Case finding for the fragile X syndrome and its consequences

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The fragile X syndrome is a cause of mental disability in both males (1/4000 births) and females (1/8000 births).¹ Diagnosis is often delayed into mid-childhood or beyond, and in some families it is never made. The inheritance pattern is X linked, which means that members of the extended family are at risk of being carriers. These individuals have a right to information and counselling in making their own choices about reproduction. In New South Wales a programme of active case finding has been in place for 10 years.² We describe this programme and look at the outcome and possible future directions.

Fragile X syndrome

Males with fragile X syndrome (fig 1) need extra help at school, protected employment later, and are not usually able to live independently. Affected females have much milder learning difficulties and fewer obvious clinical features; half of those with the full mutation are not recognised as disabled but most have some learning difficulties.

Although the syndrome is X linked, the underlying genetic mechanism is not straightforward. The function of the gene product—the FMR-1 protein—is unknown.³ The gene promoter region contains a CCG repeat island with a repeat length, normally in the 20-40 range, that is passed down from generation to generation. The repeat length may slowly increase over generations and become progressively more unstable, probably because of “slippage” (inaccurate duplication that occurs in stretches of identical repeats). An elongation of 54 or so repeats can suddenly expand to more than 200 in one generation.⁴ This large change, or full mutation, switches off the promoter and stops gene production. Both sexes may have smaller expansions or premutations of 54-200 repeats. These people are normal but the women have an earlier menopause⁵; they are called “normal transmitting” males or females. Expansion or amplification into the full range of mutation occurs only when premutations are transmitted through females. Premutations in males, however, will be inherited by all daughters—all daughters therefore are normal transmitting females. The fragile site at Xq27.3 is seen on chromosome analysis only in people with the full mutation. Molecular methods using polymerase chain reaction and Southern blotting can define both premutations and full mutations.

Summary points

A programme offering testing for fragile X syndrome to parents and guardians of people with mental disability has been running in New South Wales for 10 years, and has identified about three quarters of families who are affected

Cascade testing of 1st, 2nd, and 3rd degree relatives by genetic counsellors is well accepted

The programme has effected a reduction in the prevalence of the fragile X syndrome from 2.5 to 1/10 000 males and restoration of reproductive confidence in members of the extended family

Concern exists about unaffected males with a premutation for whom long term consequences are seen only in grandchildren as information may not be transmitted from one generation to the next

A different screening strategy—either testing women in senior school or at antenatal clinic, or testing boys as part of the routine neonatal screening procedure—may now be implemented

See editorial by Barnicoat

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The Fragile X Program was established in New South Wales in 1986 after a study had shown that only a quarter of affected males had been diagnosed and family studies had been done in only a few of these.⁶ The programme's objectives were to offer fragile X testing to families of people who were mentally disabled and, through those identified, enable women at risk in the extended family to make informed reproductive choices. Case finding was through schools, workshops, and institutions. No one was tested without the consent of their parents or guardians. Testing included a short physical examination and chromosomal analysis, which was later confirmed by molecular studies.

In 1994 we modified case finding to accommodate changes in the state educational system favouring the integration of intellectually disabled people in mainstream education. We targetted only boys in the first and second years of secondary education, by which time their disability would be understood and accepted

Fig 1 Four brothers with the fragile X syndrome

by their parents. At present we use two methods of screening. In one method the genetic counsellor visits the schools, identifies those who might have the fragile X syndrome, and asks the parents for permission to test. In the other method, used mainly in rural schools, children with an unexplained disability are offered a medical review, and their parents are involved in the assessment. Proband identification is followed by a home visit. It is recognised that both parents have to understand not only a new diagnosis but also its genetic implications.

The process of imparting this information and counselling the nuclear family (parents and siblings) and the extended family may take months or years. Reaching the extended family is done by the nuclear family, but we provide written information for parents, carriers, and members of the extended family and for teachers and the local doctors. Regular contact with the families is maintained, and we publish a yearly newsletter.

Findings

Details of findings have been published elsewhere.²⁻⁶ In brief, by December 1996 a total of 245 index cases or probands from 225 families had been identified and confirmed as having the fragile X syndrome. Thirty six families (16%) had minimal testing; in 54 families (24%) first degree relatives were tested; in 91 families (40%) first, second, and third degree relatives were tested; and 44 families (20%) underwent extensive cascade testing (fig 2).

Prevalence

The effects of making a diagnosis and the availability of prenatal diagnosis on the prevalence of affected males in relation to year of birth and new cases identified are shown in fig 3. In these families the prevalence fell from 2.5 to 0.5 males per 10 000 births.⁷

The prevalence data for New South Wales in 1984-5 and Coventry, England, in 1982-5 were for schoolchildren.¹⁻⁸ These cohorts had been born before the fragile X syndrome was commonly recognised. Both surveys found an almost identical prevalence of about 2.5/10 000 males. This can be taken as the "wild state" prevalence—that is, the prevalence before diagnosis and genetic counselling had had their effect.

From the known prevalence of fragile X syndrome in New South Wales we estimated the proportion of families with a proband who is undiagnosed and a family which remains uncounselled as follows:

- Number of males born since 1950 = 1 827 600
- Number of males expected with fragile X syndrome = 467
- Number of males found with fragile X syndrome = 347
- Number diagnosed = $347/467 = 74$

The prevalence in these families is 0.5/10 000. Other families have the "wild state" prevalence of 2.5/10 000. Overall, 1 in 10 000 males will have fragile X syndrome.

Fig 2 Cascade testing and its effects in the families of probands with the fragile X syndrome

Fig 3 Birth incidence of boys with fragile X syndrome in known relatives of probands in relation to number of boys born in New South Wales

Reproductive decisions

A prime objective in all genetic counselling is to restore reproductive confidence. This means that women at risk can have the same opportunities of having normal children as their peers. We believe the programme has gone some way towards achieving this. We know from a previous study that diagnosis and genetic counselling reduce the birth rate in families with fragile X by 20%, and that 78% of women who do become pregnant will have prenatal diagnosis made.⁷ The experience of the programme over 10 years is given in the table. This shows that although there were 19 terminations of affected male fetuses out of 104 antenatal tests, 79 unaffected children were born. More couples now seem to be asking for antenatal testing.

Provision of continuing help and support is a major component of the programme. Sons and daughters come of age and want carrier testing; discussions about and requests for prenatal diagnosis arise continually. There are particular concerns about the normal transmitting males. They have no direct problems but their actual or potential daughters will have difficult decisions to make. Furthermore, as has been shown in thalassaemia, information about carrier status may not be passed from one generation to the next (I Bianco, personal communication).

Discussion

The Fragile X Program is now a well accepted and well established service in New South Wales. It has been

Results of 125 antenatal tests for fragile X syndrome in counselled families, 1986-96

Outcome	No of births (n=104)	No of terminations (n=21)
Boys:		
Normal	35	0
With full mutation	19	19
With premutation	1	1
Girls:		
Normal	42	1*
With premutation	1	0
Other chromosomal abnormalities	1	1
Inconclusive DNA test	3	0
Miscarriage	2	0

*Before test results.

effective in reducing the number of children born with the syndrome and in alerting medical and educational professionals to its importance. Other benefits include the identification of other chromosomal abnormalities (some of which have implications for the extended family); the diagnosis of other clinical entities, such as the Williams, Noonan, Kabuki, Rett, and Angelman syndromes, which are often missed by the routine medical services; and finding other X linked conditions, particularly non-specific X linked mental retardation.

There have been problems—some continuing, some resolved. The programme is not offered in the private schools, which take about 30% of primary school children in New South Wales. When only cytogenetic testing was available, it was often possible to tell female relatives that they were carriers but it was never possible to tell them conclusively that they were not. During that phase in testing there were some over-diagnoses for reasons which are now clear.¹ The development of reliable DNA tests has solved both these problems. Not all families have received the diagnosis and its implications for the family with equanimity or enthusiasm—one irate father threatened to shoot the clinical geneticist if she ever came near the family again. Most people, however, felt relief that at last there was a medical explanation for the problems in the family. Even in those families who showed initial hostility, subsequent relations with the programme became cordial. Parents, carers, and children have increasing concerns about needles and venepuncture, but the development of reliable DNA tests using buccal smears should alleviate these.

The future

As in all screening programmes that cause a reduction in prevalence, the rate of return drops. This is compounded by increasing awareness of the fragile X syndrome in the medical and teaching professions, so that ever more children are diagnosed through the general medical services. In the evolution of a fragile X programme, should the first phase of case finding in schools and sheltered workshops, and cascade testing in the families be followed by a different strategy? We have considered two possibilities.

Identifying women with premutations

The first strategy is to identify the 1 in 250 women with premutations before or early in a pregnancy.⁹ This could be done in high schools or in prenatal clinics, but practical difficulties exist. Women have two X chromosomes, each of which has its own set of CCG repeats. In 30% of women their repeat numbers are the same so that a screening programme using polymerase chain reaction methods would also need to use Southern blot analysis in this subgroup. Assuming that case finding shows an incidence of 1/10 000 and that each carrier has a maximum risk of 1 in 4 of having an affected child, a minimum of 80 invasive prenatal tests would have to be done to identify one affected male. This would also mean counselling those 80 women and their immediate relatives. This is an expensive procedure with complicated organisational problems, not to speak of the emotional turmoil that would be caused to the women involved.

A further difficulty is that although much is known about premutations and their amplification in women from families with the fragile X syndrome, we cannot tell whether this applies to women with the same number of CCG repeats found in the general population. These women may have a stable CCG number and be at little or no risk of having a child with the fragile X syndrome. At present we do not have the data which would enable us to give these women sound advice.

Testing boys during routine newborn screening

The second strategy is to incorporate testing for affected males into routine newborn screening programmes using DNA from the Guthrie spot. The infrastructure for the collection of specimens is in place and laboratory tests could be automated. Although informed consent before collection would be required, no large expansion of the counselling service would be necessary. Neonatal screening was considered in a questionnaire sent to members of the Fragile X Society of the United Kingdom in 1995. Eighty five per cent reported that they would have preferred to know the diagnosis from birth if that option had been available. Comparable newborn screening programmes have been established to identify boys with Duchenne muscular dystrophy in Wales, Manitoba, and parts of Europe, and the uptake has been 95%.¹⁰ The purpose is to provide genetic counselling to the immediate and extended family. The effectiveness of such a programme should be greater in fragile X syndrome than in muscular dystrophy, since in the former no fresh mutations exist and the mother's sisters are at a greater risk of being carriers.

We believe we have shown that case finding followed by cascade testing is highly effective. We also believe that an outreach, proactive programme is warranted with this syndrome. Up to half of women with the fragile X full mutation have some degree of intellectual disability. This, together with the burden of caring for one or more children with the fragile X syndrome, raises considerable odds against their seek-

ing a diagnosis and obtaining genetic counselling. Such a programme requires some laboratory infrastructure and a dedicated team of genetic counsellors who will support these families in the long term. Once the service is established case finding may move into the next phase, which could be neonatal testing. It goes without saying that well planned pilot studies are essential.

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A memorable patient

"There is nothing wrong with me"

"Next, please," and in came a spry, fit looking, silver haired man. In answer to the usual question, "What can I do for you?" he replied, "I am not complaining of anything. There is nothing wrong with me."

There was no letter from his general practitioner. Why not? "Because there was no point in troubling him, so I came straight to you because you are the consultant for outpatients." There was open access in the general medical outpatients department in the Royal Infirmary of Edinburgh and one consultant physician, two registrars, and three rotating senior registrars. We would see between 80 and 100 patients each morning. This certainly gave us much experience but evidently did not give me the wisdom to advise this man.

I was unable to obtain any clinical history from him apart from an appendectomy at the age of 18. After some resistance, because he said that I would find nothing, I examined him. He was right; I found nothing. Again with some complaint from him, I took blood for such simple screening tests as blood counts, sedimentation rate, and liver function tests. All were found to be normal.

He then said, "Now what are you going to do about me? I am a widower, aged 70, a retired lawyer with three married sons, all

employed and provided for. I have no desire to carry on until I am disabled and miserable." I probably made some encouraging or reassuring remark, which was not well received. "Of course, I realise that the NHS can't kill people but can it afford to keep me for 10 or more years of possible illness?" He left in a disagreeable mood, and I was quite shaken by the whole episode.

At lunch I told my tale to my consultant colleagues, and the new professor of psychiatry castigated me for missing acute depression, which was crying out for help. He even suggested that I encouraged the lawyer to commit suicide. This shook me even more. I have often wondered what the professor of psychiatry would have said to this educated man and how he would have managed him.

I wrote to the patient a month later and asked him to come again. There was no response. On inquiry, his general practitioner said that he had not seen him for many years and knew nothing about his visit, other than my letter reporting it. Two months later, a second letter was returned marked, "Gone away." It was unfortunate that he saw a cardiologist.

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Women's health

Life span: conception to adolescence

Naomi Craft

The life span approach to women's health recognises that the health status of a woman in one phase of her life affects not only the subsequent phases but also the lives of her existing and future children. International health programmes and policies aim to enhance women's physical, mental, and social wellbeing throughout their lifespan. Most of the issues described in this article affect women living in the developing world.

Surviving the first years

The missing millions

Though 5% more boys are born in the world, given similar care, women survive better at all ages, including before birth.¹ This means that in many developed countries there are more women than men. For example, in the United Kingdom, France, and the United States the ratio of women to men is more than 1.05. Girls are known to be intrinsically more resistant to infection and malnutrition, perhaps because of sex differences in chromosomal structures and a slower maturing of boys' lungs due to the effects of testosterone.²

Whatever their biological advantage, evidence is mounting that in many parts of the world, girls are at a social disadvantage which has a profound impact on their chance of survival. This social disadvantage depends on the practices in an individual society.

"Why did you come, oh girl, when we wished for a boy? Take the jar and fill it from the sea. May you fall into the water and drown." (Pakistani folksong)

The preference for boys has complex historical roots. In many traditional societies, it stems from the reliance on men as primary breadwinners and providers of security in the parents' old age, while women are accorded secondary support roles. In India, for example, a daughter is considered to be a financial asset to her husband's family and a drain to her own because she will need a dowry—a practice still prevalent, despite it being illegal in India. The absence of social support for old people in India has also contributed to making society highly dependent on sons and the perpetuation of the extended family.³ "Women are tuned to a certain way of thinking and behaving, certain stereotypes and assumptions," said Dr Seshagiri Rao, assistant secretary general of the Family Planning Association of India.⁴

Because of what Unicef calls "gender apartheid," in many developing countries the female:male ratio may be as low as 0.95 (Egypt), 0.94 (Bangladesh, China, and western Asia), 0.93 (India), or even 0.90 (Pakistan).⁵ After taking into consideration the lower life expectancy and higher birth rate in developing countries, it has been calculated that there are more than 100 million missing women worldwide.⁵

Summary points

Although women survive better than men at all ages, in many parts of the world girls are at a social disadvantage which has a profound impact on their chance of survival

Pregnant women may undergo selective abortion or infanticide if they have a girl, and those girls who survive may receive less nutrition, health care, and education than their male siblings

Each year, an estimated 2 million girls are circumcised despite international support for the eradication of the practice, and over 100 000 teenage girls die from causes related to pregnancy and childbirth

Education is at the foundation of many initiatives to improve the health of girls, supported by research which confirms the close positive correlation between women's education and reduced infant mortality and improved family health

This is the second of three articles exploring the impact of women's health on the international community

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Sex selection

As a result of the social disadvantage of having a baby girl, children are at risk of harmful practices such as sex selection, common in India for centuries. Sex selection was relatively common in 19th century England and in some areas of Italy even in the 20th century.

According to Dr Poonam Thapa, from the International Planned Parenthood Federation's Europe region: "Killing of newly born girls by poisoning has been practised in some rural pockets of India for many years." In 1975 amniocentesis was introduced to India for detecting fetal malformations but without a law regulating its use. The technique rapidly became a lethal weapon for promoting selective abortion. "Amniocentesis gave the practice of sex selection a sophisticated aura as the middle class jumped on the bandwagon and extended its use to ominous proportions," commented Dr Thapa.³

"When a girl is born the earth sinks by a foot, but when a son is born it rises up one foot to greet him." (Maithili proverb, Nepal)

A survey of Bombay and its suburbs in 1986 showed that 84% of gynaecologists were performing about a total of 270 amniocentesis tests per month, of which 95% were done for sex determination. Almost all the clients who asked for these tests opted for an abortion if the fetus was female. About half of the

In Nepal, women derive their social status from their fathers, husbands, and sons. Sons carry the family name and represent "insurance" to parents in old age. Property is passed on to sons from each generation. A girl's marriage is therefore of great importance. To ensure the best possible eligibility at marriage age, girls usually have a guarded and restricted upbringing and are taught submissiveness and obedience as feminine ideals. Only one third of girls attend school; many receive less food, and less nutritious food, than boys; and girls have less access to medical care.⁴

doctors surveyed admitted that they had been conducting these tests for at least 10 years.⁶

Poor nutrition and immunisation of girls

There is evidence from many countries in Asia and north Africa that girls are relatively neglected in childhood.⁷⁻⁸ Girls may be fed less than boys, even weaned early so that the mother can conceive another child as soon as possible, preferably a boy.⁹ Boys are more likely to receive their full immunisations in childhood, particularly when there is a fee for treatment. Girls are therefore relatively more vulnerable to infection.

In countries with such a preference for boys, girls under 5 years have a higher mortality than boys. For example, in Bangladesh, the rate for girls was recorded as 175 per 1000 live births compared with 160 per 1000 for boys.¹⁰

Female genital mutilation

Female genital mutilation poses a serious threat for many girls. The World Health Organisation estimates that 130 million women in the world today have undergone genital mutilation, and every year an estimated 2 million more girls are circumcised.¹¹ Female genital mutilation is practised in at least 20

African countries, mainly by Muslims but also in certain Christian communities. It is also practised in Oman, Yemen, and the United Arab Emirates and by some Muslims in Malaysia and Indonesia.¹² Many of these girls and women now live in Europe and North America due to international migration.

The operation is performed most commonly between the ages of 4 and 8, but complications may not be realised until adulthood. Problems include dyspareunia due to introital or vaginal stenosis; obstructed labour, possibly complicated at a later stage by vesico-vaginal or rectovaginal fistula; keloid formation; and implantation dermoids.¹²

Cultural beliefs perpetuate the practice of female genital mutilation: the procedures are supposed to reduce the woman's sexual desire and to help ensure that she remains a virgin until she is married. In addition, reducing the size of the vaginal orifice is supposed to make sexual intercourse more pleasurable for the man. A bride will reach a good price if she has been circumcised, and an eligible man would not consider marrying a woman who had not had the operation.

"The best role a girl can play is to get married, produce children, and take care of the household."²³

Female genital mutilation is supported and encouraged by men; many regard it as an exercise in male supremacy and the oppression of women.¹² Despite the international support for the eradication of this practice, there have been disagreements among health activists fighting the same cause: white feminists who have spoken out against the practice have sometimes been criticised by African and Asian women who share their beliefs. Lesley Doyal, professor of health and social care in the School of Policy Studies at the University of Bristol, believes that these problems arise because campaigns of this kind raise complex questions about the relation between cultural imperialism and solidarity and about the "ownership" of particular issues.¹³ For this reason, many groups of women are now working under the broad banner of reproductive rights. This enables women with different backgrounds and very different levels of resources at their disposal to share common goals.

"Women are inherently entitled to adequate nutrition in their own right as individuals. They need constantly to balance their reproductive, nurturing, educational, and economic roles, which are so important to the health and nutritional wellbeing of the household and of the entire community." (World Declaration and Plan of Action adopted at the International Conference on Nutrition, Rome, 1992)

Early pregnancy

Nearly 15 million teenage women give birth each year, accounting for up to 10% of all births globally.¹² The figure may be even higher as the number of mothers under 15 years is not recorded. Childbearing in adolescence is known to be a considerable health risk. One quarter of the 500 000 women who die every year

from causes related to pregnancy and childbirth are teenagers.⁹ Teenage mothers have more complications of pregnancy and delivery, including toxæmia, iron deficiency anaemia, premature delivery, prolonged and obstructed labour, hypertensive disorders of pregnancy, and even death.¹⁴ Because teenage mothers are more common in the poorest countries, they are also likely to be malnourished and physically immature, increasing the obstetric risks.¹⁵

"My mother, sisters, and wife have all had circumcisions. So will my daughters. This has nothing to do with Islam but sometimes society governs people's lives." (Married man, 33, teacher; quoted in *World Health*, Sept 1995)

Improving the health of girls

Equal education for girls and boys

Education is at the foundation of many initiatives to improve the health of girls. Although the gender gap is narrowing, more women than men are still illiterate. In 1995, a World Bank report quoted that 77 million girls of primary school age (6-11 years) are not in school, compared with 52 million boys.¹⁶ Suggested reasons for this include limited financial resources and a preference for educating boys, parental fears and attitudes about the position of women in society, negative prevailing attitudes about female education in rural areas, and the need for girls to help their mothers with household chores.

The importance of educating girls and women is underscored by research which indicates the close positive correlation between women's education and reduced infant mortality and improved family health.¹⁸ Women with an education tend to delay their first child and have fewer children. The association of paternal literacy with health status is only about half as strong as that of the mother's education.¹⁸ After other variables such as access to immunisations and to a supply of potable water have been controlled for, education emerges as the strongest influence on child mortality.¹⁹

Education influences child health probably through a combination of several factors.²⁰ Increasing education brings improved understanding of health and nutrition and more use of health services, including immunisation and antenatal care. It also empowers women, giving them more control in family decision

Condemnation of female genital mutilation

In 1959 the general assembly of the United Nations adopted the Convention on the Rights of the Child, which states (article 24, paragraph 3) that "States Parties shall take all effective and appropriate measures to abolish traditional practices prejudicial to the health of children." In 1982 the United Nations human rights subcommission of the World Health Organisation assured governments of its readiness, together with Unicef, to support national efforts against female genital mutilation. The practice was again condemned by the WHO in 1986 and by the International Planned Parenthood Federation and in the African Charter on the Rights and Welfare of the Child.²⁴

Effect of mother's schooling on risk of death by age 2, late 1980s. Comparison is in relation to mothers with no schooling. Adapted from Hobcraft¹⁷

making. Empowering women provides them with a greater willingness to try new ideas and make use of health services.

The World Bank has urged governments to take the lead by changing public policy to enable girls to attend school. In China, the introduction of compulsory education laws in 1986 was complemented by policies to reduce poverty and increase gender equality. The main decision was to devolve responsibility for primary education to local communities, which were expected to devise appropriate measures for raising primary enrolments, especially of girls, taking into account specific local problems. Government measures included awareness campaigns to motivate parents to enrol all children, flexible work schedules, evening classes, sibling care, and special schools for girls. The programmes succeeded in raising enrolments among both girls and boys, even in some of the poorest and most remote regions.

Educating girls in Africa

The Forum for African Women Educationalists has brought together a group of male education ministers who are committed to expanding education for girls in their countries. Fourteen projects have been funded, including alternative education for out-of-school girls in Burkina Faso, remedial mathematics and science teaching for girls in Kenya, and help for poor students in Zimbabwe.²⁴

Successful projects tackle the social and cultural inequalities at the same time as trying to improve women's health. As another example, the Bangladesh Women's Health Coalition now runs at least 10 projects providing reproductive and general health services for women and children. No distinction is made between medical care and wider community development, with the coalition offering literacy classes for women as well as workshops on family law.

The World Bank believes that female education is "the most influential investment" with high financial returns.²¹ Kelsey A Harrison, professor of obstetrics and gynaecology at the University of Port Harcourt in Nigeria, explains: "Through an educated mother, the cycle of illiteracy and bad health can be broken because her daughters and sons will in all probability go to school—and so would succeeding generations."²²

The closed garden

In Poland, strong Catholic values influence the education that children receive. Wanda Nowicka, executive director of the Polish Federation for Women and Family Planning, described language in school textbooks on sexual education as "symbolic." A girl is called "a closed garden, a sealed source." The source will be unsealed after marriage.²⁴

Conclusion

Alarming numbers of women are discriminated against before birth or in childhood. Public policy measures designed to reduce discrimination may be unsuccessful if they fail to tackle the underlying social condition. "When attitudes are challenged, people feel their tradition is being destroyed," explained Dr Seshagari Rao.

Changes are occurring—for example, in India in 1994 the Prenatal Diagnostic Techniques Regulation and Prevention of Misuse Act was passed. This was regarded as an important step towards preventing selective abortion of female fetuses, but some commentators are pessimistic about its effect, arguing that previous laws that have sought to empower women (such as those on dowry prohibition, prevention of immoral traffic, or the indecent representation of women) have failed because they have not dealt with the reason why the prohibited contact takes place in the first place.³ Possibilities of change do exist, but first there needs to be a change in the social ideology which influences traditions.

The rescue of "missing women" in the world can occur through changes in public policy in three areas, says Amartya Sen, Lamont University professor at Harvard University: firstly, enabling women to earn money so as to change perceptions of their standing in society; secondly, improving literacy; and, thirdly, improving women's economic rights, including land-

ownership and inheritance.⁵ These measures can help to change traditional values and, through future generations, improve the health of a whole population.

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Cautionary tales

Blessed is he who cometh last to the case

"There's no point in asking him if it's broken." My credibility is in tatters. I've missed another fracture on the football pitch, this time a spiral fracture of the tibial shaft. Despite advancing age and declining ability I still enjoy football weekly (or should that be weakly) with non-medical friends. Whenever there's an injury the "doc" is always summoned despite the fact that I completed a surgical training devoid of elective orthopaedics. Casualty experience is but a dim memory but, like most medics, I still reckon that I can spot a broken arm or leg. I have missed two in the past couple of years—a fractured radial head and the aforementioned tibia. Despite a careful immediate examination I told both footballers not to worry, nothing was broken. After five to ten minutes sitting on the sidelines, both complained of increasing localised pain and the diagnosis became obvious. Try explaining the gate theory of pain to 21 hairy footballers.

In my day job as a consultant surgeon I have also become aware of the hazard of getting there too soon. I cannot be the first surgeon who has learnt how much easier it is to sort problems out once a patient has been in bed for a few hours with effective analgesia and a completed set of baseline investigations. All becomes clear on post-take ward rounds, much to the chagrin of junior surgeons, who are infuriated by the way signs fluctuate in the early hours of admission.

How much harder to be forced to make instant decisions in the home. I come from a large family of general practitioners and have heard all their horror stories of trying to make a diagnosis in dimly lit rooms surrounded by anxious relatives. The first time many hospital based consultants ever meet this trying situation is when asked to perform a domiciliary visit. Consultants used to a well run outpatient department may have difficulty trying to sort out a complicated clinical problem in a fully dressed patient propped in a low armchair in a tiny room with a small dog yapping at the feet. "Don't worry, he only growls when he's being friendly."

The other fraught situation is to be the first to arrive at an accident. Initially the young doctor has no fear of unexpected emergencies. Age and experience bring knowledge of the difficulty of providing medical skills in emergency situations. My first involvement at the scene of an accident occurred on a wintry afternoon on the M1 motorway. As we pulled up alongside a recent accident I wound the car window down to speak to the solitary policeman guarding the wreckage. Breathless with anticipation that my newly acquired knowledge and skills might be tested I blurted out, "I'm a final year medical student and my girlfriend sitting here is a nurse, can we help?" The lugubrious copper deflated an ego with, "Just send the nurse."

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