In-vitro fertilization (IVF) and assisted reproductive techniques have become common practice in many countries today, regulated by established legislation, regulations or by committee-set ethical standards. The rapid evolution and progress of these techniques have revealed certain social issues that have to be addressed. The traditional heterosexual couple, nowadays, is not considered by many as the only ‘IVF appropriate patient’ since deviations from this pattern (single mother, lesbians) have also gained access to these treatments. Genetic material donation, age limitation, selective embryo reduction, preimplantation genetic diagnosis, surrogacy and cloning are interpreted differently in the various countries, as their definition and application are influenced by social factors, religion and law. Financial and emotional stresses are also often described in infertile couples. Information as deduced from the world literature regarding IVF regulation, as well as about the existing religious, cultural and social behaviours towards these new technologies, is presented in this article in relation to the social aspects of assisted reproduction.

Key words: assisted reproduction/in-vitro fertilization/social aspects

Since the introduction of in-vitro fertilization (IVF) and the birth of Louise Brown, advances in assisted reproduction technologies have resulted in the creation of family types that would not otherwise have existed. With IVF using the father’s spermatozoa and the mother’s egg, the child is genetically related to both parents, whereas children conceived by donor insemination (DI) are genetically related to the mother but not the father, and children conceived using donated eggs are genetically related to the father but not the mother. When both egg and spermatozoa are donated, the child is not genetically related to either parent. This latter group of children is similar to adopted children in that they are genetically unrelated to both parents, but differ in that the parents experience a pregnancy and develop a relationship with the child from birth. In the case of surrogacy, the child may be genetically related to neither, one or both parents, depending on the use of a donated egg and/or spermatozoa. Erroneously, it is pointed out that it is now possible for a child to have five parents: the egg donor, the sperm donor, the birth mother, and the two social parents whom the child knows as mother and father. All these complex social structures forming after the performance of assisted reproduction, as well as the rapidly changing technologies, have captured the public imagination and preyed on widespread fantasies.

IVF and assisted reproductive technology (ART), today, are common practice in many countries around the world. Since their evolution there has been an ongoing debate in society, especially among members of the medical profession, as to...
the necessity of judicial regulations and public control concerning their practice (Schenker and Frenkel, 1987). As a result, some countries have established legislation pertaining to the various aspects of ART (i.e. UK, Sweden and Spain). In a number of countries, ART are practised according to regulations that have been laid down by fertility societies (i.e. USA, Canada and all of Australia except the state of Victoria, which has enacted a state statute), medical research councils (i.e. the Netherlands, Hungary) or religious authorities (i.e. Egypt). Other countries spread over the continents (i.e. Greece, Finland and Korea) operate actively in the ART field without either statutes or guidelines (Jones, 1996). Legislators have raised doubts as to whether any single piece of primary legislation will ever be sufficient in itself to deal with such a complex area and with such fast-moving technology (Jowell, 1996).

The purpose of this article is to present the social aspects of ART and to analyse in this respect, issues such as the structure of the assisted reproductive family, the welfare of the child, genetic material donation, age and assisted reproduction, selective embryo reduction, preimplantation genetic diagnosis, surrogacy, cloning, informed consent, medical record keeping and central reporting of data obtained. In support of our article, we use information, recently reported in the literature, about the IVF regulations and existing religious, cultural and social behaviours towards these new technologies in Europe (Schenker, 1997), Asia (Schenker and Shushan, 1996) and North America (Jones, 1996). Information about the current attitudes in South America was obtained after direct contact with fertility clinics operating in these countries.

Assisted reproduction families: family functioning and child development

Most professional bodies in the various countries recommend that ART should be restricted to heterosexual couples who are legally married or at least living in a stable relationship. In the majority of nations reviewed in Europe and in South America, ART is offered either to married couples or to couples pertaining to have a stable relationship; it is often stated that cohabitation of 2 years fulfils this requirement (i.e. France). In Asia, marriage is usually the requirement, as in many of these countries religion significantly influences social life (i.e. Iran, Saudi Arabia and Jordan), whereas Hong Kong, India, China and Israel also allow these procedures to cohabiting couples. Israel is the only country from the Asian region that provides IVF to single mothers. In Europe, this practice is found in Belarus, Italy, the Netherlands, Russia, Spain, Ukraine and the UK, whereas it is forbidden in South America mainly due to religion reasons. The remaining reviewed nations make no mention of a specific societal relationship of the prospective parents (i.e. Canada). In two nations (Denmark and Argentina), the statute is quite clear, verifying that IVF cannot be offered to lesbian or homosexual couples. The welfare of the child, from infancy to adulthood, is gaining worldwide acceptance as a basic factor in evaluating ART outcome, and thus some countries have already established some form of regulation or law (i.e. Australia, Belgium, Denmark) regarding this issue.

Despite the changes that have occurred in society during the past few years and especially in the interrelationships between people, the most widely accepted structure of the family remains that comprising two heterosexual married parents who are genetically related to their children, while all other deviations from this classic schema are considered to be non-beneficial for the child. Restriction of IVF to married or cohabiting couples may be explained by the widely accepted public view that children raised in a family frame have an advantage over children living with a single parent.

Families that have resulted through assisted reproduction, although continuously increasing in number, may differ from the normal, either because of a non-genetic relationship of one or both parents with the offspring (sperm, egg, embryo donation, surrogacy) or because of structural differences, as it is well known that a growing number of single heterosexual women and lesbian women are opting for assisted reproduction. In the USA, a woman has the right to decide when and how to conceive (McGuirie and Alexander, 1985). Under the European Convention of Human Rights (1978), a single woman, or even a lesbian couple, is entitled to have children, even though these children may have no legal father. The creation of these new types of family raises important questions about the psychological consequences for the children who result, and for this reason many have recommended that follow-up studies of these families should be carried out (Blyth and Cameron, 1998).

The social recognition and acceptance of these families, their social context and the processes through which social environment affects family relationships are issues that have raised many disputes and attention (Colpin et al., 1995). It is important to emphasize that negative attitudes may exist towards reproductive technologies, with procedures such as IVF and DI sometimes considered to be immoral or unnatural. As a result, families with a child conceived by assisted reproduction may experience overt prejudice not only from the wider community but also from relatives and friends (Golombok et al., 1995).

Several other concerns have been expressed regarding these families, such as the effects of the long-endured infertility and the multiple and often painful diagnostic and therapeutic procedures (many times for years) that the couple has undergone, as well as the intense economic burden resulting with these treatments. It has been suggested that the stress associated with this problem may make bonding with the child difficult (Burns, 1990) or even lead to marital problems with a certain appeal on the child (Cook et al., 1989; Cox et al., 1989).
In this respect, sociological studies have shown that several aspects of parenting influence the development of children: sensitive responding, emotional availability and a combination of warmth and control are associated with positive outcomes, whereas marital conflict and parental psychiatric disorder have a negative effect (Rutter, 1985). Taking this into account, society is now facing the dilemma of the ‘ideal structure’ of families resulting after assisted reproduction, since social groups considered in the past as not appropriate for parenting have been re-evaluated and their rights have been reconsidered.

A European study (conducted in Italy, UK, Spain and the Netherlands) of family relationships and social and emotional development of children in families (heterosexual couples) created by IVF and DI compared with control groups of families with a naturally conceived child and adoptive families was recently presented (Golombok et al., 1996). Mothers of children conceived by assisted reproduction expressed greater warmth towards their child, were more emotionally involved with their child, interacted more with their child and reported less stress associated with parenting than mothers who conceived their child naturally. Similarly, assisted reproduction fathers were found to interact more with their child and to contribute more to parenting than fathers with a naturally conceived child. With respect to the children themselves, no group differences were found for either the presence of psychological disorder or for children’s perceptions of the quality of family relationships.

Previous studies have stated that, on average, children in single-parent families do less well than those in two-parent households in terms of both psychological adjustment and academic achievement (McLanahan and Sandefur, 1994). They are also less likely to go on to higher education and more likely to leave home and become parents themselves at an early age. In these cases, the rather non-optimal outcome is not only explained by the fact that the child is raised by a single parent, but other factors also seem to play an important role, such as economical distress and the psychological influences of being exposed to conflict and family disruption that is commonly associated with their parents’ separation or divorce (Amato and Keith, 1991).

Children born to single mothers following DI differ in important ways from children who find themselves in a one-parent family following divorce, in that they are raised by a single mother from the beginning without experiencing the detrimental effects induced by the separation of their parents. However, these families still have to face several social adjustment problems as a result of the occasional reluctance of society to accept single mother families and because of possible financial scarcity. These children might be forced to attain an attitude of solitude and isolation as a result of the absence of a father and thus their single parenthood.

Despite the lack of studies on single mother families resulting from DI, other studies conducted on fatherless or so-called ‘sole mother families’ show that whether or not these children do less well than those from two-parent homes seems to depend on their financial situation and the extend to which their mother has an active network of family and friends to offer social support. The currently existing information indicates the best predictor of outcomes for children in these families to be the family circumstances rather than single parenthood per se (Weinraub and Gringlas, 1995; Golombok et al., 1997).

Lesbian families, although similar to those headed by a single heterosexual mother in that the children are being raised by women without the presence of the father, do differ in the sexual orientation of the mother. The raising of a child by a lesbian couple encompasses certain disadvantages. Firstly, these children have a higher possibility of developing psychological problems due to their family structure and the reactions it raises in society, especially at school. Secondly, the absence of a male eliminates the traditional father figure of a normal family model, endangering the normal sexual development of these children: that is, boys may be less masculine and girls may be less feminine. This might lead them into homosexuality, an outcome that is often considered undesirable by courts of law, policy-making bodies, and a large part of society.

Earlier studies checking the outcome of children in lesbian families included women who had become mothers in the context of a heterosexual marriage before adopting a lesbian identity and who were compared with single heterosexual mothers. No differences between their children were identified for emotional-well being, quality of friendships or self-esteem, or in terms of masculinity or femininity. Regarding the parenting ability of the mothers themselves, it was demonstrated that lesbian mothers were just as child-oriented, just as warm and responsive to their children and just as nurturing and confident as heterosexual mothers (Patterson, 1992; Golombok and Tasker, 1994).

Controlled studies of lesbian couples who conceived their child through DI have recently been reported. In the UK, 30 lesbian mother families were compared with 41 two-parent heterosexual families using standardized interview and questionnaire measures of the quality of parenting and the socio-emotional development of the child (Golombok et al., 1997). Similarly, Brewaeys et al. (1997) studied 30 lesbian mother families in comparison with 68 heterosexual two-parent families in Belgium. These studies proclaim that the children’s development, thus far, does not seem to differ from that of their peers in two-parental heterosexual families in terms of gender development, implying that the presence of the father is not necessary for the development of sex-typed behaviour for either boys or girls, and that the mother’s lesbian identity, in itself, does not have a direct effect on the gender role of behaviour of her daughters or sons. In terms of socio-emotional development, the children appeared to be functioning well; there seemed to be no evidence of raised levels of emo-
tional or behavioural problems among the children raised in a lesbian mother family.

These results show that society, either as expressed through laws or legislation, or as influenced by religious or cultural issues, maintains in the majority of cases a more compassionate and supporting role to the normal heterosexual family (marriage or stable relationship), and hesitates to provide full access to other ‘deviated’ groups. On the other hand, findings from recent studies suggest that all of these ‘new’ aspects of family structure may matter less for children’s psychological adjustment than warm and supportive relationships with parents and a positive family environment.

It is our view that society should not seek to prevent any fertile person, whatever his marital status, from reproducing, and the written law or professional bodies should not discriminate against any group of society. Each case should be judged on its merits, leaving aside the question of whether or not infertile couples or single persons have an inalienable right to a child whatever the method or cost to society or themselves. There should be the provision, however, that IVF in unmarried couples should not be carried out without the written consent of the man involved. Regulatory bodies in countries dealing with assisted reproduction should set laws or other statutes through which the welfare of the offspring should be followed.

Genetic material donation

The widespread availability of IVF and the growing acceptance of egg and sperm donation have made third party involvement in the reproductive process commonplace throughout the world (Schenker, 1993). Indications for artificial donor insemination have expanded and include cases of male partner sterility, presence of severe semen abnormalities, genetic disorders, non-curable ejaculation dysfunction, or a single woman who wishes to have a biological child. It is extensively used throughout the world and thousands of infertile couples today have children who were conceived through this procedure. Oocyte donation is indicated in cases of infertile women who are suffering from gonadal failure or in cases where the oocytes do function but other problems (i.e. poor responders to ovarian stimulation, abnormal oocytes, oocyte retrieval problems, or genetic abnormalities) interfere with fertilization success. Pre-embryo donation is indicated in cases of both male and female infertility, habitual abortions and genetic diseases (Schenker, 1995).

Statutes or regulations have been established regarding genetic material donation in the majority of nations reviewed. This form of treatment is strictly prohibited in Muslim countries, since according to Islam, the practice of DI is considered to be adultery and leads to confusion regarding the lines of genealogy, whose purity is of prime importance to Islam. Ovum donation and pre-embryo donation are also not permitted by Islam. Sperm donation, provided in the majority of nations reviewed, is practised on a wider base than donation of the other two forms of genetic material. The reluctance of women to donate their oocytes in combination with the more complex technique for their retrieval may explain the delay in the establishment of oocyte donation, and the more complex ethical, legal and social issues associated with embryo donation seem to be related to the fact that it is practised in even fewer nations (Taiwan, Singapore, Thailand, India, Belgium, Finland, Greece, Russia, Spain, Ukraine, UK).

The privacy versus disclosure debate is one of the main issues of controversy in assisted reproduction with donor gametes, centred around the traditional anonymity, if not secrecy, of the procedure (Templeton, 1991). It has been argued that it is designed to protect the adults involved, either the prospective parents, especially the male partner in the case of DI (Daniels and Taylor, 1993), or even the intermediaries, donors, and practitioners (Haimes, 1993), rather than the prospective child, toward whom all parties share responsibility. Thus, debates about the anonymity of donation and the secrecy of the procedure have often overlapped, but these issues bear more than a semantic difference (Shenfield, 1997). In Europe, the majority of prospective parents still choose to keep the means of conception after gamete donation secret (Shenfield, 1997). On the other hand, legislation in some countries (Sweden) recommends that the child, upon reaching the age of 18 years, should have access to the hospital’s records to obtain information concerning the ethnic origin and genetic health of his biological father (Daniels and Lalos, 1995).

In the field of assisted reproduction, the absence of a genetic link between the child and a parent or both parents may endanger the relationship between the non-genetic parent and the child (Schaffer and Diamond, 1993). Family relationships in which the truth is withheld from the child (either in cases of DI or egg donation) may be undermined, contributing to the possible appearance of identity confusion in these children (Snowden, 1990). Whether or not children conceived using donated gametes should be told about their genetic origins remains one of the most disputed ethical issues raised by the practice of assisted reproduction (Weil, 1997). Whereas parents have generally not been encouraged to tell their children, there is a growing body of opinion which believes that it is not justifiable to keep such information secret, either because it is argued that children have a right to know, or because of concern about the effect of secrecy on family relationships (Brodzinsky et al., 1995).

From a psychological perspective, the quality of children’s relationships with their parents, and particularly how securely attached they are to their parents, is considered to be central to their emotional well-being throughout childhood and into adult life (Bowlby, 1969, 1973; Main et al., 1989). Studies involving the development of a family, and especially from the perspective of attachment theory, concluded that it is parental responsiveness, rather than biological relatedness, that is...
considered to be important for the development of secure attachment relationships (Grossmann et al., 1985; Isabella et al., 1989).

Aspects of parent–child relationships other than security of attachment have also been shown to shape children’s development, the most widely studied of which are parental style and interrelations (Baumrind, 1989). As a result, in cases of children resulting from gamete donation who are not informed about their genetic origins, and who face some difficulties, problems should not be attributed to the fact that the child was not informed about the missing genetic link, but better they should be evaluated from the aspect of the negative consequences that the lack of genetic ties interfered with the quality of the relationship between the parents and the child.

Research on children conceived by gamete donation shows not only that these children are functioning well, but also that they have better relationships with their parents than children who were naturally conceived (Cook et al., 1995; Golombok et al., 1996). This suggests that a strong desire for parenthood seems to be more important than genetic relatedness for fostering positive family relationships, and that conception by gamete donation does not appear to have an adverse effect on the socio-emotional development of the child.

The ‘modern’ family description seems at first glance the result of a technological imperative: a specific characteristic of ART. As such, ART is viewed by some as leading society in a worrying or inappropriate direction. Despite the complex social and ethical issues imposed by ART (Schafer et al., 1995), it is widely accepted that ART did not create the essence of the issues. It seems that society must accept that the definition of the ‘traditional’ family has changed. Its boundaries have expanded to include alternative arrangements for child bearing and parenting that are accompanied by complex social and ethical issues. Society and practitioners of ART alike should contemplate all these issues. Families resulting from gamete donation mirror society’s norms and emulate society’s example. Claims that medical technology merely fosters positive family relationships, and that conception by gamete donation does not appear to have an adverse effect on the the enormous social evolution that has occurred (Seibel et al., 1996).

Age and assisted reproduction

The progress achieved through assisted reproduction has led to the rise of another critical issue: the age limit until which these new techniques can be applied. The oldest woman to date to become pregnant by this means was 62 years old at the time of birth of the offspring. The technology used to establish a pregnancy in women beyond the natural reproductive age, that is post-menopausal women, is itself not new. IVF with donated oocytes has been used for some time to treat infertility in women who have no oocytes of their own, owing for instance to premature ovarian failure, or whose oocytes cannot be used for medical reasons. In older women the absence of oocytes caused by the natural depletion of the available stock can also be remedied by oocyte donation (Edwards, 1993).

Because of the medical context in which the problem originated, the on-going debate is whether an age limit should be imposed for medical assistance. From the very beginning late motherhood is presented as a medical problem. A question that has to be settled is whether it is acceptable that a woman above a certain age bears a child with or without medical assistance. If it is irresponsible for a woman to have a child when she has reached a certain age, it is also unacceptable to assist in the deliberate initiation of such a pregnancy by means of medical technology (Benagiano, 1993).

There is a growing trend among modern day women to delay childbearing, so that there is a greater proportion of older women among those who attempt pregnancies. The result of this is an increase in the rate of pregnancies in older age groups. Advanced maternal age is associated with an increase in maternal and fetal morbidity and mortality. Recent advances in medicine and the advent of ovum donation (OD) programmes have enabled the introduction of oocytes into the uterus of menopausal and post-menopausal women. The uterus seems to retain its receptivity to embryo implantation beyond the age of natural menopause as long as sufficient doses of exogenous oestrogens and progesterone are administered. The success of the procedure seems not to be influenced by age. This raises several important ethical and social issues regarding the well-being of both mother and child (Eisenberg and Schenker, 1997).

There is an innate imperative to reproduce. In the era of advanced knowledge in the maintaining of a youthful habitus, a menopausal woman may not feel too old to have a child. Modern society protects the individual’s right to privacy and reproductive choice. Couples who have been deprived of their natural ability to reproduce will divert a tremendous amount of personal energy as well as resources in order to achieve conception. Women with premature ovarian failure have no options for achieving pregnancy other than OD. Denying oocyte donation to these women constitutes a denial of their reproductive choice. Life expectancy at 50 years of age is long enough to enable a healthy woman to raise a child to adulthood. Recent societal changes enable women to choose to have a career first and delay childbearing to a later age. Some women in a second marriage find themselves desirous of a child with their new partner. Others may have lost their children to cancer or war. For some women with primary infertility, the technology to solve the problem was not available until they reached menopause, by which time their only option was OD. It may appear as cruelty or unfairness to deny such a woman access to OD, her first chance of reproduction, on the grounds of her age alone (Pennings, 1995).

Society does not view men and women equally when it comes to age, so that an older woman is considered unable to have a child, whereas a man would be considered able to do so. The absence of an explicit condemnation of late father-
hood cannot be fully explained by the impossibility of controlling or regulating the procreation of men. The most important element explaining this discrimination is that men and women are not seen as making the same commitment by becoming parents. The content and extent of their parental duties are filled in by their traditional gender roles, mainly set by society. The father provides protection and income for the mother and child, whereas the mother provides the day-to-day care and the experience which are the bases for the healthy personality of the child. Whereas the father’s job can be taken over by others, the mother’s presence is indispensable and irreplaceable. This unequal weight attributed to the two genders in the upbringing of a child seems to be the main factor for limiting the age at which women can procreate (Flamigni, 1993).

Opponents to OD in the older woman may base their arguments on the interests and welfare of the potential child, implying that individuals are less capable of coping with the physical and psychological stress of parenting. Having patterns of advanced age may cause children to endure a greater generation gap or the lack of grandparents. On the other hand, financial and professional security and a greater motivation for parenthood usually characterize older couples. Taking all this into consideration makes it a reasonable supposition that the interests of the child would be better served by being born to older parents than to never exist at all.

Reproduction is a fundamental right in a free society. From the social point of view, the main factor remains the welfare of the child. Denying access to resources and treatment to a population of women who must rely upon them to procreate essentially negates this freedom. This raises the issue of age limitation in the post-menopausal group. Some suggest that this limit should be 60 years, if considering the average life span in developing countries to be near 80 years. The writings in the media are harsh relating to this issue. Doctors who attempt OD in the older woman are likely be accused of tampering with nature and acting irresponsibly, and those who oppose may be accused of arrogance, sexism and paternalism. Recent surveys assessing community attitudes toward OD to postmenopausal women reveal only minority support for this practice.

Almost every application of new reproductive techniques has forced the medical staff to reconsider and clarify their conceptions about parenthood, procreation and family relationships. Late motherhood is no exception. Certainly, guidelines need to be established so that pregnancy can be achieved with minimum harm to the mother and child. Nevertheless, taking into consideration the mother’s and the child’s welfare, an age limit should be set. This, according to the majority of publications, varies between 50 and 55 years of age.

**Multifetal pregnancy reduction**

Multifetal pregnancy reduction was initially used as a procedure to terminate selectively a fetus affected by a genetic disorder (Aberg et al., 1978). Subsequently, its usage was extended to eliminate one or more fetuses of a multiple gestation pregnancy while allowing some fetuses to remain alive (Berkowitz et al., 1988). Several reports suggest increased perinatal outcome after the use of this procedure (Hobbins, 1988).

During the past decade, the use of fertility drugs and assisted reproductive techniques have allowed many ‘infertile’ couples to have their own children. However, there has been a concomitant substantial rise in the number of multifetal pregnancies. The incidence of multiple gestation after ovulation induction ranges from 6–8% when clomiphene citrate is administered, to 15–53% when gonadotrophins are administered (Schenker et al., 1981), whereas IVF and embryo transfer are associated with a 24–30% incidence of multiple pregnancies (Evans et al., 1995). In addition, multifetal gestation has been correlated with an increased frequency of maternal complications and higher perinatal morbidity and mortality (Gonen et al., 1990).

From the early days of its application, multifetal pregnancy reduction has been questioned by several authors, in view of the ethical, legal and social issues arising from the procedure (Zaner et al., 1990). There seems to be a general consensus in society that selective termination is acceptable in multiple gestations where one or more fetuses are determined to be severely abnormal (Robie et al., 1988) or where continuation of the multiple pregnancy represents a clear threat to the life or health of the mother, and reduction of the number of fetuses may lessen the risk (Elias and Annas, 1987).

In cases where neither of these risks is present, selective termination of presumably healthy fetuses could be considered a type of abortion. It could be argued that in a society where abortion is available on demand, a multifetal pregnancy reduction procedure requires no additional rationale. However, in the debate over abortion, opinions are considerably diverse. Clinics carrying out selective termination claim that the procedure should not be considered as an abortion since the purpose of selective termination is the continuation of life and not the termination of the pregnancy, thus differentiating the procedure from abortion. A philosophical similarity to the ‘lifeboat analogy’ is proposed as a medical justification for performing multifetal pregnancy reduction, which is that some drowning individuals can be legitimately denied access to an overcrowded lifeboat if bringing them aboard will cause it to sink and result in the loss of additional lives. On the other hand, there are physicians who do not approve of abortion and presumably are opposed to any form of selective termination, considering it as an action taken to cause fetal death, which is a criminal offence (Evans et al., 1988).

If one ignores social and economic issues and concentrates entirely on those of medical relevance, the existing data indicate that multifetal pregnancy reduction effectively reduces the risk of very early preterm delivery with its associated increase in perinatal mortality or severe morbidity (Evans et
The question of how many gestations should exist in utero before the option of selective termination is offered to the couple is still under debate. There seems to be no doubt today that quadruplets and higher-order pregnancies are appropriate candidates that benefit from multifetal pregnancy reduction, as both the survival rate and the mean gestational age are intensely improved. We have shown (Fasouliotis and Schenker, 1997) that the survival rate of quintuplets or higher-order gestations after reduction is 75.2%, whereas that of quadruplets also after reduction is 88.7%, survival rates which are much higher than those that would probably be achieved if the multiple pregnancies were allowed to continue without reduction (40% for quintuplets and 78% for quadruplets).

Recent studies suggest that the benefits of reducing triplets to twins exceed the risks involved in the procedure per se, and even more, that the outcome parameters evaluated are improved in the twin gestation after reduction as compared with triplet pregnancies managed expectantly (Check et al., 1993; Lipitz et al., 1994). Reduction of twins or even higher-order pregnancies to a singleton is still controversial. As the ‘learning curve’ of the procedure is moving forward, limiting greatly the risks from the procedure, it can be assumed that reduction of multifetal gestations to singleton may be justifiable on a clinical basis, since twin gestations have been associated with an increased risk of maternal and neonatal complications compared to singletons (Powers and Kiely, 1994). However, the majority of authors (Evans et al., 1993) still suggest considering the risk of pregnancy loss, and to set the optimum reduction number to twins, except in cases where medical reasons indicate that a better outcome would be obtained after the reduction to a singleton (bicornuate uterus, monoamniotic twins in triplet pregnancy, prior preterm delivery of singleton at 30 weeks of gestation or earlier).

Multifetal pregnancies leading to deliveries are also associated with an increased socio-economic strain on the family. Parents often face severe social and economic problems when they have to deal with the raising of two, three or more children resulting from a multiple pregnancy. Multifetal pregnancy reduction can be used to alleviate these worries by decreasing the number of fetuses carried in a multiple pregnancy (Bryan, 1991). The British Medical Association recently announced, as a result of the request of a single mother to reduce her twin pregnancy to a singleton for social reasons, that no ethical precepts had been violated and that no laws were broken.

A recent study evaluating pregnancies, infants and families after multifetal pregnancy reduction showed that, although 19% of the women remained without a surviving child after the procedure, they still considered that reduction in cases of excessive multiple pregnancies is an acceptable option. There seem to be no adverse effects for the infants and the families provided the counselling before multifetal pregnancy reduction is done properly, the procedure is correctly performed, and the couple is given support before and after the procedure (Kanhai et al., 1994). Another study reported that >65% of the women involved recalled acute feelings of emotional pain, stress and fear during the reduction procedure. Mourning for the lost fetuses was reported by 70% of women, but most grieved for only 1 month. Thoughts about reduced fetuses occurred moderately frequently after the reduction but rarely at follow-up. Persistent depressive symptoms were mild, although moderately severe levels of sadness and guilt continued for many. Normal maternal bonding and achievement of parenthood goals facilitated grief resolution. Nonetheless, 93% would make the decision again. The emotional reactions of patients who miscarried differed little. The small subsample who continued to be most affected were younger, were more religious and had viewed the multifetal pregnancy on ultrasonography more often (Schreiner-Engel et al., 1995).

Multifetal pregnancy reduction has been established as an efficient and safe way by society and especially the involved population (couples, physicians) to improve the outcome of multifetal pregnancies, and thus, in most nations the opportunity of fetal reduction is provided to IVF patients. Multifetal pregnancy reduction is not performed in Indonesia, Mexico, Thailand, Japan, Iran, China, Pakistan, Portugal and Hong Kong. Until advances in assisted reproductive technology eliminate the iatrogenic cause of multiple gestation, multifetal pregnancy reduction offers hope for a good outcome in an otherwise dismal situation.

Preimplantation genetic diagnosis

Preimplantation genetic diagnosis (PGD) is a very early form of prenatal diagnosis aimed at eliminating embryos carrying serious genetic diseases before implantation. It is currently being performed clinically at over 20 centres around the world. More than 160 children have already been born following PGD in over 1200 clinical cycles performed for single gene and chromosomal disorders (data obtained from the 2nd International Symposium on PGD, Chicago, September 1997). Currently, many genetic diseases can be detected by PGD, and research work is being performed in many centres, so its application should be expanded to the detection of other diseases (Delhanty and Handyside, 1995).

The main objectives of PGD include an effort to offer the widest possible range of choices to women at risk of having children with genetic abnormalities; to provide reassurance and reduce the anxiety associated with reproduction, especially among women at high risk; and to enable women at high risk to continue a pregnancy by confirming the absence of certain genetic diseases. The emphasis is placed on the provision of life for new children who may otherwise never have been born.

The great advantage that enhances the acceptance of PGD by social groups is that it avoids the implantation of defected embryos, and this process of selection eliminates the need for future termination of pregnancy (Raeburn, 1995). Thus, PGD
avoids all the debates related with the issue of abortion in society and in individual cases, reduces or prevents the suffering for the affected family, fetus and society and also protects the society’s resources. One of the goals of PGD is to enhance the couple’s ability to make informed reproductive decisions, even though sometimes such a decision is influenced by pressure applied by society (Robertson, 1992).

Preimplantation gender selection, another issue of social conflict, is already practiced in some centers. Gender selection can be used in order to avoid the almost 300 X-linked recessive diseases that are known today. Typically, healthy female carriers of a defective gene of their X chromosomes transmit the disease to their offspring: females are generally healthy (50% being carriers like their mothers), but half of the boys will be affected with the disease. In genetic conditions such as Duchenne muscular dystrophy or haemophilia, which affect only males, while the exact gene defect may not be known, examination of the DNA of the biopsied cell can determine the sex of the embryo and thus allow only female embryos to be replaced (Lissens et al., 1996). Family balancing through PGD remains an issue of debate. The subject raises such concerns and emotions that people generally have very polarized views: those wanting complete freedom to choose however they please the sex of their child and those that demand the total prohibition of sex selection for non-medical purposes. The objection to sex selection arises from the examples of countries such as China, Korea and the Middle East, in which boys are highly prized for economic, hereditary or religious/cultural reasons. The financial hardship of raising girls in some of these countries has led to the abandonment of female children and the widespread use of abortion and infanticide in favour of boys, and this would ultimately alter the established sex ratio. Family balancing as a procedure strikes an equilibrium between too much control and too much freedom (Liu and Rose, 1996; Pennings, 1996).

The development of PGD has also been related to a future possible use for the detection of polygenic disorders. The clarification of the multiple genetic factors responsible for a large part of the susceptibility to diseases such as diabetes mellitus, coronary heart disease and malignancies will greatly affect the moral problems. The genetic information obtained by PGD may in the future affect specific individuals and family members. There are several late-onset genes, perhaps even genes predisposing to cancer, where diagnosis could result in the carrier being ‘typed’ socially for the affliction by employers, insurance companies and even by potential marriage partners (Struwing et al., 1995). A positive diagnosis of, for example, the dominant gene for Huntington’s chorea in a fetus implies that one of the parents or a child is affected, and must face the personal consequences of this diagnosis. All of these possibilities pose problems of confidentiality that could conflict with the duty of disclosure. The provision of information should be limited to the person or persons concerned, as disclosure of information to certain parties may not be used for the benefit of the individual concerned. This scenario enhances the need for confidentiality to be of primary importance in PGD, but also increases the desire for introducing alternative strategies, including even gene correction, for improvement of as many human individuals as possible (Schulman and Edwards, 1996).

The low pregnancy rate achieved (~20%) and the high cost of the procedure seem to be the limiting factors which delay its routine application, especially in societies with lack of resources. Nevertheless, in considering its great advantages, the vast majority of the nations reported in our survey have already adopted this technique.

**Surrogacy**

Few would doubt that the important aspects of who we are, what we know, believe or feel and how we function in our societies have little to do with the exact nature of our genetic stock and still less to do with the uterine environment in which we grew as embryo and fetus and most to do with the care, guidance and general experience we received during our rearing. This perception leaves little doubt about the prime value of parental nurturing. However, as important as this prime component of parenting is, few societies have not had qualms or become involved in moral debate when needs dictate resorting to a ‘surrogate’ for these functions. Wet-nurses, nannies, child-minders and boarding schools are all surrogates for parental functions that we must consider as being inherently more valuable to the development of the individual than the initial uterine or even genetic origins. Nevertheless, surrogacy, though already performed, is still viewed by many with suspicion (Schenker, 1992a).

Analysis of the ethics of any action of an individual or society will, usually, take into consideration three interrelated sets of criteria. Firstly, there are the religious and philosophical traditions of that society. These in turn influence the enacted and bench law by which the society is governed. Both forms of law, in a democratic society at least, are also influenced to a greater or lesser extent by the third factor, public opinion. In turn, public opinion may be guided by what is or is not legal and by what is perceived as being coincident with a prevailing moral tradition. None of these are fixed scales of values and even the interpretation of historical ‘truths’ may vary with attitudes and evolution of opinion (Sureau, 1997). Public opinion differs from the law and historical precedence in that, when faced with a new situation outside the exact confines of existing thought, it is more protean and malleable. Assessment of informed opinion and its processing to format law is thus against a background of shifting public attitude (Schenker, 1989).

The extent to which surrogacy arrangements may provoke less adverse public opinion and become more socially acceptable remains an issue of dispute among legislators and other interested political and legal decision-making bodies (Brom-
The practice of surrogacy is limited in a few countries (i.e. Korea, Thailand, Israel, UK and Holland), which reveals the difficulty of the international community in dealing with this assisted method of reproduction. In Brazil and Hungary, it is only allowed only if a relative is willing to undergo the procedure. The rest of the nations studied either prohibit (IVF law) or simply do not use surrogacy, mainly as a result of cultural or religious attitudes.

**Cloning**

Cloning is a biological mechanism of parthenogenetic reproduction by which one or more genetically identical cells, organisms, or plants are derived from a single parent. Although reproduction by cloning is widely used in plants and in the biological industry, the achievement of Wilmut *et al.* (1997), who cloned a mammary cell from an adult sheep and consequently developed and grew a sheep embryo to term, set this method of reproduction to medical and social criticisms, as it raised the possibility of replicating humans through asexual means. Despite the fact that through cloning several clinical problems might be resolved (embryogenesis, carcinogenesis, the use of embryonic tissue for transplantation), its use as a reproductive method in humans raises serious legal, religious and social problems.

Medical indications for which nuclear cloning and transfer may be potentially applied include cases of women with premature ovarian failure who do not wish to use donated oocytes or are not able to do so due to low oocyte availability; males or females with dominant genetic disease or couples carrying a recessive genetic disease; single women not interested in using donor spermatozoa; improvement of IVF results, especially in low responders who produce only a small amount of oocytes/embryos; sex preselection; reduction of the incidence of multiple pregnancies and, hence, the number of premature neonates and reduction of the risk for ovarian hyperstimulation syndrome in women with polycystic ovaries by transferring only one embryo each cycle; use of cloned embryos as a part or source for organ transplantation; study of cell growth and development in order to better understand embryogenesis, carcinogenesis, and senescence; and ovulation induction and oocyte retrieval, which need to be performed only once, and the cloned embryos transferred at a different time (Tanos and Schenker, 1998).

Nevertheless, cloning by nuclear transfer, as asexual reproduction, can lead to detrimental biological effects and evolutionary consequences on the human genome, as well as have ethical, legal and social implications. In the case of a successful human cloning, an indefinite cell line will be created, leading to the loss of the selective advantage of the organism’s
interaction with its environment, which exists naturally. Several generations of cloning by nuclear transfer increase the risk of an accumulation of deleterious recessive genes and the possibility of mutations introduced to the human genetic pool, which may lead to an increase in various diseases and malformations. For example, today the genes for sickle-cell anaemia and cystic fibrosis occur at a high frequency among the population, but because of their heterozygous forms many mutations exist, creating a large variability in the degree of the disease (Romeo et al., 1989). Bypassing such evolutionary processes by missing the natural pathways may lead to the creation of organisms with morbid or lethal genes. Such genetic errors would also be reproduced with the germ-line, thereby ensuring transmission to progeny. This is the main biological limitation of nuclear cloning in humans and therefore is unacceptable in clinical practice.

Human cloning by embryo splitting shares certain advantages over nuclear transfer, as the cloned embryos are the products of both maternal and paternal gametes (Hall et al., 1993). This eliminates the risk of creating a super human being or of genetic alterations, and also makes biologically impossible the selection of elite individuals. During this micromanipulative procedure the risk of embryo damage and destruction rises. The increasing experiences with its application, as well as, the clinical advantage of the large number of ‘back-up’ embryos limit the importance of these complications. One possible risk for society arising by the use of this method includes the birth of identical embryos several years apart and also the creation of an unlimited number of clones. Supporters suggest that limiting the number of cloned embryos to two and the period of transfer of embryos to 5 years can control this. After the successful delivery of children, the remaining stored embryos should be thawed. Commercializing this process should be strictly prohibited.

The potential of cloning by embryo splitting for reducing clinical risks and costs as well as enhancing success rates for infertile couples who desire children is a challenge. Ovulation induction and oocyte retrieval need to be performed only once and the cloned embryos can be transferred at different time periods. Such a management would greatly reduce IVF costs and complications.

In every society, religions influence public opinion greatly, and as with every aspect of reproduction, they have also set their views about cloning. The Roman Catholic Church prohibits it, as it is contrary to the moral law and opposes the dignity both of human procreation and of conjugal union. Islam rejects it also, as it separates the act of reproduction from human relationship and marriage. In Buddhism, cloning may raise the problem of inheriting the Karma, which is in conflict with reincarnation. The Jewish view is that it may be applied only in cases where there is a clear therapeutic indication (Tanos and Schenker, 1998).

Animal cloning is already supported by international ethical guidelines such as those of the International Federation of Gynaecologists and Obstetricians (FIGO), World Health Organization, American Congress and European Council. By retrieving results from our survey, we observed that cloning is not practised in any country, and that at present several countries, for example the UK, Denmark, Germany, Belgium, the Netherlands and others, have set legislation that prohibits its application. In other countries it is forbidden by regulations. The American Fertility Society is also against the encouragement of this procedure.

**Informed consent**

The obligation to obtain the informed consent of a woman before any medical intervention is undertaken derives from respect for her fundamental human rights. However, informed consent for treatment is an ethical requirement often misunderstood or not fully appreciated by physicians.

The purpose of obtaining informed consent is to ensure that patients know what doctors propose to do and freely grant their permission. This may be difficult to achieve in cases where women have little education, or where very unequal power relationships in a society mitigate against women’s self-determination. Nevertheless, these difficulties do not absolve physicians caring for women from pursuing fulfilment of the required criteria for informed consent.

Although the purpose of informed consent and the standards by which it is to be employed are the same in all areas of medical practice, special problems arise in assisted reproduction since it applies to some rather unique procedures that are not practised everywhere but have nevertheless become well established in some parts of the world (i.e. cryopreservation, oocyte donation). These situations call for disclosures and discussions in the informed consent process that go beyond the normal ethical requirements in clinical practice. Assisted reproduction requires no more and no less than any other medical treatment by way of disclosure of the purpose of intervention, the procedures to be done, the risks, benefits and alternatives. At the same time, evidence exists that there have been fewer adherences to appropriate disclosure of information by practitioners of assisted reproduction than is ethically required, such as the failure to provide accurate and understandable information about success rates to couples seeking IVF (Macklin, 1995).

The preparation of an informed consent is required before every procedure in every country studied. In some nations, law regulates the necessity of obtaining the informed consent and in others it is set according to their own ethical standards. There seems to be a mutual agreement in society between the collaborating parties about the necessity of the informed consent.
Medical record keeping: central reporting

There is a consensus among medical professionals that keeping accurate medical records is essential. Record keeping has always been an important part of both medical practice and quality assurance (Schenker, 1995). However, it raises particularly difficult ethical and legal questions with regard to medical confidentiality and family privacy. The right to privacy is a fundamental human right. In the context of medical information that is personal and intimate, the concern for respect of privacy of the participants is paramount. Truth-telling and candidness are values to be respected in the communication between the physician and the patient, and in the case of gamete and pre-embryo donation it may be considered in the relationship between the physician, the donor and the recipient. Candidness with the family after the birth of a child as to the method of his conception or later as to the identity of the donor is of a different nature. Society’s (state) intervention in the privacy and intimacy of the familial relationship, in order to force a greater openness, could be an invasion of the freedom of procreation decision making that extends beyond legitimate concern for the quality of services and for the proper follow-up of the offspring.

Legislation and regulations in different countries in which assisted reproduction, and especially gamete and pre-embryo donation, is practised, consider the nature of the information to be maintained about the parties involved in the programme. A distinction has been made between non-identifying and identifying information. The non-identifying information includes a detailed description of physical characteristics and ethnic origin, medical history and background and social characteristics like education and profession. When identifying information is required, it will include full names, addresses, date and place of birth, and identity of the parties involved. The responsibility for collection of information should lie with the physician performing each stage of the donation procedure.

There are different opinions regarding the storage of information. Where should information be kept? Who should have access to it? What kind of information should be released to the parties involved in the programme? In most countries where genetic material donation is practised, the records of identifying and non-identifying information are kept and maintained by the physicians or medical institutions according to the regulations of the particular country. In some countries, it has been suggested that the identifying information of the parties should be stored in a Central Government Registry. In South Africa, for example, a National Data Bank exists. The advantages of central state registry include the fact that the information can be safely kept for long periods, that there is a protected central control on release of information, update and access to the information can be more feasible, and that a central computerized national register may provide control over the number of donations made by each donor. It is of importance to restrict to a minimum the personnel who have access to this information (Schenker, 1992b).

Identifying material may be released according to the legislation in a specific country. In France and Spain, for example, sperm donation is anonymous, while in others, such as Germany and Sweden, the law insists on the child’s right to know the identity of its biological father. Our survey reveals also that in the large majority of the nations involved, results from the application of IVF and other ART are reported every certain period of time (usually every year) to a central registry.

IVF and other ART: financial and emotional stress

The resulting competition for available resources between high-technology medicine on the one hand and routine primary health services on the other has created severe shortages and stresses within the health care system. In this situation, which is by no means unique to a particular country, there is an obvious need to assess the public sector costs of the new high-technology medical procedures, including IVF and related technologies.

IVF and other ART are funded differently in various countries. Many private insurance companies do not regard serious infertility treatment as being genuine medical care. In the USA patients are generally able to claim treatment, at least up to a limited number of treatment cycles, on private medical insurance; there is no federal medical cover available for IVF, which reflects the view that infertility is not a disease. IVF was one of the few procedures explicitly excluded from the standard benefit package in the Clinton administration’s Health Security Plan (1993). In Belgium, Holland, Denmark, France, Spain, Norway, Israel and Italy there is limited or full state insurance for IVF and other ART. In Canada, the Royal Commission recommended that it is unethical to offer as services unproven procedures such as IVF and other ART and to devote public resources to them (Mor-Yosef, 1995).

In France, the legal context of the different treatment methods is quite nebulous, requiring complicated legal procedures, sometimes with degrading aspects such as a judicial inquiry prior to any embryo donation. Nevertheless, the French may be considered to be lucky, if one considers that infertile couples in the USA almost always have to pay for infertility treatment involving ART themselves, and the average cost ranges from $6000 to $10 000. In Great Britain, infertility treatment is available in most gynaecology departments, but waiting lists for treatment within the context of the National Health Service are often prohibitive. As a result, more than 75% are treated in private clinics, if they can afford it (Neumann, 1994).

The wide range in costs and prices in various countries is on one hand due to different ways of calculation and on the other because of differences in wages, equipment and prices among these countries. It has recently been published that for women
who did not pursue a second IVF cycle after the first failed, the major reason was financial (Goldfarb et al., 1997).

Infertility, its evaluation, and its treatment have also been associated with significant emotional stress for the couple involved. There have been reports that anxiety related to infertility not only is a problem in itself but also may impact on the success rates of IVF (Demyttenaere et al., 1992).

Although some people experience early success in the treatment process, with relatively few and non-intrusive interventions being needed, other couples may experience years of treatment with many interventions, some of which are complex, invasive and expensive. Treatment costs and number of tests and treatments received have correlated highly with the stress associated with fertility problems. The difficulties that the time necessary for treatment imposes on the lives of infertile couples, such as time off work and travel to attend appointments and the stress created by continually focusing on the infertility treatment and the fear of failure, have also been described (Abbey et al., 1992).

Despite these difficulties, infertile couples studied were found to be generally satisfied with their treatment, which was mainly a result of the technical skills and emotional support provided by the therapeutic team involved (Halman et al., 1993).

The stress associated with infertility may be lowered if the physicians and their staff pay particular attention to their patients’ emotional needs, to their patients’ understanding of procedures explained to them, to discussing adoption with their patients, to involving men more in the infertility treatment, and to assisting women to have more control over their course of treatment. The introduction of a psychologist, psychiatrist or social worker into the therapeutic team may help to achieve these goals.

These problems encountered in the use of IVF and other ART have led to the formation of several organizations, which aim to support their members by helping them to share information and by promoting the needs and concerns of infertile people in the medical, scientific and political arenas of the international community. One of these organizations, the International Federation of Infertility Patients Association, (IFIPA), aims to achieve open access to infertility treatments for all couples around the world.

**Conclusion**

IVF and other ART, since their evolution and implementation, have raised complex ethical, legal and social issues. No other medical advent has ever caused so many conflicts among the scientists, the public and society as a whole. Despite all the obstacles, the medical world has succeeded in establishing this new procedure and even more to further increase its possibilities and range of treatment in many aspects.

As these techniques are associated with the human and his/her reproduction problems, there is no doubt that their application will continue to have implications with regard to many social issues and disputes. Legislation or other type of regulations will be installed by many countries for the control of any undesired exploitation of the patient. Society, in every case, should weigh the benefits against the risks and set the limits for the provision of these very useful treatments.

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