

# Fetal sex determination in infants in Punjab, India: correlations and implications

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## Abstract

**Objectives**—To determine the proportion of children whose sex was determined prenatally among those attending one Indian hospital and to identify factors which affect use of fetal sex determination.

**Design**—Cross sectional study using interviews with mothers.

**Setting**—Medical school hospital in Punjab, India.

**Subjects**—596 children delivered or seen for inpatient or outpatient care.

**Main outcome measures**—Fetal sex determination, sex of child, number and sex of siblings, type of care received, socioeconomic status, and maternal education.

**Results**—Sex had been determined prenatally for fewer girls (5/236, 2%) than boys (49/360, 14%). Fetal sex determination had been done for only 2% (3/154) of first born boys compared with 18% (12/66) with one older sister and no older brother and 63% (30/48) with more than one older sister and no older brother. Only four boys whose sex had been determined prenatally had older brothers. The five girls whose sex had been determined prenatally either had a male twin or were incorrectly identified as male. Prenatal sex determination had been done for 21% (26/122) of boys admitted for inpatient care compared with 11% (19/173) seen as outpatients. Use of fetal sex determination increased with increasing monthly income ( $\chi^2$  for trend=6.384,  $P=0.0115$ ). None of the mothers who had had no education had used fetal sex determination, but among mothers with some education the frequency of use did not change with increasing education. The sex ratio of children born at the hospital rose from 107 boys/100 girls in 1982 to 132 boys/100 girls in 1993.

**Conclusions**—Fetal sex determination was common, especially if the family already had daughters. Sex determination seems to be driven by a desire to have sons, with socioeconomic status and education having little effect. The lower prevalence of fetal sex determinations for girls is likely to be due to abortion of fetuses found to be female.

## Introduction

In many parts of India intense economic and social pressures act to make sons much more desirable than daughters.<sup>1,2</sup> In these areas most medically terminated pregnancies are of female fetuses that have been detected by ultrasonography or by amniocentesis.<sup>3,5</sup> However, it is not known how common fetal sex

determination during pregnancy or abortion of female fetuses is.

We estimated the prevalence of fetal sex determination retrospectively by interviewing the mothers of infants who were brought to our hospital for care (or delivery). We examined the rates of fetal sex determination in boys and girls, and analysed the effects of the presence and sex of older siblings, the type of medical care, socioeconomic status, and maternal formal education.

## Subjects and methods

We conducted the study from May 1990 to December 1991 at Brown Memorial Hospital Christian Medical College, Ludhiana, Punjab, India. The hospital has 730 beds and provides primary through tertiary care. The study population consisted of 360 boys and 236 girls selected at random from those who attended the paediatric outpatient clinics (173 boys, 136 girls), were admitted to the paediatric ward (122 boys, 49 girls), or were born at our hospital and stayed with their mother on the obstetrics ward (65 boys, 51 girls).

Mothers of the selected infants were all interviewed by the same investigator after her consent had been obtained. The mothers were asked if they had had fetal sex determination during the pregnancy with the selected infant. We did not attempt to verify that fetal sex determination had been performed; ultrasonography or amniocentesis for fetal sex determination is illegal in India and written reports are not given to the women. It was unlikely that the person who had performed the procedure would have been willing to confirm that the examination had been performed on a particular woman. The number and sex of any older children, reported monthly income, and number of years of formal education of the mother were also noted. Tabulation and  $\chi^2$  analysis were performed with the BMDP (Los Angeles, California, United States) and EpiInfo (Atlanta, Georgia, United States) statistical software packages.

To eliminate the potential selection bias arising from preferential abortion of female fetuses we analysed the association between fetal sex determination and type of medical care, maternal education, and socioeconomic status only for boys. The number of live births of boys and girls during 1976 to 1993 at our hospital was obtained from the medical records department.

## Results

Prenatal sex determination was reported for 9.1% (54/596) of infants. Many fewer mothers of girls reported having had fetal sex determination (5/236, 2%) than mothers of boys (49/360, 14%). Of the five girls whose mothers had had fetal sex determination, all either had a male twin or had been incorrectly identified as male by ultrasonography. Fetal sex determination in all cases was performed by ultrasonography.

The number of boys whose sex had been determined prenatally varied greatly with the presence and sex of older siblings (table I). Fetal sex determination had been done on less than 2% of the infants with no older siblings—18% of infants with one sister and no

TABLE I—Effect of sex and number of older siblings on prevalence of fetal sex determination for boys

No of sisters	No (%) of brothers			Total
	0	1	>1	
0	3/154 (2)	0/48 (0)	0/6 (0)	3/208 (1)
1	12/66 (18)	4/31 (13)	0/2 (0)	16/99 (16)
>1	30/48 (63)*	0/4 (0)	0/1 (0)	30/53 (57)
Total	45/268 (17)	4/83 (5)	0/9 (0)	49/360 (14)

\* $\chi^2$  Test for trend for boys with no older brothers=55.4;  $P<0.0001$ .

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brother, and over 60% of those with two or more sisters and no brothers. The presence of even one brother in the family greatly decreased the likelihood of fetal sex determination having been done.

The sex of so few girls had been determined prenatally that stratification for older sisters and brothers was not possible. However, girls whose sex had been determined prenatally were much more likely to have older sisters (4/5, 80%) than were girls whose sex had not been determined prenatally (46/236, 19.5%) ( $P=0.008$ ).

Mothers of boys admitted to the paediatric ward were twice as likely to have had fetal sex determination as mothers of boys seen in the paediatric clinic (table II). Fetal sex determination was least common among mothers of newborn boys who were staying in the obstetrics ward.

Use of fetal sex determination increased with increasing household monthly income (table III). None of the mothers who had had no formal education had had fetal sex determination (table IV). The frequency of fetal sex determination among mothers who had had some formal education remained constant for all levels of education.

The sex ratio at birth of those children born at the hospital was in the normal range (104-106 boys per 100 girls) until the mid-1980s, when it began to increase (figure). In 1993 the sex ratio at birth was 132 boys per 100 girls.

### Discussion

In this study of infants seen at a large hospital as newborns, inpatients, and outpatients fetal sex determination was reported by the mother for 13.6% of boys and 2.1% of girls. The large difference between mothers of boys and girls probably reflects abortion of fetuses that were detected to be female. This is corroborated by the finding that the only girls whose sex had been determined prenatally were either incorrectly identified as being male or had a male twin. This suggests that most families that are willing to have fetal sex determination are planning to abort fetuses that are found to be female. Because male fetuses are not aborted, the frequency of fetal sex determination reported for boys probably approximates to the true rate of fetal sex determination for both male and female fetuses.

Use of fetal sex determination was less common during pregnancy with a first born child than that with a higher birth order child. Most fetal sex determinations were had by mothers who already had at least one daughter. The presence of even one son greatly reduced the enhancing effect of a daughter. These findings are not surprising, given the growing pressures to limit family size to two or three children in an environment of intense desire for at least one, or preferably two, sons. None of the women who already had two sons had fetal sex determination.

The proportion of boys whose sex had been determined prenatally was higher among those admitted to the paediatric ward than among those seen as outpatients. Inpatient care is more costly than outpatient care. This barrier may be sufficient to prevent families from bringing less valued children for hospital treatment. We have previously reported that girls are less likely to be admitted to this hospital than boys.<sup>6</sup> The higher rate of fetal sex determination among inpatient boys may reflect a subpopulation of children who are more valued by their families.

Our findings cannot be generalised to the greater population. The overall rate of fetal sex determination in boys of 13.6% may be an overestimate of that in the general population if more highly valued children,

### Epidemiological implications

- In many parts of India pressure exists to have sons
- In this study fetal sex determination by ultrasonography had been used by mothers of 13.6% of boys and 2.1% of girls receiving medical care at a hospital in Punjab
- The lower use of fetal sex determination by mothers of girls probably reflects abortion of fetuses detected to be female
- The birth sex ratio at the hospital rose from 107 boys/100 girls in 1982 to 132 boys/100 girls in 1993
- Since sex cannot be determined before 13-14 weeks' gestation, sex selection increases the risk of maternal morbidity and mortality and may have serious effects on the population balance

specifically sons identified by fetal sex determination, were preferentially brought for care. It is also likely that people coming to our hospital for services were more affluent and more educated than the general population. The effects of higher socioeconomic status and greater maternal education may, however, be minimal. Although fetal sex determination was less common in families with lower incomes, 8% of families in the lowest economic category had fetal sex determination. Sadly, it is a wise investment: a procedure that may cost 500-1500 rupees today may save tens of thousands of rupees later in the form of a dowry that does not have to be given to marry off a daughter. The effect of maternal education was not large. Although none of the women who had had no formal education had had fetal sex determination, the frequency did not vary among women with minimal to more than 10 years' schooling. Since mothers with daughters were much more likely to have fetal sex determination, it seems that if families are aware of, and have access to, fetal sex determination, socioeconomic status and maternal education will not matter.

Amniocentesis for determination of fetal sex has been available for many years, but the cost, invasiveness, and technical expertise required have limited its widespread use. The use of ultrasonography for determination of fetal sex was first reported in the late 1970s. The procedure is safe, relatively inexpensive, and not technically difficult. The rise in the birth sex ratio at our hospital began in the early 1980s and is testimony to the rapidity with which a new medical procedure can become widely practised when demand is great.

### LONG TERM IMPLICATIONS

The rate of rise in the birth sex ratio seems not to be lessening. Presumably awareness of, and access to, ultrasound diagnostic facilities is increasing, at the same time as the efforts of family planning programmes to limit family size become more effective. If female feticide continues at this rate or, as seems more likely, increases, the ultimate effect on the sex distribution of the population will be profound. Ironically, this may increase the status of women by creating a shortage of them. Predetermination of sex can, however, have undesirable long term consequences.<sup>7</sup>

The initial studies reported that fetal sex determination could be determined with considerable accuracy only after 16 weeks' gestation. In two large series of fetuses greater than 16 weeks' gestation the external genitalia could be successfully visualised in 61% to 83.5% of fetuses.<sup>8</sup> In fetuses of 16 to 20 weeks'

TABLE II—Effect of type of medical care of boys on prevalence of fetal sex determination by mothers of boys

Type of health care	No (%) having fetal sex determination
Inpatient (n=122)	26 (21)
Outpatient (n=173)	19 (11)
Delivery (n=65)	4 (6)

\* $\chi^2=10.24$ ,  $P=0.006$ .

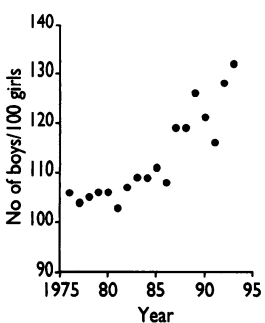
TABLE III—Effect of reported monthly income on prevalence of fetal sex determination for boys

Monthly income (rupees)	No (%) having fetal sex determination
0-1499 (n=100)	8 (8)
1500-2999 (n=182)	24 (13)
3000-4499 (n=63)	14 (22)
4500-6000 (n=15)	3 (20)

$\chi^2$  for trend=6.384,  $P=0.0115$ .

TABLE IV—Effect of maternal formal education on fetal sex determination by mothers of boys

Years of formal schooling	No (%) having fetal sex determination
0 (n=39)	0 (0)
>0-5 (n=30)	5 (17)
6-10 (n=162)	24 (15)
>10 (n=129)	20 (16)



Number of boys per 100 girls live born at Christian Medical College, Ludhiana, from 1976 to 1993. Total number of live births ranged from 1297 to 2468

gestation in which the genitalia could be visualised the accuracy of sex determination was 86% to 92.7%.<sup>8,9</sup> In one of the studies the accuracy for male fetuses was 90% and for female fetuses 100%.<sup>8</sup> Experience and technological improvements mean that fetal sex can now be determined as early as 13-14 weeks' gestation (personal communications with radiologists specialising in ultrasound). Thus, if the fetus is detected to be female and the family elects to terminate the pregnancy abortion is performed in the second trimester. Mid-trimester abortions require more aggressive methods than those performed earlier and are associated with increased morbidity and mortality.<sup>10</sup>

Fetal sex determination and medical termination of pregnancy on the basis of fetal sex are illegal in India, and a bill has recently been passed in parliament which strengthens the law. Although stricter enforcement of the appropriate laws may help, only a change in the attitude of society, perhaps accomplished through efforts that raise the social and economic status of women, will decrease the use of fetal sex determination and subsequent female feticide.

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## Stress, anxiety, and depression in hospital consultants, general practitioners, and senior health service managers

Richard P Caplan

### Abstract

**Objective**—To study stress, anxiety, and depression in a group of senior health service staff.

**Design**—Postal survey.

**Subjects**—81 hospital consultants, 322 general practitioners, and 121 senior hospital managers (total 524).

**Main outcome measures**—Scores on the general health questionnaire and the hospital anxiety and depression scale.

**Results**—Sixty five (80%) consultants, 257 (80%) general practitioners, and 67 (56%) managers replied. Of all 389 subjects, 183 (47%) scored positively on the general health questionnaire, indicating high levels of stress. From scores on the hospital anxiety and depression scale only 178 (46%) would be regarded as free from anxiety, with 100 (25%) scoring as borderline cases and 111 (29%) likely to be experiencing clinically measurable symptoms. The findings for depression were also of some concern, especially for general practitioners, with 69 (27%) scoring as borderline or likely to be depressed. General practitioners were more likely to be depressed than managers (69 (27%) v 4 (6%) scored  $\geq 8$  on hospital anxiety and depression scale-D;  $P=0.004$ ) with no significant difference between general practitioners and consultants. General practitioners were significantly more likely to show suicidal thinking than were consultants (36 (14%) v 3 (5%);  $P=0.04$ ) but not managers (9 (13%)). No significant difference could be found between the three groups on any other measure.

**Conclusions**—The levels of stress, anxiety, and depression in senior doctors and managers in the NHS seem to be high and perhaps higher than expected.

### Introduction

Many reports have suggested that stress among doctors is high, but careful searches of the literature show that few studies have measured stress with much

reliability or validity. Most comment on the postulated causes of stress or on specific subgroups of the medical specialties, and few use standardised rating scales. It is rare to find studies that include a control group. The most frequently quoted British study is confined to junior doctors in their preregistration year.<sup>1</sup>

It is difficult to find a study that includes consultants across specialties and that provides much information about their current level of stress. A recent study has measured levels of stress among general practitioners before and after the introduction of the new contract and suggests that stress has risen among this group.<sup>2</sup> Firth found that nearly a third of medical students and half of junior doctors in their preregistration year were suffering from emotional disturbance.<sup>1,3</sup> The BMA has recently published a document on stress within the medical profession,<sup>4</sup> but, although comprehensive, it contains no references or information about measured levels of stress or psychological symptoms in senior hospital doctors.

I set out to measure the current levels of stress among three defined groups who by and large lived and worked in similar geographical and demographical circumstances.

### Subjects and methods

Three discrete groups of senior NHS staff were included in the study. The first group included all 81 hospital consultants working within North Lincolnshire Health Authority in all medical and surgical specialties. The second group included all 322 general practitioners registered with Lincolnshire Family Health Services Association. A third group included all 121 members of a group representing the senior and middle managers of North Lincolnshire Health Authority. This group, although not a control, was included to balance the "medical" variable. The managers' group included the district general manager, his chief officers, and all the key managers in the district.

All those taking part were asked to complete the

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