved, 99% of abortions were registered as induced. Stillbirths were significantly more common in second than in first pregnancies, but they appeared only among approved pregnancies (Table 10).

The PNMR was 69 per thousand births. If the 30 induced abortions in which the gestational age was more than 28 weeks were counted as perinatal deaths, the PNMR would be as high as 78 per thousand. Approximately two thirds of the perinatal deaths occurred in the early neonatal period. Both the SBR and the ENMR increased with parity. The risk of a stillbirth in a second pregnancy was almost four times that for a first pregnancy, while the risk of an early neonatal death doubled. The ENMR was twice as high for female as for male infants. The sex difference in the ENMR was mainly attributable to mortality in second births. The male ENMR was not affected by parity, while the female ENMR increased dramatically with parity: it was about six times higher for second births than for first births (Table 9). The PNMR was negatively associated with the wealth of the township (Table 11). The differences between townships were due to the ENMR, which was higher in townships of lower socioeconomic status, while the SBR, whether calculated with or without the late abortions, was not affected by the wealth of the township.

Table 9 Pregnancy and perinatal outcomes by parity in 1999-2000 in the study county 1)

<table>
<thead>
<tr>
<th>Parity1</th>
<th>Parity2</th>
<th>Parity3+</th>
<th>Total</th>
<th>RR 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pregnancies</td>
<td>2255</td>
<td>1409</td>
<td>11</td>
<td>3697</td>
</tr>
<tr>
<td>Pregnancy outcomes (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscarriages</td>
<td>3.9</td>
<td>10.4</td>
<td>0.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Induced abortions</td>
<td>1.0</td>
<td>20.5</td>
<td>0.0</td>
<td>8.4</td>
</tr>
<tr>
<td>Still births</td>
<td>1.2</td>
<td>3.3</td>
<td>0.0</td>
<td>2.1</td>
</tr>
<tr>
<td>Live births</td>
<td>94.6</td>
<td>66.2</td>
<td>100.0</td>
<td>83.6</td>
</tr>
<tr>
<td>Perinatal outcomes (%o) 4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity 1</td>
<td>Parity 2+</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBR 5)</td>
<td>12.5</td>
<td>48.0</td>
<td>-</td>
<td>24.0</td>
</tr>
<tr>
<td>SBR 4) 6)</td>
<td>14.3</td>
<td>72.6</td>
<td>-</td>
<td>33.1</td>
</tr>
<tr>
<td>ENMR 7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>34.9</td>
<td>205.8</td>
<td>-</td>
<td>69.0</td>
</tr>
<tr>
<td>PNMR 5)</td>
<td>43.5</td>
<td>121.4</td>
<td>68.8</td>
<td>2.8</td>
</tr>
</tbody>
</table>

1). Pregnancy outcomes total over 100% because there were 24 pairs of twins and one set of triplets.
2). Includes 22 women of unknown parity.
3). Calculated for Parity 2 with Parity 1 as reference group.
4). The numbers of live births were 2134, 933, 3092 for parity 1, parity 2 and total respectively.
5). SBR = stillbirth rate, ENMR = early neonatal mortality rate, PNMR = perinatal mortality rate.
6). Calculated per 1000 births (stillbirths and live births).
7). Including 30 induced abortions after 28 gestational weeks.
### Table 10 Pregnancy and perinatal outcomes by approval status and parity in 1999-2000 in the study county (%) 1)

<table>
<thead>
<tr>
<th>(Pregnancies, n)</th>
<th>Approved pregnancies</th>
<th>Unapproved pregnancies</th>
<th>Unapproved/Approved</th>
<th>P2/ p1 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
<td>Total</td>
<td>P2</td>
</tr>
<tr>
<td>(Pregnancies, n)</td>
<td>(2255)</td>
<td>(1072)</td>
<td>(3327)</td>
<td>(336)</td>
</tr>
<tr>
<td>Abortions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Induced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stillbirths</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Live births</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1). There were 24 pairs of twins and one set of triplets, and therefore the sum of pregnancy outcomes is not equal to 100%; the outcome of 3 pregnancies was lacking. p1 = parity 1, p2 = parity 2, p3 = parity 3, RR = relative risk, CI = confidence interval.

2). Approved pregnancy is defined the woman has to have permission for it from the population authorities. Unapproved pregnancy is just opposite (Hemminki E et al, 2005)

3). Calculated for parity 2 with parity 1 within the approved group.

### Table 11 Perinatal outcomes by township wealth in 1999-2000 in the study county 1)

<table>
<thead>
<tr>
<th>Perinatal outcomes</th>
<th>Highest quarter FNI</th>
<th>Middle FNI</th>
<th>Lowest quarter FNI</th>
<th>RR 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBR 3)</td>
<td>19.2</td>
<td>27.8</td>
<td>20.8</td>
<td>1.1</td>
</tr>
<tr>
<td>SBR 3), 4)</td>
<td>26.8</td>
<td>39.4</td>
<td>25.5</td>
<td>1.0</td>
</tr>
<tr>
<td>ENMR 5)</td>
<td>33.3</td>
<td>44.1</td>
<td>68.6</td>
<td>2.1</td>
</tr>
<tr>
<td>PNMR 3)</td>
<td>51.9</td>
<td>70.7</td>
<td>88.0</td>
<td>1.7</td>
</tr>
</tbody>
</table>

1). n = total births. The numbers of live births were 870, 1610, and 612 for the columns respectively. SBR = stillbirth rate, ENMR = early neonatal mortality rate, PNMR = perinatal mortality rate, FNI = farmers’ net annual income per capita.

2). Calculated for lowest quarter with highest quarter as reference.

3). Calculated per 1000 total births (stillbirths and live births).

4). Stillbirths including induced abortions at a gestation age of more than 28 weeks.

5). Calculated per 1000 live births.
6.2 Sex ratio at birth of registered pregnancies in 1999-2000 in the study county (II)

The total sex ratio at birth of 3697 registered pregnancies was 152 males to 100 females, with 118 and 287 in first and second pregnancies respectively. Among unapproved pregnancies, there were almost 5 live-born boys for each girl. However, because these births only accounted for 3% of the live births, the sex ratio at birth in second pregnancies was determined mostly by the approved pregnancies. Within 24 hours, the sex ratio rose to 158 and remained almost unchanged until the seventh day of life (Table 12).

Most (82%) early neonatal deaths happened within 24 hours after birth, and during that time, girls were almost three times more likely to die than boys. The death rate of females on the day of birth increased much more sharply with parity than that of males. Girls born from second pregnancies were almost seven times more likely to die on their day of birth than boys, while there was no significant difference in the death rates of first-born girls and boys. At the age of 1–6 days, the death rates of girls and boys did not differ in first or in second pregnancies (Table 13).

To estimate the potential contribution of different reasons for the high sex ratio at birth, we calculated the hypothetical number of missing girls in the original cohort (Table 14). Assuming the normal sex ratio at birth to be 106 males for 100 females (Davis DL et al. 1998), the original cohort of pregnancies that produced 1853 boys (only women of known parity included) should have produced 1747 girls; however, 528 girls less were actually born. Most often, females were missing in the group of approved second pregnancies. In that group, as opposed to other groups, the total number of recorded abortions was less than that of missing female infants.

In the 267 pregnancies entered into the family planning records of 1999 retroactively, there were 251 live births, 189 boys and 62 girls, a higher sex ratio (305 per 100) than in the original cohort. Similar to the original cohort the sex ratio reflected the approval status being 421 per 100 among unapproved (n=125) and 232 among approved pregnancies (n= 126). When the known additional live births were added to the original cohort the sex ratio rose to 159 per 100 at birth and 166 at 7 days of age. The estimated number of missing girls at birth in the supplemented cohort was 645.

### Table 12 Number of live born boys and girls born from the original cohort of registered pregnancies and sex ratio by approval status, parity, and time after birth in 1999-2000 in the study county 1)

<table>
<thead>
<tr>
<th>Time after birth</th>
<th>Approved pregnancies</th>
<th>Unapproved pregnancies</th>
<th>Total pregnancies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p1</td>
<td>p2</td>
<td>Total</td>
</tr>
<tr>
<td>0 hours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>1156</td>
<td>617</td>
<td>1773</td>
</tr>
<tr>
<td>Girls</td>
<td>976</td>
<td>228</td>
<td>1204</td>
</tr>
<tr>
<td>Sex ratio</td>
<td>118.4</td>
<td>271</td>
<td>147</td>
</tr>
</tbody>
</table>
Table 13 Early neonatal deaths per 1000 live births by sex and days after birth among approved live births in the original cohort in 1999-2000 in the study county

<table>
<thead>
<tr>
<th>Days after birth</th>
<th>p1</th>
<th>P2</th>
<th>Total</th>
<th>RR 2)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 day</td>
<td>21.2</td>
<td>78.1</td>
<td>36.3</td>
<td>3.7</td>
<td>0.8-2.6</td>
</tr>
<tr>
<td>Boys</td>
<td>17.6</td>
<td>31.8</td>
<td>22.0</td>
<td>1.8</td>
<td>4.0-11.2</td>
</tr>
<tr>
<td>Girls</td>
<td>25.6</td>
<td>206.1</td>
<td>59.8</td>
<td>7.8</td>
<td>1.9-4.0</td>
</tr>
<tr>
<td>RR 3)</td>
<td>1.5</td>
<td>6.7</td>
<td>2.7</td>
<td>1.0</td>
<td>0.4-2.3</td>
</tr>
<tr>
<td>95% CI</td>
<td>0.8-2.6</td>
<td>4.0-11.2</td>
<td>1.9-4.0</td>
<td>1.0</td>
<td>0.4-2.3</td>
</tr>
</tbody>
</table>

1). There were no deaths among unapproved births during the neonatal period. p1= parity 1, p2= parity 2, p3= parity 3, RR = relative risk, CI = confidence interval.

Table 14 Missing girls: Recorded live births versus expected live births, and the contribution of recorded abortions and stillbirths, in the original cohort in 1999-2000 in the study county

<table>
<thead>
<tr>
<th></th>
<th>Recorded live Births 1)</th>
<th>Expected live born girls 2)</th>
<th>Missing girls 3)</th>
<th>Recorded abortions</th>
<th>Recorded stillbirths</th>
<th>Difference 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>1773</td>
<td>1673</td>
<td>469</td>
<td>294</td>
<td>74</td>
<td>-101</td>
</tr>
<tr>
<td>Girls</td>
<td>1204</td>
<td>1091</td>
<td>115</td>
<td>27</td>
<td>47</td>
<td>+23</td>
</tr>
<tr>
<td>Parity 1</td>
<td>1156</td>
<td>1091</td>
<td>115</td>
<td>27</td>
<td>47</td>
<td>+23</td>
</tr>
<tr>
<td>Parity 2</td>
<td>617</td>
<td>582</td>
<td>183</td>
<td>47</td>
<td>47</td>
<td>-124</td>
</tr>
</tbody>
</table>

1). Live births of unknown parity and of unknown sex excluded, and 3 pregnancies with unknown outcome excluded. p1= parity 1, p2= parity 2, p3= parity 3, RR = relative risk, CI = confidence interval.
<table>
<thead>
<tr>
<th>Unapproved</th>
<th>80</th>
<th>15</th>
<th>75</th>
<th>60</th>
<th>252</th>
<th>0</th>
<th>+192</th>
</tr>
</thead>
<tbody>
<tr>
<td>parity2</td>
<td>69</td>
<td>15</td>
<td>65</td>
<td>50</td>
<td>252</td>
<td>0</td>
<td>+202</td>
</tr>
<tr>
<td>Parity3+</td>
<td>11</td>
<td>0</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>-10</td>
</tr>
<tr>
<td>Total</td>
<td>1853</td>
<td>1219</td>
<td>1747</td>
<td>528</td>
<td>546</td>
<td>74</td>
<td>+92</td>
</tr>
</tbody>
</table>

1). Excluding the live births of unknown parity and unknown sex.
2). Calculated using the recorded number of male live births as the base and assuming that the normal sex ratio at birth is 106 boys per 100 girls and assuming that no male foetuses were aborted.
3). Expected live born girls minus recorded live born girls.
4). A bortion and stillbirths minus missing girls.

6.3 Provision, financing, and utilization of maternal care in
2000–2003 in the study county (III)

6.3.1 Provision of maternal care

The public maternal care system in the study county, like the health care system in general, was organized into three levels of care: the county, township and village levels.

At county level, secondary to tertiary obstetric care was provided at two general hospitals (the county hospital and the hospital of traditional Chinese medicine) and at one specialised hospital (the maternal and child health care station). Specialised obstetric services were available only at the county level. At the township level, primary to secondary care was provided by midwives for normal births, but there were usually no systematic prenatal care services. The village-level private clinics were officially not involved in pregnancy or birth care. All three levels of health care in the study county functioned on a fee-for-service basis, and most farmers paid for all the health services out-of-pocket. Most delivery care was to be taken care in township hospitals. Also, most prenatal care services were provided by township midwives.

The county level hospitals served as the referral centres for the township hospitals in the county. However, there was no formal regulation or guidelines on how the referral system should work. Whether or not a woman was referred to a higher level hospital depended on the individual midwife’s professional judgment and on the clients’ compliance. Referral was not mandatory even in critical cases. However, women could freely seek care at the higher level hospitals if they so wished and could afford the cost of travel and higher fees. Most women attending the county level hospitals did so without a formal referral.

In parallel there were three levels of family planning services: at county institutes, township service stations and village service posst. At the county level, the family planning institutes were in charge of implementing the national family planning policy by supervising mandatory
pregnancy tests regularly to all married women. At township level, services were provided by medically trained staff at family planning stations that organised and performed systematic pregnancy testing, abortions and IUD insertions plus other contraceptive services. The family planning staff at county and township levels also offered maternal care consultations and did simple obstetric examinations during routine pregnancy test sessions. In addition to family planning services, these facilities at the county and township levels could also provide delivery services. At the village level, there was one female family planning worker who provided contraceptives, assisted in pregnancy testing and reported population events (including miscarriages, abortions, stillbirths, live births and neonatal deaths) to the township authorities. In the family planning system, married women aged 20 to 49 were required to undergo a pregnancy test every two or three months.

In the study county, the county health bureau had little power over township hospitals, because township hospitals had in the decentralisation process become directly accountable to the township government. At least some health bureau officials were health professionals, but the township government officials were all non-health-professionals.

6.3.2 Financing and funding of maternal care

In the township and county hospitals only 10-20% of the recurrent costs were funded by local government (township hospitals were funded by township governments and county hospitals were funded by county governments) and the hospitals collected user fees to balance their budgets. Also the staff salaries depended on the level of activity and thereby fee income in the hospital. The midwives’ income per month varied from 36 to 109 USD (mean=75 USD).

The hospitals could define the user charges themselves. Prenatal care consultations were however free in most township hospitals. Only one township hospital charged 0.36 USD for a consultation. The cost of an ultrasound test was from 1.81 to 3.63 USD (mean = 2.65 USD). The fees for urine and haemoglobin testing were from 0.48 to 1.21 USD (mean = 0.78USD), fees for normal deliveries were from 15.72 to 36.28 USD (mean = 24.91 USD) and Caesarean sections (at the county level) cost from 133.01 to 145.10 USD (mean = 139.06 USD) respectively.

6.3.3 Facilities and resources

Each study township hospital had a midwifery department with two to five rooms with basic equipment for delivery care where midwives saw women for prenatal and postnatal appointments. Delivery rooms were basic rooms with a simple delivery bed. All had electric lights but only 40% had running water. Manual suction pumps for infant airway clearance were available in 30%. Only two delivery rooms in the study area were equipped with air conditioners (combination heater/coolers), most used charcoal for warming up the rooms in the cold winter months when temperatures can drop down to minus 2-6 degrees Centigrade. Eighty per cent of the township
hospitals had an ultrasound machine and a technician to use it, but only 50% had a scale for weighing the mother during pregnancy. Basic laboratory equipment for urine and haemoglobin tests was available in 90% of the township hospitals. Only one of township hospitals had an operation theatre and a surgeon who could perform Caesarean sections. No medical records were kept in six of the 10 study township hospitals. Individual prenatal care cards were used in two out of the 10 township hospitals.

6.3.4 Timing, frequency and content of prenatal care

About half of the women had their first prenatal visit before their 13th gestational week, which is between the level of type II and Type III rural areas (Table 8). The timing of first prenatal visit did not change with parity.

More than half of interviewed women had 5 or more prenatal visits during their last pregnancy (Table 8). There were about 9% of the women who had no visits. The reasons for not attending prenatal care were: feeling the care was not necessary or worthless (42%), no time (17%), transportation issues (15%), too expensive (4%), other reasons (4%), no answer (19%). The reasons given were similar among women having had their first and second baby.

Blood pressure was measured on every visit for 54.1% of the women, 39.9% informed that it had been measured sometimes, 12.0% had no measurements. Haemoglobin measurement was done on 31.7% of the women once, 13.3% were tested more than once, 54.9% had no blood tests done. Ultrasound screening during pregnancy was common: 57.5% had had an examination at least once. There were more than 70% women who received health education on maternal nutrition (77%), baby care (73%), and maternal health care during pregnancy (84%) et al. from midwives during pregnancy.

6.3.5 Delivery and postnatal care

Most of the women (88%) gave birth in public health facilities, which was between the level of type I and type II (Table 8). There was an association between times of prenatal visits and the place of delivery. The women who delivered in public facilities had on average almost twice as many prenatal visits as the women who delivered in private clinics or at home. Thirty-five per cent of women who delivered outside public health facilities had not received prenatal care at all. In comparison 5% of the women who delivered in public health facilities had not used prenatal care.

According to the interviews of township hospital managers and township midwives, most of the women left hospital within 24 hours after delivery; the women only made postnatal visits to the clinic if the baby was sick; none of the midwives made postnatal home visits. Midwives did not provide postnatal visits to women’s home.
6.4 Changes in use of maternal care in China (IV)

6.4.1 Time trends in the use of maternal care in 1991-2003

1) Prenatal care use

(1) Proportion of women receiving first pre-natal visit within 12 weeks

The proportion of women who received their first prenatal visit within 12 weeks increased greatly from the early 1990s to the middle 1990s in all areas except for large cities. The increase was much larger in the rural areas, reducing the urban-rural difference from more than 4 times to about 1.4 times. The disparity decreased more remarkably among different types of rural areas than among cities of different size. The difference between the type 1 and the type 4 rural areas was narrowed from 8.1 times to about 2.1 times (Table 15 and Table 16).

(2) Frequency of pre-natal visits meeting MOH standards

In urban areas, the proportion of women who received antenatal care visits meeting MOH standards (at least 8 times) slightly increased from 47% in 1991-93 to 58% in 2001-2003 while in rural areas the proportion meeting MOH standards (at least 5 times) increased sharply from 12% in 1991-1993 to 36% in 2001-2003. The proportion of prenatal visits meeting MOH standard increase varied among different types of cities and different types of rural areas. In rural areas, the proportion increase was much faster in less developed areas than in developed areas. The proportion increased by 4.2 times in type 4, 4.1 times in type 3, 3.6 times in type 2 and 2 times in type 4 rural areas from 1991-1992 to 2001-2002 respectively (Table 15 and Table 16).

2) Delivery care use

The hospital delivery rate increased from 37.61% to 74.02% in China during the study period. However, the change of the rate varied among different classes of areas. The hospital delivery rate increased slightly from 89.70% to 94.36% in urban areas while the proportion increased from 27.25% to 69.44% in rural areas. The fastest change was found to be in type 4 rural area, where the utilization even quadrupled. The overall difference between rural and urban areas was substantially narrowed over the period (Table 15 and Table 16).

3) Postnatal care use

The proportion of women who received at least one postnatal visit dropped slightly in both urban and rural areas. It decreased from 64% to 61.68% in urban areas, and fell slightly from 55% in 1993 to 52% in 2003 in rural areas with no statistical significance. The difference of proportion of women receiving at least one postnatal visit between urban and rural areas was much smaller than the difference in the proportion of women who paid for prenatal care visits and delivered in
hospitals between urban and rural areas (Table15 and Table16).

Table 15 Use of maternal care in China by time and areas, 1991 to 2003 (%)

<table>
<thead>
<tr>
<th></th>
<th>Urban areas</th>
<th>Rural areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>First prenatal visit within 12 weeks of gestation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>56</td>
<td>13</td>
</tr>
<tr>
<td>1996-97</td>
<td>74</td>
<td>45</td>
</tr>
<tr>
<td>2001-03</td>
<td>68</td>
<td>49</td>
</tr>
<tr>
<td>Hospital delivery rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>90</td>
<td>27</td>
</tr>
<tr>
<td>1996-97</td>
<td>92</td>
<td>42</td>
</tr>
<tr>
<td>2001-03</td>
<td>94</td>
<td>69</td>
</tr>
<tr>
<td>Having postnatal care visits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>64</td>
<td>55</td>
</tr>
<tr>
<td>1996-97</td>
<td>61</td>
<td>51</td>
</tr>
<tr>
<td>2001-03</td>
<td>62</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: National House Household Survey Data

Table 16 Maternal care use in rural China by the development of the area, 1991-2003 (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
<th>Type 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>First prenatal visit within 12 weeks of gestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>24</td>
<td>17</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>1996-97</td>
<td>65</td>
<td>52</td>
<td>43</td>
<td>19</td>
</tr>
<tr>
<td>2001-03</td>
<td>61</td>
<td>57</td>
<td>47</td>
<td>29</td>
</tr>
<tr>
<td>Having prenatal visits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>27</td>
<td>13</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>1996-97</td>
<td>46</td>
<td>34</td>
<td>27</td>
<td>6</td>
</tr>
<tr>
<td>2001-03</td>
<td>53</td>
<td>46</td>
<td>32</td>
<td>12</td>
</tr>
<tr>
<td>Hospital delivery rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>57</td>
<td>28</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>1996-97</td>
<td>69</td>
<td>51</td>
<td>37</td>
<td>11</td>
</tr>
<tr>
<td>2001-03</td>
<td>93</td>
<td>83</td>
<td>65</td>
<td>33</td>
</tr>
<tr>
<td>Delivery out of hospital attended by trained staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>92</td>
<td>82</td>
<td>74</td>
<td>38</td>
</tr>
<tr>
<td>1996-97</td>
<td>72</td>
<td>79</td>
<td>65</td>
<td>33</td>
</tr>
<tr>
<td>2001-03</td>
<td>75</td>
<td>75</td>
<td>69</td>
<td>26</td>
</tr>
<tr>
<td>Having postnatal care visit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991-93</td>
<td>71</td>
<td>64</td>
<td>48</td>
<td>39</td>
</tr>
<tr>
<td>1996-97</td>
<td>66</td>
<td>61</td>
<td>48</td>
<td>27</td>
</tr>
<tr>
<td>Year</td>
<td>First Prenatal Visits</td>
<td>Prenatal Visits</td>
<td>Home Birth</td>
<td>Postnatal Visits</td>
</tr>
<tr>
<td>------</td>
<td>----------------------</td>
<td>----------------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>2001-03</td>
<td>67</td>
<td>55</td>
<td>51</td>
<td>37</td>
</tr>
</tbody>
</table>

Source: National House/hold Survey Data.

1). Proportion of the first prenatal care visits within 12 weeks of gestation.
2). Proportion of prenatal care visits no less than 5 times.
3). Proportion of the deliveries out of hospital attended by trained staff.
4). Proportion of postnatal visits no less than 1 time.
7 DISCUSSIONS

7.1 Main findings in view of previous literature

7.1.1 The determinants of perinatal mortality and high sex ratio at births

The results from this study show that the early neonatal mortality rate (ENMR) contains two-thirds of the perinatal mortality rate (PNMR). The ENMR among those in the lowest quarter for farmer net annual incomes was double that of those in the highest quarter. However, female ENMR among those with two children was about 6 times that of male ENMR. The results also suggest that, although ENMR was associated with economic development, the excess female ENMR contributed much more to high ENMR and PNMR than economic factors in the study county. This big gender disparity in ENMR might be a result of family planning policy and the traditional culture of son preference, which leads to lethal neglect of female newborns.

The possible scenarios leading to the high sex ratio at birth and among newborn infants discussed here are based on the assumption that cultural and economic preference for boys are prevalent in the study county. Other studies have shown that these factors are prevalent elsewhere in rural China (Hesketh and Zhu 1997; Mu 1995; Doherty et al. 2001; Li 2004), and that this preference in the context of strict enforcement of the family planning policy would guide the parents to try to ascertain the sex of the foetus prenatally and perform sex selective induced abortion. These practices of course are very difficult to prove due to their illegality. Though the use of medical technology to perform prenatal sex determination has been strictly forbidden in China since 1989 and sex-selective abortions were outlawed in 1994 (Bogg 1998), enforcement of the regulations has proven difficult. Prenatal screening of foetal sex is widely practiced in China, even in rural areas (Chu 2001; Bloom and Tang 1999).

The one child policy is one of the indirect causes of increased SRB. The sex ratio in some other Asian countries, such as South Korean, Vietnam, and India are also high, where there is no coercive one-child policy but son preference exists (Ansley 1994; Poston et al. 1994; Park and Cho 1995; Shah et al. 2000). The root cause or motivation for couples to abort female foetuses, not to report female births or to infanticide the female baby is due to the culture of son preference. This culture is intricately linked with the economic reality couples’ lives, as there are financial and psychological repercussions for parents who have no sons (Hemminki et al. 2005; Liptov et al. 2008). Sons are preferred because (i) they have a higher wage-earning capacity, especially in agrarian economies (Badu 1989); (ii) they continue the family line; (iii) they are generally recipients of inheritances (Coale and Banister 1996; Ahold et al. 1998); and (iv) daughters cease to have responsibility for their parents in illness and old age (Leone et al. 2003; Shah et al. 2000).
7.1.2 The determinants of the use of maternal care in the study county

Previous studies in many underdevelopment or poor rural areas in China have shown that that expensive user fees, long distance to travel or lack of transportation means were the most important obstacles to access to available prenatal care (An et al. 2004; Huang et al. 2001). In this study the most important factor which the women reported as a hinder for prenatal care was their belief and lack of recognition of the importance of prenatal care.

The equipment in prenatal care facilities did not conform to the needs of good prenatal care settings. Rather it seems that investments in equipment were based on the ability to generate income for the hospital. The high hospital delivery rate may be attributed to the “Healthy mother and well baby” campaign launched by the health related international organizations such as WHO and UNICEF and supported by the Chinese government since the early 1990s (Chen 1994; Zhang 1996).

The economic reform in rural China (changing the collective economy to household responsibility economy) and social reform (decentralization of government administration, changing from the Cooperative Medical Scheme to fee for health services and paying out of the users’ own pockets) hinders the delivery and implementation of the policies or regulations from a high level government to a lower level government. In our study this could be seen in the lack of authority of county health bureau over township hospitals. The management decisions of township hospitals were more governed by balancing the income and expenses of the facilities rather than whether quality care practices compiled with the regulations from the higher levels of government.

7.1.3 Change and equity in the use of maternal care in China

From 1991 to 2003, there were significant improvements in utilization of maternal care, including prenatal care and delivery care in both rural and urban areas, but the pace of increase varied over different periods and between different areas. Utilization of post-natal care was the exception in that it slightly decreased in all areas.

The overall trend towards substantially increased utilization of most maternal healthcare services may be attributed to several major developments in China. First, the findings suggest that despite legitimate concerns about the negative impact of health sector reforms, general socio-economic development, including increases in income, living standards and educational levels may have played an important part in enabling increased utilization of services. Second, external pressures through the global emphasis on MCH and the availability of finances from international organizations supported a substantial legislative, policy and programmatic efforts by the Chinese government in the 1990s.
The more rapid increases in utilization of maternal care occurring in the rural than urban area, and particularly in the poorest rural areas, may be partly attributed to the focus of these development programmes on socio-economically less developed rural areas. However, it may also be due to the already relatively high utilization in urban areas so that further progress was harder to make. Despite the more rapid increase in utilization in rural areas, the absolute level of utilization of some services remained unacceptably low in rural areas in the early 2000s.

In addition, some indicators stagnated or even decreased after the late 1990s. For instance, the proportion of first prenatal visit within 12 weeks of gestation in small and medium-sized cities decreased from 1997 to 2003; and the proportion of post-natal care visits decreased slightly in both urban and rural areas. Stagnation and decreases may have been due to the effects of health sector reforms, including decentralization of the management of rural hospitals to local government leading to management problems, a lack of attention to preventive care; and increases in out-of-pocket payments for healthcare and healthcare costs relative to income level (Kaufman and Fang 2002; Gao et al. 2002; Tang and Bloom 2000; Tao et al. 2010; Feng et al. 1995).

7.2 Methodological considerations

7.2.1 Strengths of the study

In most developed countries, the data source for perinatal mortality is the routine vital-statistics registration system. In China this is available only in urban areas where most perinatal statistics are hospital-based. The reliability of such statistics has been questioned because of under-reporting of deaths occurring at home (Almanac of China's population 2000).

This was the first community-based cohort study in China that used data collected routinely by the family planning system at the village level to study issues of perinatal mortality and sex ratios at birth (Paper I and Paper II). The chosen data source proved effective in following up the pregnancies to their end outcomes, as only in 3 out of 3697 cases were the outcome data missing. In China, where family planning policy and its implementation are given top priority status at all levels, pregnancy data collection are also prioritized. Families also have a specific incentive to report miscarriages, stillbirths and infant deaths to the family planning system as this leads to authorization for a new pregnancy. Since the family planning cadre was responsible for only one village with a population of 1000 on average in a relatively small area, she would generally be aware of pregnancies among her clients. Married women living outside their home villages for longer periods of time were required to regularly mail back family planning certificates for pregnancy testing. The control system was therefore comprehensive.

Few studies describing maternal care in China in detail are published in English. This is the first study (Paper III) exploring the organization, provision and use of maternal care in rural China,
while covering both service providers and users.

Few articles were previously published internationally with data collected from three National Household Health Surveys. This was the first paper in English (Paper IV) to use nationwide household survey data to explore changes in the use of maternal care in China.

### 7.2.2 Limitations of the study

The data used in study I and study II had some possible biases. Though the whole cohort with a registered pregnancy was followed up, some unregistered pregnancies might have occurred. There might also have been misclassification of cases in the registers. Pregnant women were also inclined to report a later-than-actual date for their last menstrual period in order to gain time for the determination of the sex of the foetus. Therefore, the detected SBRs are probably underestimated.

In Study III, because the women’s interviews were done by local health workers who came from the same area as the interviewees, the women may have thought that they represented health authorities, which might have reduced their willingness to speak freely in interviews and the level and quality of maternal care use might be overestimated.

Another drawback of this study is that the parents of dead neonates were not interviewed, so that it is impossible to explore the factors influencing the use of maternal care of these mothers and its association with neonatal deaths. It was also impossible to study the impact of the family planning policy and son preference on perinatal health among this group of women.

As Study I, II, and III were conducted in only one county, the study results might not be generalized to other areas.

In study IV, the data on women who experienced stillbirths or maternal mortality is not available in the NHHS. The exclusion of these women should be considered a limitation of our study methodology since it places some limitations on the generalizability of our findings to the whole population of pregnant women.

This thesis did not explore the association between the use of maternal care (Paper III, Paper IV) and perinatal health (Paper I and Paper II).
8 CONCLUSIONS

1) Perinatal mortality in this study was much higher than that for urban areas and also higher than any reported rate from specific studies in rural areas of China. Previous studies in which calculations of infant mortality were not based on epidemiological surveys have been shown to underestimate the rates by more than 50%.

2) Routine statistics collected by the Chinese family planning system proved to be a reliable data source for studying perinatal health, including stillbirths, neonatal deaths, sex ratio at birth and among newborn. National Household Health Survey data proved to be a useful and reliable data source for studying population health and health services. Few articles in these areas have previously been provided to international audiences.

3) Though perinatal mortality rate was negatively associated with level of township economic development, the excess female early neonatal mortality rate contributed much more to a high perinatal mortality rate than economic factors. This was likely a result of the role of the family planning policy and the traditional preferences for sons, which leads to lethal neglect of female newborn and high perinatal mortality.

4) The selective abortions of female foetuses were likely to contribute most to the high sex ratio at birth. The underreporting of female births seemed to have played a secondary role. The higher early neonatal mortality rate in second-born as compared to first-born children, particularly in females, may indicate that the neglect or poorer care of female newborn infants also contributes to high sex ratio at birth or among newborn. Existing family planning policy proved not to effectively control the steadily increased sex ratio at births.

5) The rural-urban gap in service utilization was on average significantly narrowed in terms of maternal healthcare in China from 1991 to 2003. This demonstrates that significant achievements in reducing inequities can be made through a combination of socio-economic development and targeted investments in improving health services, including infrastructure, staff capacities, and subsidies to reduce the costs of service utilization for the poorest. However, the huge gap which still remained among cities of different sizes and within different types of rural areas indicates the need for further efforts to support the poorest areas.

6) Hospital delivery care in the study county was better accepted by women because most of the women think delivery care was very important while prenatal and postnatal care were not. Hospital delivery care was more systematically provided and promoted than prenatal and postnatal care by the township hospitals in the study county. The reliance of hospital staff income on user fees gave the hospitals an incentive to put more emphasis on revenue generating activities such as delivery care instead of prenatal and postnatal care, since delivery care generated much profits than prenatal and postnatal care.
9. RECOMMENDATIONS FOR POLICY MAKERS AND FUTURE RESEARCH

1. It is essential for the central government to re-assess and modify existing family planning policies. In order to keep national sex balance, the existing practice of “one couple one child” in urban areas and “at-least-one-son” a couple in rural areas should be gradually changed into a two-children-a-couple policy throughout the country. The government should establish a favourable social security policy for pension and medical care insurance for couples, especially for rural couples who have only daughters. This should be, combined with an educational campaign for equal rights for boys and girls in the society.

2. There is no routine vital-statistics registration system in rural China so far. Based on the findings of this study, it is possible for the central government to set up a routine vital-statistics registration system using family planning routine work records and allow policy makers and researchers to use it.

3. It is possible for the central and provincial governments to invest more in the less developed and poor rural areas to increase the access of pregnant women in these areas to maternal care services. Central government together with local government should gradually provide free maternal care including prenatal and postnatal as well delivery care to the women in poor and less developed rural areas.

4. Future research could be done to explore if county and township level health care sector and family planning system could be merged to increase the effectiveness and efficiency of maternal and child care.

5. Future research could be done to explore the relative contribution of maternal care, economic development and family planning policy on perinatal and child health by using prospective cohort studies and community based randomized trials.
10. ACKNOWLEDGEMENTS

First of all, my deepest and warmest thanks go to Professor Elina Hemminki, my main supervisor, for her efforts in guiding me in this work. Without her support and encouragement in my research and writing, this thesis would have been impossible. I appreciate her accepting me as her Ph.D. student and introducing me to the field of maternal and child health research. Her experience and excellent arrangements made my course work, papers and thesis writing smooth and efficient, using her profound knowledge, professionalism and enthusiasm for research. I would also like to thank her family for their hospitality and kindness, which made my stays in Helsinki warm and enjoyable. Special thanks to my second supervisor, Dr Shenglan Tang, now working for WHO, Geneva. Many thanks for his sharing the ups and downs over the years with me, always giving me the needed encouragement and support.

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Finally, I would like to express my sincere thanks to my parents, my brothers and sister, for their continuous moral support; to my parents-in-law for their support when I was studying abroad; to my wife (Gao Yumei) and my daughter (Lily) for their understanding, patience and support of my study. I would like to dedicate this thesis to my dear daughter Lily. She keeps my every day life filled with happiness and hope for the future.
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Appendix 1: Form for collecting information of married women’s pregnancy and its outcomes from township family planning station

1. Name of township:
2. Name of village:
3. Pregnant woman’s name:
4. Pregnant woman’s age: (Date of birth: Year /month)
5. Time of last menstrual period: (Year /month)

5. Outcomes of the pregnancy

<table>
<thead>
<tr>
<th>Name of pregnancy outcomes</th>
<th>Date of the outcomes happened</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural abortion</td>
<td>Year /month/date</td>
</tr>
<tr>
<td>Induced abortion</td>
<td>Year /month/date</td>
</tr>
<tr>
<td>Still birth</td>
<td>Year /month/date</td>
</tr>
</tbody>
</table>

**Live birth**

- 1) Date of live birth
- 2) Baby gender (boy or girl)
- 3) Parity (order of the living children)
- 4) Mode of delivery (vaginal or cesarean section)

<table>
<thead>
<tr>
<th>Infant death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of the death</td>
</tr>
<tr>
<td>Gender of the dead infant (boy or girl)</td>
</tr>
</tbody>
</table>
Appendix 2: Questionnaire for community-based household women’s survey

Mother’s address ______ Province ______ County ______ Country ______ Village
The Code of the Questionnaire ______
The mother’s name _______ The Zip Code of the Address ______
The Date of the survey ____________ in 2007
Who is answering the question? The child’s 1) mother 2) father 3) grandmother 4) grandfather 5) other _______.
If it’s not answered by the child’s mother, specify the why it is not ________.

Family information

1. Your birth date __________ (mm/dd/yyyy)
2. Your nationality __________
3. Your education __________ (1) illiteracy (2) primary school (3) middle school (4) high school (5) college or better. Or you had been educated for _____ years.
4. Your occupation __________ (1) farmer (2) worker (3) teacher (4) doctor (5) others ________
5. Your health status during your pregnancy (1) very good (2) good (3) not bad (4) bad (5) worst
6. Your husband’s birth date _______ (mm/dd/yyyy)
7. Your husband’s nationality ______
8. Your husband’s education status (1) illiteracy (2) primary school (3) middle school (4) high school (5) college or better. Or you had been educated for _____ years.
9. Your husband’s occupation (1) farmer (2) (3) worker (4) teacher (5) doctor (6) other ________
10. How many people were in your family? _______
11. Comparing with other families in your village, your family’s economic status was _____ (1) very good (2) good (3) not bad (4) bad (5) worst
12. In the year before the child’s birth your family annual income was _____ yuan? your annual household expenditure was _____ yuan?
13. Before the child was born, did your husband work out of your hometown?_____ (1) yes (2) no.
   If yes, for how many years ______, and make how much money for your family in 2005 ______?
14. Before the child was born, did you work out of hometown? ______ (1) yes (2) no.
   If yes, for how many years ______, and make how much money for your family in 2005 ______?
15. Did your family own TV during your pregnancy? _____ (1) no (2) yes, we had a black-white TV (3) yes, we had a colour TV (4) yes, we had 2 or more TVs
16. Did your family have telephone during your pregnancy? ______ (1) no (2) yes, we had a phone. (3) yes, we had a mobile phone. (4) yes, we had both a phone and mobile phone.
17. The type of your house was: 1) The ceiling and was tile or concrete 2) The ceiling was tile and wall was soil 3) others _____
18. The distance between your house and village clinic was (1) less than 1 kilometres (2) 1-2 kilometres (3) 2-3 kilometres (4) 3-4 kilometres (5) 4-5 kilometres (6) more than 5 kilometres

19. How long does it take from your house to the village clinic? ______ minutes

20. The distance between your house and the township hospital was ______ kilometres.

21. How long does it take from your house to township hospital ______ minutes

22. Did you know the New Cooperative Medical Scheme? (1) yes (2) no

23. Did you join the New Cooperative Medical Scheme? (1) yes (2) no

24. Did you join the maternal and child health care prepaid scheme before or during your pregnancy? (1) yes (2) no

**Pregnant care and pregnant history**

25. How many times have you ever got pregnant? ______ times; The pregnant outcomes were: spontaneous abortion for ______ times; induced abortion for ______ times; still birth for ______ times. Now you have _____ children, _____ boys and _____ girls; The parity of this child is _______. The time of infant death (if it happened) was _______.

26. Your latest child birth date was _______ (mm/dd/yyyy); the gender is _______ (1) male (2) female; the birth weight was _____ jin (half of a kilogram) or _____ gram

27. Did you have a check up at the gynaecological department before pregnancy? (1) yes (2) no

28. Did you ever get the treatment for the infection of your reproductive organ before your pregnancy (1) yes (2) no

29. When did you pay the first prenatal visit _____ (weeks after pregnancy).

30. How many times did you pay the prenatal care visit ______ times in total ______ times in county level hospital; ______ times in township hospital ______ times in village clinic ______ times in other health facility

31. If you got prenatal care in the hospital, who suggested that you go there? ______ (1) I myself wanted to go. (2) My families did. (3) The village doctors did. (4) The village FP members (5) The doctors of township hospital did. (6) others ______

32. (If the prenatal visits you got less than 5 times,) why not got more? ______ (1) It is not necessary to pay so many times visit. (2) The content of the examination was almost the same, and the results were normal. (3) It was too expensive for the examination. (4) It was not convenient to go to hospital for examination. (5) Other reasons ______

33. What examination had you had in your prenatal visit? ______ measuring height for _____ times; measuring weight for _____ times; blood test _____ times; urine test for _____ times; B-ultra-sound test for _____ times; others ______ (to specify)

34. How much money in total did you spend for you prenatal visit? ______ yuan

35. Had you ever been suggested by township hospital doctors to go to higher level hospital for prenatal check up or treatment ______ (1) yes (2) no

36. During your prenatal care visit in township hospital, did the doctors tell you about the following ______ (1) yes, he told me a lot about them (2) yes, he told me something about them; (3) yes, but he told me only a little; (4) no
Work and rest
Food and nutrition
Personal hygiene
To avoid toxicant
Right medication
Breastfeeding
Baby care
When you should go to hospital for the delivery
Sexual activity
No smoking and drinking

38. What do you think about the doctor’s professional expertise during your prenatal visit in township hospital?
1) very good 2) good 3) not bad 4) bad 5) very bad

39. What do you think about doctors’ attitudes during your prenatal visit in township hospital?
_____ (1) Very good; (2) good; (3) not bad; (4) bad; (5) very bad

40. Were you satisfied with the doctors during the prenatal care visit in the township hospital?
_____ (1) very satisfied; (2) satisfied; (3) not satisfied (4) dissatisfied ; (5) very dissatisfied

41. Why didn’t you go to hospital for prenatal visit? _____ (1) I didn’t think it’s necessary; (2) The family members didn’t think it was necessary; (3) It cost too much; 4) Transportation problem 5) other reason _____

42. Did the village doctor tell you any message about maternal care during your pregnancy? _____ (1) yes (2) no

43. Were you satisfied with the village doctor health care services during your pregnancy? _____ (1) very satisfied (2) satisfied; (3) not satisfied ; (4) dissatisfied (5) very dissatisfied

Delivery and postnatal care

44. Where was your child born? _____ (1) county level or above hospitals (2) county maternal and child care institute or above (3) township hospital (4) village health clinic (5) my house (6) on the way to hospital (7) other place _____

45. What was the mode of child delivery? _____ (1) normal delivery (2) delivery assisted by instrument (3) cesarean section

If it was a Caesarean section, who made the decision?
(1) The doctor (2) Myself (3) My family members 4) Other _____

If you made the decision, your reason is:
(1) My suffering (pain) was less (2) my baby was safer. (3) Myself was safer (4) other reasons _____

46. If your child was born in the hospital, who suggested you to go there for delivery? _____ (1) I myself wanted to go there. (2) My family members let me to go there. (3) The village doctor let me go there. (4) The village FP staff (5) The doctor of the township hospital. (6) The township FP staff (7) Others _____ (to specify)
47. Why did you choose this specific hospital for delivery? (1) It was convenient to get there. (2) I knew the doctor in the hospital. (3) The health services provided by them was better than other hospitals (4) The charge was less than other hospitals (5) It was safer than other hospitals. (6) Others _____ (specify)

48. How long did you stay in the hospital? ___ hours before the delivery and ___ hours after the delivery.
Did the doctor suggest you to stay in hospital before and after the delivery?
(1) Yes (2) No
If yes, The doctor suggested you stay in the hospital_____ hours before the delivery and _____ hours after the delivery.

49. What do you think about the doctor’s professional expertise in the delivery care in the hospital? ____ (1) It was very good. (2) It was good. (3) It was not bad. (4) It was bad. (5) It was very bad.

50. What do you think about doctors’ attitude in the delivery care in the hospital? _____ (1) It was very good. (2) It was good. (3) It was not bad. (4) It was bad. (5) It was very bad.

51. Were you satisfied with the doctors in the delivery care in the hospital? _____ (1) very satisfied. (2) satisfied (3) not satisfied (4) dissatisfied (5) very dissatisfied.

52. How much did you pay for the hospital delivery? ___ yuan

53. Had the charge been discounted? ____ (1) Yes (2) No (3) I’m not certain of it.

54. If the charge had been discounted, how much was it? _____ yuan. Which department or program made discount for it? (1) The New Cooperative Medical Scheme (2) health 8 program (3) Decreasing maternal death and tetanus program (4) Others _____ ( to specify)

55. If the delivery was not in hospital, the major causes were ______ (1) I feel it is not necessary to go to hospital for delivery. (2) I did not get enough time to go to hospital for the delivery. (3) I didn’t have enough money to pay for hospital. (4) Transportation problem. (5) Other_____ ( to specify)

56. If the delivery was not in hospital, who was the attendant ____ (1) The doctor from the township hospital (2) The doctor from the village health clinic (3) A professional attendant. (4) not a professional attendant (5) A family member as the attendant (6) others ___ ( to specify)

57. If the delivery was not in hospital, how much did you pay for the attendant? ____ yuan

58. How many times did you get the postnatal visit in 42 days after the delivery? for_____ times. Among these visits, _____ times from village doctors _____ times from township hospital doctors.

59. If the doctor came to your house to do prenatal or postnatal care, how much should you pay? On average _____ yuan for village doctor _____ yuan for township hospital doctor a time.

60. When did you feed your baby with the breastfeed for the first time? _____ within half an hour after the delivery (2) within 24 hours after delivery (3) more than 24 hours after the delivery (4) never.

61. How long did the breastfeeding only last? _____ month

62. When did you start to add some other food to your baby for the first time? ____ month after delivery

63. Have your child taken following vaccines? (to be completed later)
1) For measles
2) For tetanus et al
3) For T.B
4) For Polio
5) For Hepatitis

64. To what extent was the subject cooperative with you?
   1) very good 2) good 3) not bad 4) bad 5) very bad

Name of interviewer:

Date of the interview:
Appendix 3: Themes of interviews of county health bureau officials and director of county maternal and health care institute

1. The authority and responsibility of county health bureau
   - on county level hospitals including county maternal and child health care institute
   - on the township hospitals
   - on village clinics

2. The authority and responsibility of county maternal and child health care institute

3. Health care system
   - Quantity and quality of public health facilities at county, township and village level
   - Quantity and quality of private clinics at county, Township and village level

4. Maternal health care
   - Organization of the maternal care
   - Provision of the maternal care
   - Financing of the maternal care
   - Funding of the maternal care
   - Obstacle of the maternal care

5. Referral system for maternal care

6. Utilization of the maternal care

7. The work relationship between health sector and family planning system
   - At county level
   - At township level
   - At village level
Appendix 4: Themes of interviews of township hospital directors

1. **Equipment and staff**
   - Characteristics of the staff (education, specialty)
   - Hospital bed
   - Equipment for delivery services
   - X-rays machine
   - Ultrasound machine

2. **Funding of the hospital**
   - % from county government
   - % from township government
   - % from fee for services

3. **The level of providers’ income**
   - The degree of providers’ satisfaction with the income

4. **Maternal health care delivery**
   - Contents of prenatal care services provided
   - If a Cesarean section is performed
   - If postnatal care service is provided
   - Charges for prenatal, delivery and postnatal care

5. **Obstacles for proving systematic maternal care**

6. **Work relationship between township hospital and township family planning station**