GENDER DIFFERENCES IN CHILD SURVIVAL IN RURAL CHINA: A COUNTY STUDY

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Resum.- L'article examina les diferències de gènere front a la supervivència infantil, a la Xina d'àmbit rural, analitzant el cas d'un comptat de la província de Shaanxi. Es comença descrivint la sobremortalitat infantil femenina que ha tingut lloc en aquest comptat entre 1994 i 1996. Tot seguit, s'analitzen els mecanismes que hi poden influir, on es ressalta el paper dels factors socials, econòmics i culturals. Es parteix de la idea que la sobremortalitat femenina està causada fonamentalment per la preferència, dins la cultura tradicional xinesa, pels fills, aspecte potenciat per les regulacions i el programa de planificació familiar dut a terme pel govern. Això suggereix que és bàsic augmentar la consideració i l'estatus de les dones, tant dins la família com dins la comunitat, per així mitigar la pressió discriminatòria, cap a les noies, dins un context de baixa fecunditat. Per acabar, es comenten les possibles opcions polítiques per a contrarestar aquesta pressió i començar a millorar la supervivència infantil femenina en l'àmbit rural de Xina.

Paraules clau.- Diferències de gènere, supervivència infantil, Xina rural.

Resumen.- El artículo examina las diferencias de género en relación a la supervivencia infantil en el ámbito rural de China, analizando el caso de un condado de la provincia de Shaanxi. Empieza describiendo la sobremortalidad infantil femenina que se ha producido en este condado entre 1994 y 1996. Seguidamente se analizan los mecanismos que pueden influir, resaltando el papel de los factores sociales, económicos y culturales. Se parte de la idea que la sobremortalidad femenina está causada fundamentalmente por la fuerte preferencia, en la cultura tradicional china, hacia los hijos pero además viene potenciada por las regulaciones y el programa de planificación familiar llevado a cabo por el gobierno. Ello sugiere que es crucial aumentar la consideración y el estatus de las mujeres dentro de la familia y de la comunidad, para así mitigar la presión discriminatoria, en contra de las niñas, en un contexto de baja fecundidad. Por último, se comentan las posibles opciones políticas para contrarrestar esta presión y empezar a mejorar la supervivencia infantil femenina en el ámbito rural de China.

Palabras clave.- Diferencias de género, supervivencia infantil, China rural.

Abstract.- Using the data from a survey of deaths of children aged under 5 years old conducted in 1997 in a county in Shaanxi province, China, this paper examines gender differences in child survival in rural China. We begin by describing excess female child mortality in the county in 1994-96. We then move on to analyse the mechanisms whereby the excess mortality takes place, and the underlying social, economic and cultural factors behind it. We argue that the excess mortality of girls is caused fundamentally by the strong son preference in traditional Chinese culture, but is exacerbated by the government-guided family planning program and regulations. This suggests that it is crucial to raise the status of girls within the family and community, so as to mitigate the pressures to discriminate against girls under China's low fertility. Finally, we discuss the possible policy options to counter these pressures and in turn to improve female child survival in rural China.

Key words.- Gender differences, Child survival, Rural China.

Résumé.- Cette article examine les différences de genre dans la survivance infantile dans un comté de la province de Shaanxi, en Chine rurale. Nous commençons par décrire l'excès de la mortalité infantile féminin dans le comté en 1994-1996. Ensuite, nous analysons les mécanismes qui ont influencé cet excès de mortalité et nous soulignons les facteurs sociaux, économiques et culturelles qui l'ont influencé. L'excès de la mortalité des fillettes résulte essentiellement de la forte préférence donnée aux garçons dans la culture traditionnelle chinoise, et de la régulation des naissances engendrée par le programme de planification familiale mené à terme par le gouvernement. Il est important de connaître le statut des fillettes dans la famille et la communauté, pour ainsi diminuer la pression discriminatoire menée à l'encontre des jeunes filles á cause de la faible fécondité chinoise. Finalement nous commentons les possibles options politiques qui pourront contrecarrer ces pressions et améliorer la survivance infantile féminine en Chine rurale.

Mots clés.- Différence de genre, survivance infantile, Chine rurale.

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GENDER DIFFERENCES IN CHILD SURVIVAL IN RURAL CHINA: A COUNTY STUDY[1]

1.- Introduction

Child (aged 0 to 4) mortality is usually determined by biomedical, demographic, socio-economic and environmental factors (Mosley and Chen, 1984). In populations with no discrimination against either sex, biomedical factors are the major determinants of sex differences, and child mortality is higher for males than for females (Coale, 1991). In fact, at different levels of child mortality, there exists a "normal" ratio of male to female child mortality. This normal ratio reflects the natural "sex" difference in child mortality resulting from innate genetic factors. If the observed ratio of male to female child mortality in a population is lower than normal, the existence of "excess" female child mortality is indicated.

Excess female child mortality has existed in many developing countries, especially in East Asia, such as China and South Korea, South Asia, such as Pakistan and Bangladesh, and India, as well as some countries in North Africa (Tabutin and Willems, 1995). This excess is usually explained in terms of various discriminations against girls in socio-economic and health-related behavioural and environmental factors, such as nutrition, food, and health care. Moreover, excess female child mortality also reflects low status of females, especially girls, and the related strong preference for sons in families and societies (Waldron, 1983).

Strong son preference and discrimination against girls have existed throughout China's history. They still exist in contemporary China, especially in rural areas (Arnold and Liu, 1986; Wen, 1993; Poston et. al., 1997; Graham et. al., 1998). In recent years, with rapid fertility decline and below-replacement fertility resulting from both dramatic socio-economic changes and the effective government-guided family planning program, son preference and discrimination against girls have intensified. The evidence for this is found in various socio-economic and demographic indicators, the most obvious of which are an abnormally high sex ratio at birth and excess female mortality among children. According to the 1995 1% Population Survey of China, in 1995, the sex ratio at birth was as high as 118, and the sex ratio of male to female infant mortality was as low as 0.75, a level unprecedented since the

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1950s (Li and Zhu, 1998). These generate serious social and demographic consequences for current and future Chinese society, such as an imbalance in the future marriage market (Tuljapurkar et al., 1995; Das Gupta and Li, 1999).

The high sex ratio at birth in China has been the subject of attention by researchers, the general public, policy makers, and the Chinese government. Many studies have been carried out to investigate the levels, trends, geographic variations, and causes of China's high sex ratio at birth, as well as its relationships with other socio-economic and demographic variables and the implication for society (Hull, 1990; Johansson and Nygren, 1991; Wen, 1993; Zeng et al., 1993; Gu and Roy, 1995; Tuljapurkar et. al., 1995). The Chinese government at various levels is cognisant of this situation and has promulgated stricter legal regulations and used prenatal maternal health and family planning services to control prenatal sex determination and unapproved abortion of planned pregnancies. However, governmental interventions on this issue have not yet succeeded.

In contrast, there are few studies that have systematically investigated excess female child mortality in China. Das Gupta and Li (1999), using data from the four population censuses, found that excess female child mortality existed throughout the period of the 1920s -1990s. They showed that female disadvantage in child survival is heightened in periods with relative household resource constraints, especially during war, famine, and fertility decline. Li and Feldman (1996), using national child mortality data, analysed temporal trends and the spatial pattern of excess female mortality in the 1950s -1980s, as well as its relationship with some socio-economic, cultural, and family planning factors. They found that excess female child mortality is fundamentally caused by the traditionally strong son preference, but exacerbated by current below-replacement fertility. Choe et. al. (1995) used data from the China 1988 National Survey of Fertility and Contraception to investigate the roles of gender in the sex pattern of child mortality. Their results reveal that discrimination against girls is selectively targeted on those with both older brothers and sisters, or those with only older sisters. Using data from the China In-Depth Fertility Survey in 1985 and 1987, Ren (1995) examined sex differences in child survival in three provinces of China. His results suggest that under persistent son preference, the government guided-family planning policy has resulted in higher than expected female child mortality in China.

Two points emerge from these earlier studies on excess female child mortality in China. First, the data used in these studies are mostly from national population censuses and national surveys on fertility and contraception. Few studies have used data from surveys specifically designed to explore gender differences in child survival. Second, there has to date been relatively little work of the kind done in South Asia, on the mechanisms whereby the excess female child mortality takes place, and on the socio-economic and cultural factors underlying

the phenomenon. Thus, there is an urgent need for more research on gender difference in child survival in China, especially in rural areas, with a focus on the mechanisms and proximate determinants of excess female child mortality, as well as the socio-economic and cultural factors underlying it. Such research is important both to draw attention from the general public and policy makers to the problem of excess female child mortality, and in formulating policy interventions that can be effective in alleviating such discrimination and consequently improving female child survival in China.

In this paper, following the well-known framework on child mortality in developing countries of Mosley and Chen (1984), we use data from a survey in a county in Shaanxi province to explore gender differences in child survival in rural China. We designate the county as «J» county to protect the identity of the subjects and the villages that participated in our survey. Specifically, we attempt to deal with three questions: (1) the extent of excess female child mortality in «J» county in the 1990s; (2) the mechanisms that differentially affect the survival of the two sexes; (3) the main causes underlying excess female child mortality and the possible policy options to counter it.

2.- Materials and methods

2.1.- The study area

«J» county is located in the central part of Guanzhong plain in Shaanxi province, close to the Wei River, which is a tributary of the Yellow River. It is about 40 kilometres from Xi' an City, which was an ancient capital of China for about 1,000 years until the end of Tang dynasty, and is currently the capital of Shaanxi. The county's population was close to 500,000 in 1996. "J" county is rich in fertile land and is regarded as a relatively developed county in Shaanxi. As early as 2,000 years ago, at the time of the Qin State, an irrigation system was already established in the county, making most of its arable land productive. Its agriculture is well developed, with wheat and corns the main crops. Its grain yield has been historically high enough to meet local demand and to export to the capital. Farmers are also partly involved in vegetable and fruit production to serve the needs of neighbouring urban residents. Private and township enterprises developed extensively after the 1980s, absorbing many surplus farm labourers. In 1994, per capita income for farmers in «J» county was about 1,018 yuan, slightly higher than the national average of 921 yuan for the whole of China.

The government-guided family planning policy for farmers in «J» county is about the same as that prevalent in most rural Han Chinese areas, i.e., one and a half child per couple. A couple is allowed to have a second birth only if their first child is a daughter. This policy has been implemented relatively successfully over the last decade. As a result, population growth has

slowed, and the family planning program performance of «J» county is ranked at the medium level by the provincial government in Shaanxi. Nevertheless, in «J» county, many couples who have had out-of-government-plan births. In 1994, the crude birth rates in «J» county was about 17.4 per thousand, a level very similar to that of 17.7 per thousand in China.

«J» county is regarded as one of the origins of the Han Chinese population and culture and therefore retains the core elements of the traditional Yellow River culture. Because it is located in Guanzhong plain, the population is densely distributed and the size of the villages is relatively big. Large family clans exist in almost every village and are influential in village social life. Villages maintain a strict patriarchal family system and patrilocal marriage. As in other rural Han Chinese areas of China, the strict patriarchal family system, together with other social and economic factors, make son preference very strong. This is evidenced by the high sex ratio at birth of 130 in 1995 in «J» county, considerably higher than that of 118 for all of China in 1995.

In short, «J» county is about at the medium level in China in terms of its economic development, family planning policy and implementation, and extent of son preference. Therefore, «J» county can to some extent represent the general situation of rural China, providing a good example for us to explore gender differences in child survival in rural China and make adequate policy suggestions.

2.2.- The survey and data

As mentioned earlier, our research approach follows the well-known framework for child mortality in developing countries introduced by Mosley and Chen (1984). In their model, child survival is jointly determined by five proximate variables: maternal factors, environmental contamination, nutrient deficiency, injury, and personal illness control. In addition, socio-economic, institutional, and cultural factors at individual, household and community levels operate through the proximate determinants of child survival to affect the sex pattern of child mortality. In this paper, we incorporate the roles of gender in proximate determinants and factors at individual, household and community levels into their model, to explore excess female child mortality in «J» county.

We designed and conducted several surveys including a household survey, a community survey, focus group discussions, and a clinic survey. These surveys are complementary in that they provide us with both qualitative and quantitative data, enabling us to explore gender differences in child survival and to better understand the child survival situation beyond just statistics. The contents of these surveys and their implementation are discussed below.

The household survey was aimed at investigating the general situation of child survival during 1994-1996 in «J» county, as well as proximate, individual, and household factors that affect sex differences in child survival. The household survey was conducted with a structured questionnaire. Its targets included all households that had child deaths aged fewer than 5 during 1994-1996. The questionnaire consisted of three sections: In the first, each member of each household reported individual demographic and social background in the year when a child died, including information about nationality, age, education, occupation, marital status etc. In addition, each household reported its economic condition. In the second section, parents of dead children reported information about their dead children, including their sex, age at birth and death, birth order, birth quota, as well as information about their maternal factors, food and nutrition, the use of health care, and cause of death (illness or injury). In the third section, the mother reported her maternal and abortion history, and contraceptive use.

The community survey, which collected general information about the village, was also conducted with a structured questionnaire. The targets of this survey included all administrative villages that had child deaths aged fewer than 5 during 1994-1996. In this questionnaire, each village reported its geographic location, infrastructure, health facilities, family planning implementation, economic development, as well as customs and beliefs relating to childbearing.

The Population Research Institute, Xi' an Jiaotong University, conducted the household and community surveys in May 1997. About 50 interviewers and 5 supervisors participated in conducting the survey. The supervisors were staff and graduate students at the institute, and the interviewers were either local farmers with high school education or local family planning workers. Before conducting the survey, the supervisors and interviewers had obtained a list of the child deaths provided by the «J» county Family Planning Commission and the Public Health Bureau. The list was checked and supplemented by village heads, village family planning workers, village doctors, and others who knew a great deal about births and deaths of children in the villages. As a result, 815 child deaths from 231 villages were included in the survey.

Every measure was carefully implemented to ensure the quality of field interviews, data entry, and data quality. Before conducting the survey, all people involved in the survey were given a training workshop, focusing on the purposes of the survey, the structure of the questionnaires, the meaning of the questions, and skills in on-site interviewing. During the survey, the supervisors carefully reviewed all questionnaires completed by interviewers, and those questionnaires with problems were returned to interviewers and interviews were repeated when necessary. In addition, for each interviewer, his or her supervisor selected several households that were asked to answer several key questions again in order to check the quality of the first

interview and the consistency between the two interviews. After the survey, a double data entry method using Foxpro was utilised to reduce data entry error. After the database was established, a computer program was used to check the internal logical consistency of questionnaires, and those with inconsistent logic were reviewed again by supervisors. As a result, although errors were present in the survey data, but the quality of data is quite reliable.

The clinic survey conducted by clinic doctors with a structured questionnaire was administered to parents of 31 children who died in one county hospital and one township clinic between June and December 1997. This survey was aimed at collecting information on children who died in clinics rather than at home or other places. Information collected in this questionnaire concerned the circumstances of these 31 child deaths, including the cause of death and the use of preventive and curative health care.

In addition, we conducted five focus group discussions between June and August 1997. About 60 people who were either local farmers or family planning workers at the grassroots level participated in these discussions. The focus group discussions were aimed at discerning people's perceptions of gender differences in childbearing. These included cultural customs and beliefs relating to childbearing, expectations of children, manifestations of son preference, and causes behind son preference.

2.3.- The methods

Our household and community surveys were only administered to households and villages with child deaths; those households and villages with only surviving children were not included. A survey including both surviving and dead children is of course much more ideal for analyses of determinants of gender differences in child survival. However, due to various resource constraints, it was not possible for us to conduct such a survey. This is quite different from most previous studies on child survival, in which both surviving and dead children were included. Therefore, using data on child deaths, we adopt two approaches to analyse gender differences in child survival in «J» county.

The first approach is to compare different aspects of male child deaths to those of female child deaths by various kinds of proximate, parental individual, household and community factors. This includes three parts. First, we calculate ratios of male to female child deaths. In most countries with normal sex differences in child mortality, the ratio of male to female child deaths is about 1.2-1.4 for infants aged 0, and 1.0-1.2 for children aged 1-4 (Li and Feldman, 1996). Combining infants and children together, the ratio of male to female child deaths should be at least above 1. If the observed ratio is below 1, it indicates the existence of excess female child deaths. Second, we investigate whether the distributions of child deaths by

various factors, such as birth order, birth quota etc., are significantly different between the sexes. Third, we examine whether the means of some indicators relating to child survival, such as duration of breastfeeding, duration of survival after becoming ill etc., are significantly different for the two sexes. The aim of the last two parts is to explore which factors affect child survival of the two sexes differently. The first approach in this paper is a pairwise analysis, in that we examine the interaction of sex with each proximate, individual, household and village factor. We also compare means of some factors by sex.

In the second approach, we use multivariate logistic and survival models to investigate how social, economic and cultural factors at individual, household and community levels such as maternal factors, food and nutrition, preventative and curative health care, affect the proximate determinants of child survival, and how these socio-economic and cultural factors operate through the proximate determinants to affect sex differences in the pattern of child survival.

These complementary bivariate and multivariate analyses use data only from the household and community surveys and the results of the analyses are presented in the next section. Data from the clinic survey and the focus group discussions are presented in the discussion section.

3.- Results

3.1.- Child deaths and child mortality

During 1994 -1996, there were 815 child deaths in «J» county. Of these, 388 were males and 427 females, with a ratio of male to female child deaths of 0.91. Using the number of births in 1994 -1996 provided by the Family Planning Commission, we estimated infant mortality in «J» county at about 31.82 per thousand for males and 46.06 per thousand for females. Based on the "West" model life tables of Coale and Demeny (1983), assuming the male infant mortality was normal, we estimated that the "expected" female infant mortality about 25 per thousand. Thus, female infants suffered excess infant mortality after birth of over about 21 per thousand. This female child survival disadvantage was obvious in «J» county in 1994-1996. In fact, according to the 1990 Population Census, infant mortality in 1990 in «J» county was 42.12 per thousand for males and 44.00 per thousand for females. Therefore, similar to the trend observed in China in the 1990s (Li and Zhu, 1998), relative to males, female child survival has been decreasing in «J» county.

Next we examine children's age at death, death place, cause of death, and duration of survival after becoming ill. These are presented in Table 1.

Table 1.- Distribution ans sex ratio of child deaths and duration of child survival, "J" county, 1994-1996.

Item	All child deaths				Deaths within 1 day			
	M	F	R	P	M	F	R	P
Age at death				0,03				
Within 1 day	119	174	0,68					
1-7 day	97	85	1,14					
8-30 days	61	50	1,22					
1-12 months	68	75	0,91					
12-59 months	43	41	1,05					
Death place				0,00				0,00
Clinic	202	158	1,28		69	64	1,08	
Home or other places	183	266	0,69		49	110	0,45	
Duration of survival after becoming ill (hours)	646	533		0,55	13	11		0,51
Cause of death				0,23				0,00
Illness	358	401	0,89		11	174	0,66	
Accident	30	24	1,25		5	0,00		

Source: Survey of child survival in «J» county in 1994-1996, conducted by the Population Research Institute, Xi' an Jiaotong University in May 1997.

Notes: (a) Deaths within one day stand for those who died within the first 24 hours of birth.

(b) M stands for males, F for females, R for ratio of male to female deaths.

(c) For death distribution, P is the significance of the likelihood ratio test; for average value, P is the significance of the t test.

(d) Same for the following tables.

From Table 1, the sex distribution of child deaths is significantly different by age at death, indicating that excess female deaths were unevenly distributed over age. Assuming the number of male child deaths to be normal and taking a normal sex ratio of child deaths to be 1.3 for infants (aged 0) and 1.1 for children (aged 1 -4), we estimated excess female child deaths in 1994-1996 in «J» county at about 121, i.e., about 28% of female deaths were unexpected. Among them, 119 were infants and 2 were children. Moreover, the excess of females who died within the first 24 hours of birth was about 82, an overwhelming majority. These estimates are based on a normal sex ratio at birth of 105-107. Considering the high sex ratio at birth of 130 in 1995 in «J» county, we believe that the actual number of excess female deaths exceeded our estimate. Since excess female deaths were concentrated on those who died within one day of birth, in the following analyses, we also present the situation of this special group of deaths for reference (For simplification, hereafter we call it the "one-day group").

From Table 1 we see that the sex distribution of child deaths is significantly different by death place, with the sex ratio of deaths above 1 for those who died at a clinic, but well below 1 for those who died at home or other places. A similar situation was also found in the "one-day" group. Clearly, females were more likely to die at home, and this situation was more obvious

among those who died within one day of birth. In addition, for both all child deaths and «one day» group deaths, children's duration of survival after becoming ill was higher for males than for females, although these differences are not significant.

Because this paper focuses on gender, rather than innate genetic sex differences in child survival, cause of death in the survey was classified into only two categories: illness and injury (accidental or intentional). We anticipated that with excess female child mortality in «J» county, some parents who might have abandoned or killed their children would report the cause of death as injury. However, contrary to our anticipation, sex ratio of deaths in Table 1 is quite normal among those who died of injury, but abnormal among those who died of illness. This suggests that the reported cause of death was not accurate in the survey.

3.2.- Child deaths by proximate factors

In the model of Mosley and Chen (1984), there are five proximate determinants of child survival: maternal factors, nutrient deficiency, personal illness control, environmental contamination, and injury. Here we focus only on the first three of these. The results are presented in Table 2.

3.2.1.- Maternal factors

In Table 2, with respect to mother´s age at birth, the sex ratios of deaths among all the groups are below 1, and the sex distribution of child deaths is significantly different by mother´s age at birth. However, both for all child deaths and for the «one day» group, the sex ratio of deaths is much higher for those children with mothers age at birth 27 and below than for those with mothers age at birth 28 and over. Clearly, excess female child deaths occurred mainly among children of older mothers. In rural China, mother's age at birth is also related to children's birth order, and this requires more examination. We also see in Table 2 that the sex distribution of child deaths is significantly different by birth order. Moreover, while the sex ratio of child deaths among first order children is normal, those of second or higher birth order children are well below 1.

Thus, excess female child deaths occurred mostly among girls who were second or higher order births. Li (1992) also found a similar situation in his analysis of child deaths from the 1990 Population Census. In «J» county, according to family planning regulations, a couple receives a quota from the Family Planning Commission before giving birth. Those births outside this are regarded as out-of-government-plan births. This is confirmed in Table 1: the sex distribution of child deaths is significantly different by birth quota, and the sex ratio of

deaths is as low as 0.64 for all child deaths, and 0.25 for the «one day» group. Therefore, excess female deaths were heavily concentrated on children born outside the birth quota. This confirms that the government-guided family planning program affects the female child survival to some extent, as Ren (1994) also pointed out in his analysis of child survival in Shaanxi province using data from the China In-Depth Fertility Survey.

Table 2.- Distribution and sex ratio of child deaths by proximate factors and some related measures, "J" county, 1994-1996.

	All child deaths				Deaths within 1 day			
Item	M	F	R	P	M	F	R	P
Marternal factors				0,03				0,05
Mother's age and birth								
27 and below	321	327	0,98		101	132	0,77	
28+	64	96	0,67	17	41	0,42		
Birth order								
1				0,00				0,00
2	199	137	1,45		61	41	1,49	
3+	160	253	0,63		55	106	0,52	
Birth quota	29	37	0,78		3	27	0,11	
With				0,00				0,00
Without	300	288	1,04		103	111	0,93	
Place pf delivery	88	138	0,64		16	63	0,25	
Clinic				0,05				0,01
Home or other places	202	192	1,05		68	72	0,94	
Expenses on delivery (Yuan)								
	124	107		0,5	147	90		0,25
Food and nutrition factors								
Supplementary food intake				0,55				
Yes	33	27	1,22					
No	16	17	0,94					
Duration of breastfeeding (mont	11,6	12,5		0,53				
Health care factors								
Immunization status				0,31				0,51
Yes	147	146	1,01		6	12	0,5	
No	230	265	0,87		108	154	0,7	
Receiving medical treatment after becoming ill				0,00				0,01
Yes	256	233	1,1		48	44	1,09	
No	129	192	0,67		71	130	0,55	
Duration of receiving treatment after becoming ill (hours)	61	85	0,32	6,6	4,6		0,45	
Expenses on medical treatment (	870	642		0,07	189	203		0,87
Times of hospital transfer	0,6	0,4		0,02	0,2	0,1		0,42
Causes of delayed medical treatment				0,00				0,09
Short of money, vehicle or othe	158	100	1,58		39	28	1,39	
Feel not serious by parents	73	101	0,72		3	7	0,43	

Source: Survey of child survival in «J» county in 1994-1996, conducted by the Population Research Institute, Xi' an Jiaotong University in May 1997.

Regarding place of delivery, Table 2 shows that the sex distribution of child deaths is significantly different by place of delivery, with excess female deaths mostly among those who were born at home or other places. In addition, both for all the child deaths and for the «one day» group, expenses on delivery are higher for male than for female births, although the differences are not significant.

3.2.2.- Food and nutrition factors

We use two indexes to measure sex differences in food and nutrition among child deaths. The first is among children who had completed breastfeeding before death and concerns whether they received supplementary food in addition to regular food. The second is the duration of breastfeeding among children who had completed breastfeeding before death. As seen in Table 2, the sex distribution of child deaths is not significantly different by supplementary food intake, and the difference in mean months of breastfeeding between the two sexes is also not significant. This suggests that food and nutrition is not a factor affecting sex differences in child survival in «J» county. This finding is quite different from several studies on child survival in developing countries, in which food and nutrition has been found to affect sex differences in child survival (Waldron, 1983; Paul, 1990), but it is consistent with the results of the study of Basu (1989) on child survival in several villages of two States in India.

3.2.3.- Health care factors

Health care includes preventive health care and curative health care. In the survey, parents were asked whether they're dead children received relevant immunisation before death. Because not all the immunisations for children in «J» county are free for farmers, we use children's immunisation status to measure sex difference in preventive health care among child deaths. As seen in Table 2, the sex ratio of deaths is above 1 among children with immunisation, and below 1 among children without immunisation. However, the sex distribution of child deaths is not significantly different by children's immunisation status. This suggests that immunisation is not a factor affecting sex difference in child survival, a finding consistent with the study by Bhuiya and Streatfield (1991) on child survival in Matlab, Bangladesh, and the cross-country study on gender differences in child health by Hill and Upchurch (1995).

An important aspect of children's curative health care is whether children receive medical treatment after they become ill. As seen in Table 2, the sex distribution of child deaths is significantly different by medical treatment status, and the sex ratio of deaths is quite low

among children who received no medical treatment before death, especially among the «one day» group. Thus, excess female deaths were concentrated on children without medical treatment before death, indicating that medical treatment is an important factor affecting sex difference in child survival in «J» county. However, once parents decided to seek medical treatment for their ill children, the time until they find a doctor was not significantly different by sex.

In addition to parents willingness to seek medical treatment for their children, sex differences in curative health care in «J» county are also reflected in the effectiveness of children's medical treatment before death provided by their parents. In Table 2, both expenses on medical treatment and times of hospital transfer are significantly higher for males than for females. Further, among children who received medical treatment before death, many children did not receive prompt medical treatment. This is either because their parents were short of money, vehicles, etc., or because their parents considered the children's illness not to be serious. It is seen in Table 2 that the sex distribution of child deaths is significantly different by causes of delayed medical treatment, and the sex ratio of deaths is below 1 among children whose parents thought their illness was not serious. Consequently, excess female deaths were mostly among those whose illnesses were not regarded as serious by their parents.

As pointed out by Bourne and Walker (1991) in their analysis of child survival in North India, when parents have strong son preference and face strict household resource constraints, they usually allocate more resources to boys than to girls in medical treatment. This is also found in «J» county: when children became ill, parents tended to consider illness of boys more serious than that of girls. Consequently, they were more likely to seek medical treatment for boys than for girls. Further, once parents decided to seek medical treatment for their children, they spent more money on medical treatment, and transferred children to better hospitals for boys than for girls. Thus, sex differences in children's curative health care contributed to excess female deaths observed in «J» county. Our findings are contrary to the study by Wu and Wang (1991) on sex difference in health care and child survival in rural Shandong province, where it was claimed that there was no discrimination against girls in terms of curative health care.

3.3.- Child deaths by socio-economic and cultural factors

In the model of Mosley and Chen (1984), socio-economic and cultural factors at individual, household, and community levels also affect sex differences in child survival.

The results of our examination of these factors are presented in Table 3.

Table 3.- Distribution and sex ratio of child deaths by parental individual, household, and village factors and some related measures, "J" county, 1994-1996.

	All child deaths				Deaths within 1 day			
Item	M	F	R	P	M	F	R	P
Individual factors				0.01				0.06
Mother's age								
24 and below	103	79	1.30		31	32	0.97	
25-29	213	245	0.87		72	102	0.71	
30+	69	99	0.70		15	39	0.39	
Motheris education (years)				0.88				0.74
0-6	76	86	0.88		18	32	0.56	
7-9	282	311	0.91		91	127	0.72	
10+	23	22	1.05		8	13	0.62	
Household factors								
Sibling composition				0,00				0,00
None	188	126	1.49		59	41	1.44	
Only brothers	39	42	0.93		11	9	1.22	
Only sisters	152	246	0.62		47	119	0.39	
Both	9	13	0.69		2	5	0.40	
Family income (Yuan)	4606	4558		0.86	4607	4216		0.24
Village factors								
Family planning work award				0.46				0.11
Yes	158	163	0.97		44	49	0.90	
No	230	264	0.87		75	125	0.60	
Proportion of household withonly two daughters				0.05				0.02
Above 10%	163	151	1.08		47	46	1.02	
10% and below	225	276	0.82		72	128	0.56	
Distance to county seat				0.02				0.04
10 km. and below	179	162	1.11		53	57	0.93	
10+ km.	209	265	0.79		66	117	0.56	
Bus to county seat				0.00				0.02
Yes	267	252	1.06		86	103	0.84	
No	121	175	0.69		33	71	0.47	
Per capita income (Yuan)	1160	1145		0.53	1166	1173		0.85

Source: Survey of child survival in «J» county in 1994-1996, conducted by the Population Research Institute, Xi' an Jiaotong University in May 1997.

3.3.1.- Mother's individual factors

The first individual factor considered here is mother's age. It is found in Table 3 that the sex distribution of child deaths is significantly different by mother's age, and sex ratios of deaths among those whose mothers are older than 25 are below 1. Clearly, excess female child deaths were concentrated on children of older mothers. This is consistent with factors of mother's age at birth and children's birth order, because these three factors are closely related. Given the one and a half child family planning policy in «J» county, among these three factors, we tend to regard birth order as the decisive factor resulting in excess female deaths.

The second factor is mother's education. As seen in Table 3, sex distribution of child deaths is not significantly different by mother's education, and sex ratios of deaths for almost all the groups are below 1. Thus excess female deaths occurred in all kinds of mothers regardless of their education, indicating womanise education is not a factor affecting sex difference in child survival. This is consistent with what we found in the data of the 1990 Population Census of China (Li and Zhu, 1998; Han and Li, 1999).

3.3.2.- Household factors

The most important household factor is children's sibling composition. Both Das Gupta (1987) and Muhuri and Preston (1991) point out that in India and Bangladesh, girls with the highest mortality risks are those with a surviving older sister. This is because for parents with strong son preference, excess female child morality is part of their normal family building strategy to realise their desired number and sex of children through conscious and selective neglect of, and discrimination against, girls. This is also true for «J» county. As seen in Table 3, the sex distribution of child deaths is significantly different by children's sibling composition. For deaths of children without brothers and sisters, the sex ratio of deaths is quite normal.

However, sex ratios of deaths are below 1 among children with only brothers and much lower than 1 among those with only sisters or with both brothers and sisters. This situation is much worse in the «one day» group. Hence, excess female deaths were concentrated on those girls with sisters or with brothers and sisters. In other words, discrimination against girls in «J» county was highly selectively targeted on girls with surviving sisters.

This is consistent with the studies on excess female child mortality in the China 1990 Population Census data by Li (1992) and in the China 1988 Two-Per-Thousand Survey of Fertility and Contraception by Choe et al. (1995). It seems that this family building strategy is quite universal in developing countries with strong son preference.

We use family income to represent the general economic status of households. As seen in Table 3, among all the child deaths, there is no significant sex difference in family income. Thus, consistent with previous studies on child survival in China (Han and Li, 1999), excess female deaths occurred in almost all kinds of households in «J» county, regardless of household economic status.

3.3.3.- Village factors

As shown before, the impact of family planning policy in «J» county on sex difference in child survival is revealed in terms of the birth quota. Here we explore the impact of the effectiveness of family planning policy in villages on sex differences in child survival. The index used here is whether villages received any family planning award in 1994 -1996. As shown in Table 3, the sex ratio of deaths is higher for children in villages with family planning awards than for children in villages without family planning awards, but sex ratios of deaths for both groups are below 1. Further, the sex distribution of child deaths is not significantly different by status of family planning award. This suggests that, in contrast to family planning policy, the effectiveness of family planning policy implementation had no effect on sex difference in child survival in «J» county.

As mentioned earlier, in «J» county, if the first child of a couple is a daughter, this couple is allowed to have a second birth after an interval of four years. If there were no son preference or human intervention, the proportion of households with only two daughters among all two-child households would be at least over 40%. However, because of strong son preference, there were almost no villages in «J» county with this proportion over 40%. Thus, this proportion may partly indicate the extent of son preference in villages. We expected that excess female deaths would be more likely to occur in villages with strong son preference than in those with weak son preference. This is confirmed in Table 3, where the sex distribution of child deaths is significantly different by proportion of two-daughter households, with excess female child deaths concentrated on those villages where the proportion of two-daughter households was below 10%, especially for the «one day» death group.

Remoteness of villages also affects sex differences in child survival. We use distance from village to county seat, as well as whether there is bus service from village to county seat, to measure the remoteness of the villages. As seen in Table 3, sex distributions of child deaths are significantly different by the two indexes, and sex ratios of deaths are below 1 for children in remote villages. Thus, excess female deaths are likely in those villages far from the county seat, and with no bus service to the county seat. Actually, when children in «J» county become seriously ill, it is more difficult for parents in remote villages than for parents in villages close to the county seat to obtain prompt medical treatment in county hospitals and township clinics. This may help explain the great excess of female deaths among those who received no medical treatment before death.

As with family income, there are no significant sex differences in villages' per capita income. Thus, excess female deaths occurred in all kinds of villages regardless of village's level of economic development.

3.4.- Multivariate analyses

The above bivariate analyses use child death circumstances by proximate, individual, household, and community factors to investigate the extent and mechanisms of female child survival disadvantage in «J» county. The results show what kinds of girls are more likely to suffer excess female child mortality, and which parents are more likely to discriminate against girls. In our multivariate analyses, we investigate how socio-economic and cultural factors at individual, household and community levels interact with sex to jointly affect the proximate determinants of child survival, and operate to affect sex differences in child survival.

The models used in the analyses are logistic models and survival models. The dependent proximate variables used in the models are place of delivery, duration of breastfeeding, immunisation status, medical treatment status, duration of receiving medical treatment. The dependent child survival variables are death place, and duration of survival after becoming ill. Consistent with bivariate analyses, the multivariate results show that except for medical treatment and death place variables, the influences of sex on other variables are not significant. Due to space limitations, we present only the results of the multivariate analysis of children's medical treatment status.

We use five logistic models to investigate the determinants of children's medical treatment status. The independent variables used in the models are sex, individual variables including age at death, birth quota, place of delivery, household variables including sibling composition, mother´s age and education, family income, village variables including family planning work award status, proportion of two-daughter households, distance and bus service to county seat. These factors are selected from all the factors examined in the previous bivariate studies. The results of five logistic models are presented in Table 4.

Model I, which regresses parents odds of seeking medical treatment for their children after their children became ill on sex, shows the gross effect of sex on children's medical treatment. We see that the sex of children significantly affects parent's odds of seeking medical treatment; the odds of parents seeking medical treatment for a girl are about 61% of those for a boy. This is consistent with our findings in the bivariate analysis.

Model II, which adds individual variables to model I, shows that the influence of sex on parents odds of seeking medical treatment still remain after controlling for individual factors.

Table 4.- Effects of individual, household, and village determinants on children's log odds of receiving medical treatment after becoming ill, "J" county.

Variable/model	I	II	III	IV	V
Sex (Ref. Male)					
Female	-0,492***	-0,431**	-0,389*	-0,315+	-0,183
Individual					
Age and death (Ref: 0 month)					
1-11 months		-0,921***	2,508***	2,536***	1,890***
12-59 months		1,587***	1,041***	1029***	0,422
Birth quota (Ref: With)					
Without		-0,518**	-0,462*	-0,476*	-0,394
Place of birth (Ref: Clinic)					
Home or other places		-0,866***	-0,815***	-0,743***	-0,332
Household					
Mothers'age (ref: 24 and below)					
25-29			0,024	0,005	0,08
30+			0,099	0,092	0,296
Mother's education (Ref: 0-6)					
7-9			0,143	0,100	-0,036+
10+			0,357	0,255	0,610
Sibling composition (Ref: None)					
Only brothers			-0,321	-0,357	-0,404
Only sisters			-0,408+	-0,411+	-0,475
Both			-0,043	-0,131	-0,149
Family income (log)			0,24	0,215	0,249+
Village factors					
Family planning work award (Ref:Yes)					
No				0,074	0,247
Proportion of household with only two daughters (Ref: 10% and below)					
10%+				0,367*	0,311
Distance to county seat (Ref: 10 km. And below)					
10%+				-0,379*	-0,600*
Bus to county seat (Ref: Yes)					
No				-0,346*	-0,217
Interactions with sex					
Female X age at death:1-11 months					1290+
Female X age at death:12-59 months					1415*
Female X birth quota: without					-0,118
Female X bith place: home or others places					-0,838**
Female X mothers' age: 25-29					-0,143
Female X mothers'age: 30+					-0,431
Female X mother's education: 7-9					0,173
Female X mother's education: 10+					-0,722
Female X sibling composition: only brothers					0,004
Female X sibling composition: only sisters					0,279
Female X sibling composition: both					0,047
Female X family planning work award: no					-0,285
Female X proportion of household with only two daughters: 10%+					-0,080
Female X distance to county seat: 10+ km					0,433
Female X bus to county seat. No					`-0,236
Intercep	0,685***	1,780***	-1,085	-0,722	-1,079
-2LL	1076***	934***	895***	881***	864***
Observations	810	807	786	786	786

***p<0,001, **p<0,01, *p<0,05, + p<0,1.

Source: Survey of child survival in «J» county in 1994-1996, conducted by the Population Research Institute, Xi' an Jiaotong University in May 1997.

All individual variables have significant influences on parent's odds of seeking medical treatment. As expected, the parent's odds of seeking medical treatment for a child outside the birth quota are about 60% of those for a child with birth quota, and those for a child delivered at home are about 42% of those for a child delivered at a clinic. The parent's odds of seeking medical treatment for neonatal births are higher than those for post-neonatal births, but much lower than those for children aged 1 -4.

Model III, which adds household variables to model II, shows that the influences of sex and individual variables on parents odds of seeking medical treatment still remain after controlling for household factors. It is noted that in Table 4, the parent's odds of seeking medical treatment for a neonatal birth are about 8% of those for a post-neonatal birth, and about 35% of those for a child aged 1 -4. This is different from results in model II and is what we anticipated, because parent's odds of seeking medical treatment should increase with age. As expected, mother´s age and education have no significant influences on parent's odds of seeking medical treatment. The parent's odds of seeking medical treatment for a child with only sisters are about 67% of those for a child with no siblings. However, the parent's odds of seeking medical treatment do increase with family income.

Model IV, which adds village variables to model III, shows that except for family income, the influences of sex, individual and other household variables on parents odds of seeking medical treatment still remain after controlling for village factors. As expected, the effectiveness of family planning policy implementation (or family planning work award) has no significant influence on parent's odds of seeking medical treatment. The parents odds of seeking medical treatment for a child in villages with weak son preference (high proportion of two-daughter households) are about 144% of those for a child in villages with strong son preference, and the parents odds of seeking medical treatment for a child in remote villages are lower than those for a child in villages close to county seat.

Model V, which adds the interaction effects between sex and individual, household and village variables to model IV, attempts to investigate the backgrounds of girls whose parents are less likely to seek medical treatment for their children. It is found that the parent's odds of seeking medical treatment for girls are very low among neonatal births, or births at home instead of a clinic. Thus, in spite of the fact that in general the parent's odds of seeking medical treatment are lower for girls than for boys, discriminations against girls in medical treatment are highly selective and targeted on female neonatal births or female births delivered at home.

4.- Discussion and summary

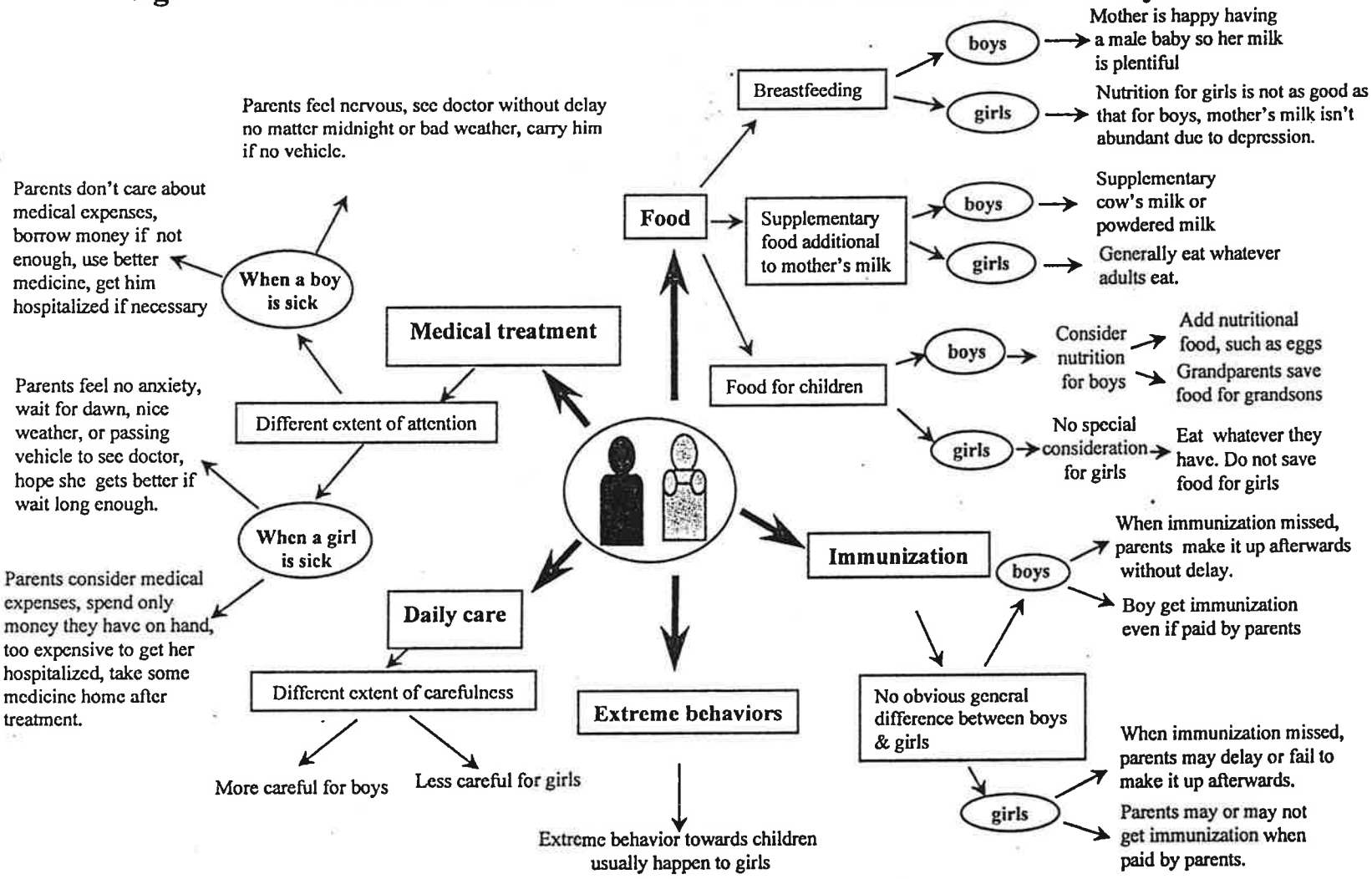
Our survey of households and communities show that infant mortality in 1994 -1996 in «J» county was about 32 per thousand for males and 46 per thousand for females, and that girls in «J» county suffered excess female infant mortality of over 21 per thousand. Among 427 female child deaths, about 28% them were unexpected excess deaths. However, substantial discrimination took place before birth, as the sex ratio at birth was as high as 130 in 1994 - 1996. In addition, female child survival disadvantages in «J» county has been increasing in the 1990s.

Most of the excess female deaths occurred among those who died at home and about two thirds of the excess female deaths took place within the first 24 hours of birth. Girls with especially high risk of excess mortality were those who were born at home, who were second or higher births in households, had only sisters or both brothers and sisters, who were out-of-government-plan births, or whose parents lived either in remote villages far from the county seat, or in villages with strong son preference.

The main mechanism of excess female child mortality is lack of use and effectiveness of curative health care, rather than preventive health care or nutrient deficiency. When children became ill, parents tended to consider illness of boys more serious than that of girls, and were more likely to seek medical treatment for boys than for girls. Further, once parents decided to seek medical treatment for their children, there were significant sex differences in the effectiveness of treatment, as reflected in expenses on medical treatment and times of hospital transfer. This finding is also confirmed in our clinic survey of 31 child deaths (Li and Zhu, 1998). Moreover, although discrimination against girls was quite universal and occurred in all kinds of households and communities regardless of socio-economic status, discrimination itself was very selectively targeted on girls whose backgrounds were those described above.

In order to better understand gender differences in child survival, we conducted five focus group discussions, focusing on people's perceptions of sex differences in childbearing and child survival, as well as the causes underlying these differences. In our focus group discussions, people reported various forms of discrimination against girls, including breastfeeding and food allocation, use of preventive and curative health care, daily care of children, and extreme behaviours such as abandonment and infanticide. The detailed results of gender differences in child survival are summarised in Figure 1.

Figure 1 Illustration of Gender Difference in Child Survival in "J" County



It is clear that the results of focus group discussions on gender differences in child survival are quite different from those in our previous analyses of the household survey data, in which the main mechanism of excess female child mortality is lack of use or effectiveness of curative health care, rather than preventive health care and nutrient deficiency. How do we interpret these contrasting results? In fact, the targets of the household survey and the focus group discussions were different. The household survey included only those children who died in 1994 -1996, and mechanisms of discrimination against girls refer to child deaths. By contrast, in focus group discussions, people's perceptions of discriminations against girls refer to all surviving and dead children. This suggests that, although there were various forms of discriminatory behaviours that affected the health of girls, the factor that directly resulted in excess female child deaths was discrimination against girls in curative health care.

An important finding from our survey is that excess female child deaths were heavily concentrated on those who died within the first 24 hours of birth in «J» county. In the survey, there was no significant difference in self-reported cause of death, i.e., illness or injury. But, this is clearly inconsistent with the above finding. It is obviously difficult to explain why most of the excess female deaths were those who died within one day of birth. Based on our in-depth investigations of local farmers and family planning workers, we give here several possible explanations.

The first factor is place of delivery. In «J» county, medical conditions for delivering and for subsequent treatment when necessary are quite different between hospital or clinic and home, with the former much better than the latter. Thus, the risk of neonatal deaths is much higher at home than in hospital or clinics. Since females were more likely to be delivered at home than in hospital or clinics, neonatal mortality risk is expected to be higher for females than for males. One factor that affects parent's decisions on where to deliver is that the expense for delivering in hospital or clinic is higher than for home delivery. With son preference, when parents have ascertained the sex of the foetus, for example through ultra-sound B or traditional Chinese medicine, they may be more likely to deliver female births at home. Another factor could be that some parents with second pregnancies might not be willing to deliver in hospital or clinic, in order to leave some room for their family building strategy.

A second factor is mi reporting of the sex of a dead child or age at death. Because our survey was a retrospective survey and based on parent's self-reports, some parents could not recall the exact age at death of their children who died within several days after birth, and it was quite possible that they reported age at death of their children as within one day. Other parents may have deliberately underreported the age at death of their children to make the cause of death seem more like illness. Further, some parents whose second birth was a girl may have

reported that child as dead in order to get a new birth quota, even though the child was actually alive. A phenomenon relating to this is adoption. Some parents who gave birth to females may have given their daughters up for adoption and reported their children as dead. These are some examples of mis eporting of child deaths.

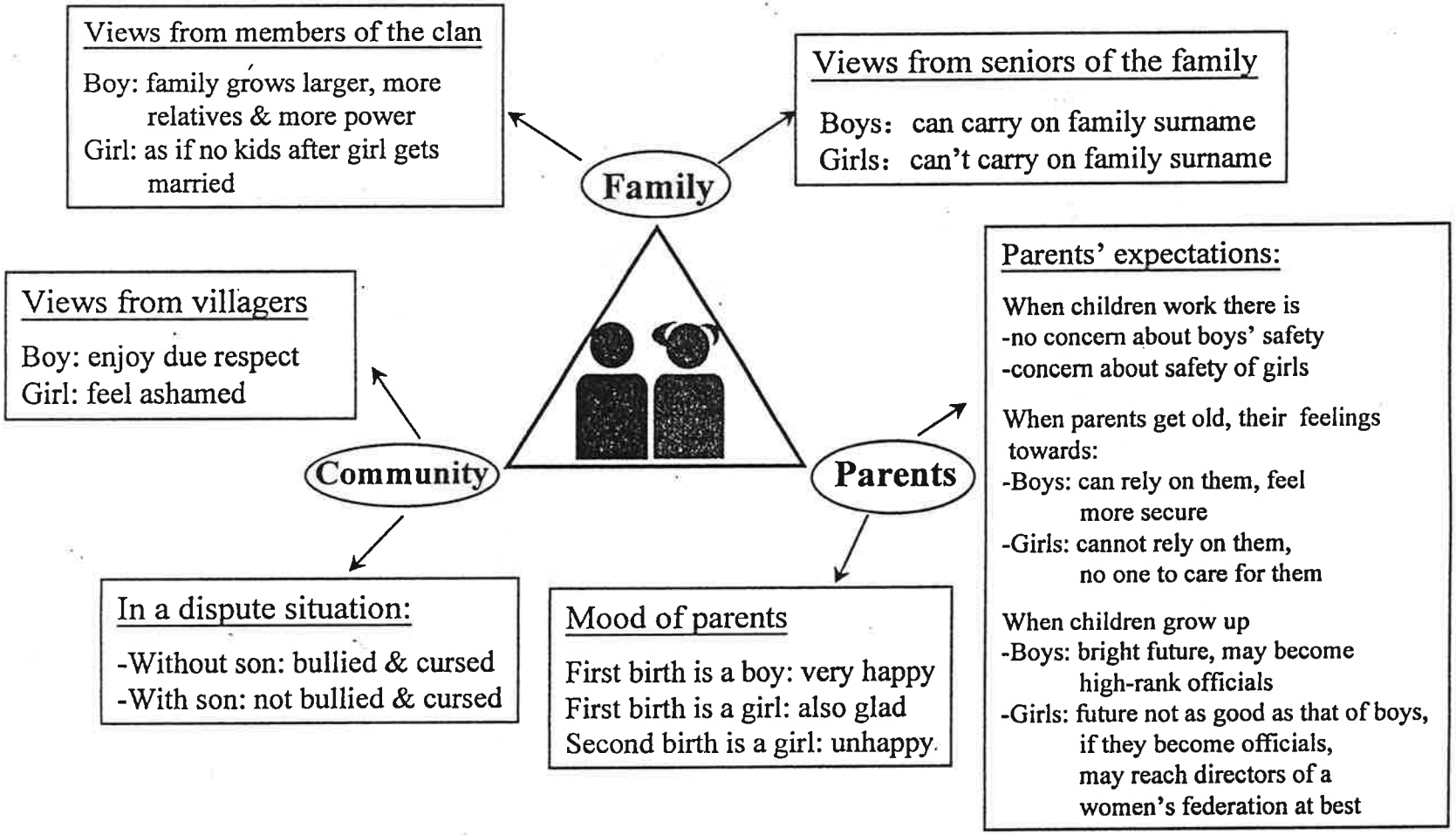
A third factor is possible female abandonment and infanticide. We lack hard evidence from our survey to support this properly. In fact, female infanticide existed widely in Chinese society before the 1950s (Wolf and Huang, 1980), even among the Qing nobility (Lee at al., 1994). It was more commonly practised in the eastern and coastal provinces (Wu, 1988). Although infanticide has been largely abandoned since the 1950s, it has not been completely eliminated. The fact that excess female child deaths occurred mainly among those reported to have died within one day of birth suggests that female abandonment and infanticide may still be more or less occurring in «J» county.

Given the fact that the sex ratio at birth in «J» county was already as high as 130 in 1995, a question naturally raised here is why some parents prefer to use female abandonment and infanticide, instead of prenatal abortion, to attain their desired family composition? Based on our observations in «J» county, there are several factors that may explain this. First, not every family has access to ultra-sound B to determine the sex of a foetus, especially since the government strictly controls the use of ultra-sound B. Second, ultra-sound B cannot precisely detect the sex of a foetus. Even if it were accurate, it is relatively less expensive for some poor farmers to abandon female babies or conduct infanticide than to abort, because for some poor families, women's childbearing itself is not regarded as an economic cost. Third, some parents may consider a new birth that has not yet received a name as no different from a foetus, and regard female abandonment and infanticide as delayed abortion. Last, but most important, most people in rural communities usually show sympathy for families without a son, and tend to regard female abandonment and infanticide as an individual immoral behaviour, but not a crime.

These are some of the possible behavioural factors that may explain the concentration of excess female child deaths on those who died within one day of birth. However, since the survey data were based on parent's self-reports, we are not able to assess the relative importance of these factors.

Our analyses clearly show that excess female child mortality in «J» county is a result from discrimination against girls. It remains to examine why people discriminate against girls in «J» county. This question relates to differences between boys and girls as perceived by the community, as addressed in our focus group discussions. The results are summarised in Figure 2.

Figure 2 Differences between Boys and Girls in "J" County



As seen in Figure 2, parents, family members, and the community in terms of their economic value, continuation of family surname, clan power, parent's emotional feeling, etc perceived boys and girls very differently. Hence, as in much of rural China, where strong son preference is an ancient part of the culture, girls tend to suffer excess mortality (Li and Feldman, 1996).

The issue of the roles of family planning policy rural communities is quite complicated. Our analyses show that excess female child mortality is more likely to occur among those children born outside the birth quota. Thus, the influences of the family planning policy on female child survival are obvious in «J» county. But does this mean that the government-guided family planning program is fully responsible for excess female child mortality in «J» county? We argue that, similar to high sex ratios at birth in China as a whole, the excess mortality of girls in «J» county is fundamentally caused by the strong son preference in the traditional Chinese culture, but exacerbated by the government-guided family planning program and regulations. This is supported by the findings of Das Gupta and Li (1999) and Li and Feldman (1996) that excess female child mortality existed before the 1970s, preceding the family planning program. Indeed, as long as China maintains its low fertility, even if it were to abandon its family planning policy, it is unlikely that excess female child mortality would disappear. More likely, the female disadvantage in child survival has been exacerbated by the rapid fertility transition but is not fundamentally caused by the family planning program.

It will take a long time and require much effort to resolve the problem of excess female child mortality in «J» county, as well as in China as a whole. On the one hand, family planning management, such as prenatal maternal and child health and family planning services, need to be improved by governments at various levels. On the other hand, in addition to enhancing women's participation in the economy and society and their status within the family and community, it is important to focus on efforts to raise the value of girls to a more equal footing with boys, so as to mitigate the pressures to discriminate against girls under the present and future low fertility regime. More importantly, the government needs to take substantial measures to create awareness of the problem among the general public, policy makers, as well as rural communities, and use the relevant laws to protect the rights and welfare of girls. To this end, a national project of reproductive health training and community development is being implemented in 39 counties. Hopefully the result will be improved female child survival in rural China.

References

ARNOLD, F. and LIU, Z. (1986), "Sex preference, fertility and family planning in China", *Population and Development Review* 12: 221-246.

BASU, A. M. (1989), "Is discrimination in food really necessary for explaining sex differentials in childhood mortality? [a] *Population Studies* 43: 193-210.

BHUIYA, A. and STREATFIELD, K. (1991), "Mother's education and survival of female children in a rural area of Bangladesh", *Population Studies* 45: 253-264.

BOURNE, K. L. and WALKER, Jr. G. M. (1991), "The differential effect of mother's education on mortality of boys and girls in India", *Population Studies* 45: 203-219.

CHOE, M. K., HAO, H. and WANG, F. (1995), "Effects of gender, birth order, and other correlates on childhood mortality in China" *Social Biology* 42 (1 -2): 50-64.

COALE, A. J. (1991), "Excess female mortality and the balance of the sexes in the population: An estimation of the number of missing females", *Population and Development Review* 17(3): 517-523.

COALE, A. J. and DEMENY, P. (1983), *Regional Model Life Tables and Stable Populations*. Academic Press, New York.

DAS GUPTA, M. and LI, S. (1999), "Gender bias and marriage squeeze in China, South Korea and India 1920-1990". *Development and Change*, forthcoming.

DAS GUPTA, M. (1987), "Selective discrimination against female children in rural Punjab, India",*Population and Development Review* 13(1): 77-100.

GRAHAM, M., LARSEN, U. and XU, X. (1998), "Son preference in Anhui province, China", *International Family Planning Perspectives* 24(2): 72-77.

GU, B. and ROY, K. (1995), "Sex ratio at birth in China, with reference to other areas in East Asia: what we know", *Asia-Pacific Population Journal* 10(3): 17-42.

HAN, S. and Li, S. (1999), "A study of the influences of individual and household factors on sex differences in child survival in China. [In Chinese]", *Journal of Population and Economics* (2): 28-34.

HILL, K. and UPCHURCH, D. M. (1995), "Gender differences in child health: Evidence from the Demographic and Health Surveys", *Population and Development Review* 21(1): 127-150.

HULL, T. H. (1990), "Recent trends in sex ratios at birth in China", *Population and Development Review* 16(1): 63-83.

JOHANSSON, S. and NYGREN, O. (1991), "The missing girls of China: A new demographic account", *Population and Development Review* 17(1): 35-51.

LEE, J., WANG, F. and CAMPBELL, C. (1994), "Infant and child mortality among the Qing nobility: Implications for two types of positive check", *Population Studies* 48: 395-411.

LI, S. and FELDAM, M. W. (1996), "Sex differentials in infant and child mortality in China: Levels, trends and variations." *Chinese Journal of Population Science* 8(3): 249-267.

LI, S. and ZHU, C. (1998), "Gender Differences in Child Survival in Rural China", Project research report.

LI, Y. (1992), "Sex ratios of infants and relations with some socio-economic variables: The results of the China's 1990 census and implications", paper presented at the *International Seminar on China's 1990 Population Census*, October 19-23, Beijing.

MOSLEY, W. H. and CHEN, L. C. (1984) "An analytic framework for the study of child survival in developing countries", *Population and Development Review* 10 (Supplement): 25-45.

MUHURI, P. K. and PRESTON, S. H. (1991) "Effects of family composition on mortality differentials by sex among children in Matlab, Bangladesh", *Population and Development Review* 17(3): 415-434.

PAUL, B. K. (1990), "Factors affecting infant mortality in rural Bangladesh: Results from a retrospective sample survey", *Rural Sociology* 55(4): 522-540.

POSTON, D. L., LIU, P., Gu, B. and McDANIEL, T. (1997), "Son preference and the sex ratio at birth in China: A provincial level analysis", *Social Biology* 44(1-2): 55-76.

REN, S. X. (1994), "Infant and child survival in Shaanxi, China", *Social Science and Medicine* 38(4): 609-621.

REN S. X. (1995), "Sex differences in infant and child mortality in three provinces in China", *Social Science and Medicine* 40(9): 1259-1269.

TABUTIN, D. and WILLEMS, M. (1995), "Excess female mortality in the developing world during the 1970s and 1980s", *Population Bulletin of the United Nations* 39: 45-78.

TULJAPURKAR, S., LI, N. and FELDMAN, M. W.(1995), "High sex ratios in China's future", *Science* 267: 874-876.

WALDRON, I. (1983), "Patterns and causes of excess female mortality among children in developing countries", *World Health Statistical Quarterly* 40: 194-210.

WEN, X. (1993), "Effects of son preference and population policy on sex ratios at birth in two provinces of China", *Journal of Biosocial Science* 25: 110-120.

WOLF, A. P. and HUANG, C. (1980), *Marriages and Adoption in China, 1845-1945.* Stanford University Press, Stanford, California.

WU, C. (1988), "Study on the sex ratio at birth in China. (In Chinese.)",in *Studies of China's Population Problems*, eds. Z. Liu et al., pp. 110-148. China People's University Press, Beijing, China.

WU, T. and WANG, J. (1991), "Is there discrimination against female babies? [In Chinese]", *Population Research* (6): 43-46.

ZENG, Y., TU, P., GU, B., XU, Y., LI, B., and LI, Y. (1993), "Causes and implications of the recent increase in the reported sex ratio at birth in China", *Population and Development Review* 19(2): 283-302.