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Infertility in industrialized countries: Prevalence and prevention

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In the last 10 years significant resources have been invested in the provision and expansion of medical treatments for infertility, especially the technologies of medically assisted conception, (e.g., *in vitro* fertilization, gamete intrafallopian transfer, zygote intrafallopian transfer, etc.). This has stimulated widespread public discussion and awareness of the problem of infertility. It is commonly believed (by clinicians as well as the lay public) that as many as 10–20% of women of childbearing age are infertile and that the prevalence of infertility is increasing[1–3]. Proponents of medically assisted conception state that little can be done to prevent infertility and therefore medically assisted conception should be designated a necessary health service and given due priority within national health programmes.

We examine the validity of, and scientific basis for these statements. We discuss the prevalence and aetiology of infertility and the relevance of this information for national infertility service and prevention programmes.

Prevalence of infertility

Prevalence estimates are affected by the criteria used for making the diagnosis of the condition in question. A clear, agreed upon, measureable definition is needed in order to diagnose people as having the condition or not.

Unfortunately, infertility is not easy to diagnose because the ability to conceive is a continuum ranging from absolute sterility through subfertility to normal fertility and perhaps even superfertility. The cut-off point on the continuum, where normal is differentiated from abnormal, is entirely arbitrary. For example, the World Health Organization (WHO) defines infertility as not conceiving after cohabitation and exposure to pregnancy for 2 years[4], while the United States Office of Technology Assessment (OTA) uses the definition, inability to conceive after 12 months of intercourse without contraception[5].

Both definitions are inherently flawed because they allow a substantial proportion of normal, fertile people to be misclassified. When the definition of 12 months of unprotected intercourse is used, only 16–21% of couples meeting this definition actually remain infertile throughout their lives. Indeed, several recent studies suggest that around 30% of couples take more than a year to conceive at some time during their reproductive lives[6,7].

Even minor differences in the phrasing of questions on fertility surveys can result in markedly different estimates of prevalence. For example, a study conducted by the United States Centers for Disease Control found that 12.5% of U.S. couples reported that they tried to conceive over a 24 month time period but were unsuccessful, whereas 20.6% reported having unprotected intercourse without conception over the same time period. Thus, less stringent definitions and shorter time periods will generally result in higher estimates of the prevalence of infertility in populations[8].

Population surveys indicate that there is wide variation among countries in indicators of the prevalence of infertility[9]. Infertility is generally a greater problem in developing countries (particularly in Africa) than in industrialized countries[9].

Studies do not substantiate a core rate of infertility of 10–20%. A recent survey in the United States (National Survey of Family Growth conducted by the National Center for Health Statistics) reported that 8.5% of married couples with a wife age 15–44 (N = 8,450) were infertile[10]. Infertility was defined as 12 months or more of intercourse without contraception. In addition, women were asked whether they, so far as they knew, had a physical problem (other than surgical sterilization) which would make it difficult or dangerous to have a baby. Only about 4% of the total sample (all age groups) were childless and had impaired fecundity (not due to surgical sterilization): less than 2% of the sample were childless, had impaired fecundity and were over 35 years of age[10]. The overall prevalence of infertility in 1988 was unchanged from a previous survey conducted in 1982, although the proportion of infertile women in younger age groups had increased (due to an epidemic of sexually transmitted disease) and the overall numbers of older women had increased due to the ageing of the baby boom cohort. These findings may account for the beliefs that there is an 'epidemic' of infertility[10].

Aetiology of infertility

The cause of infertility are many and varied. The World Health Organization Task Force Standardized

Tab. 1. Aetiology of female and male infertility, 1985.

Diagnosis	Frequency
females	
no demonstrable cause	40%
acquired tubal abnormality	12%
anovulatory regular cycles	10%
anovulatory oligomenorrhoea	9%
hyperprolactinaemia	7%
endometriosis	6%
males	
no demonstrable cause	49%
varicocele	11%
primary idiopathic testicular failure	10%
accessory gland infection	7%
abnormal sperm morphology	8%
low sperm motility	3%

Source: World Health Organization Task Forces Standardized Investigation of the Infertile Couple.

Investigation of the Infertile Couple is the largest study of infertility ever conducted [11, 12]. More than 10000 couples in 25 countries have been enroled in the study [12]. The published 1985 results show that tubal obstruction or pelvic adhesions are the most common cause of infertility in the female accounting for about 24% of female infertility in developed countries. Other specific diagnoses for the underlying cause of female infertility are given in Table 1.

The presence of tubal obstruction and/or pelvic adhesions usually indicates previous pelvic inflammatory disease (PID) [11]. PID (symptomatic or asymtomatic) is often caused by sexually transmitted diseases, (especially *Chlamydia trachomatis* and gonorrhoea) [11]. PID may also occur after induced abortion, birth, surgery, IUD insertion or other invasive procedures. In these cases, the sexually transmitted diseases are not always responsible [11].

PID, in turn, is associated with infertility. In a Swedish study of 15–24 year old women, 1 episode of PID was associated with infertility in 9.4% of cases, 2 episodes in 20.9% of cases, and 3 or more episodes in 51.6% of cases [13].

Studies in Sweden and the United States show that post-abortion PID is 3 to 30 times higher in women with untreated *Chlamydia* cervical infection than in untreated women [14, 15]. Another study demonstrated that 40% of post-abortal women infected with *Chlamydia* will develop PID [16]. When induced abortion is illegally performed, it is likely that PID rates will be even higher. *Chlamydia* infection is also common in pregnant women who do not abort. 4–5% of pregnant women in the United States are infected with *Chlamydia* and approximately 25% of infected pregnant women will develop intrapartum fever or postpartum endometritis [17].

According to the aforementioned WHO study, a history of post-abortion or postpartum infection carries a relative risk of 4.2 (95% C.I. 2.9, 6.6) for bilateral tubal occlusion [18]. Furthermore, in developed countries, 24% of women with bilateral tubal occlusion had a history of post-abortion or post-partum infection; 28% had a history of sexually transmitted disease [19].

The male equivalent of tubal obstruction following infection is the blocking of the vasa differentia and chronic infection of accessory glands. The reason for the low rate of infection related infertility in men is unknown. However, the male plays a significant role in the causation of infection-related female infertility. Approximately 90% of female partners of men with gonorrhoea and 60% of female partners of men with *Chlamydia* will become infected [20].

In addition to the causes noted previously, a number of invasive procedures are associated with infertility including tubal sterilization, vasectomy, ovarian wedge resection, appendectomy, uterine suspension, caesarean section, hysterosalpingogram, infant hernia repair, and dilatation and curretage [5]. While some of these procedures are quite common, there is no data on their contribution to overall rates of infertility.

Some drugs may also affect fertility. Diethystilboestrol (DES) has been associated with infertility in the sons and daughters of the women who took the drug while pregnant. Over-prescription or incorrect prescription of fertility drugs can cause hyperstimulation and infertility [5].

Other social, psychological and lifestyle factors are associated with infertility. Excessive strenuous exercise, rapid weight loss, low body fat, stress, smoking and chronic alcohol consumption reduce fertility as does exposure to certain environmental toxins in the workplace [5, 8]. Many acute or chronic illnesses can cause anovulation or decreased spermatogenesis.

Whether a couple conceives within a given time period is strongly influenced by the frequency of intercourse. In one study 16.7% of couples having intercourse less than once a week conceived within 6 months while 83.3% of couples having intercourse 4 or more times a week conceived within the same period of time [20].

Clinical and health policy implications

These data indicate that the prevalence of infertility in the community is far below 10–20%. While it is true that perhaps 30% of couples may, at some point in their lives, have difficulty conceiving, only a fraction actually remain childless.

One may then infer that the accepted clinical definition of infertility (12 months of unprotected intercourse) inevitably results in over-diagnosis and over-treatment. Over-diagnosis and over-treatment exposes women unnecessarily to the risks associated with drugs and invasive procedures. Of course, the impact of unnecessary medical care on national health budgets is staggering.

Estimates of the need for infertility treatment services, therefore, must be based on conservative estimates of prevalence. For clinical practice and health service planning needs the concept 'fecundity status', as used by the U.S. National Center for Health Statistics, is much more precise a term than infertility. Fecundity status is defined as the person's physical ability to have children. Women, men or couples can be classified as surgically sterile, fecund, or as having impaired fecundity. Moreover, estimates of prevalence should account for cohort effects in the birth rate and the age distribution of the population, and the proportion of the population that is childless.

A review of what is known about the causes of infertility and the potential for prevention does not support a nihilistic attitude towards prevention. In a rational plan for the overall management of infertility in the community, prevention has to come first. Prevention efforts benefit the whole community, not just a few individuals. There is good evidence to support the redirection of research priorities, health manpower resources, and health care expeditures away from high-tech medical treatment, toward infertility prevention programmes.

Around a third of all infertility is caused by potentially preventable infections[21]. Renewed efforts to control sexually transmitted diseases are required. Sexually transmitted disease prevention and control programmes can also help to reduce pregnancy wastage, cervical malignancy and the transmission of HIV.

Low cost mass screening technology for *Chlamydia* and other sexually transmitted diseases is available. Antibiotic treatment of infected individuals is safe and effective. Higher priority should go to health education for the public (including school children), improved disease detection and treatment, better education of health professionals and contact tracing[21]. Contact tracing would be facilitated by making *Chlamydia* infection and its symptoms (nonspecific urethritis in the male) reportable. At the moment, Sweden is the only country in which *Chlamydia* infection is a notifiable disease.

Iatrogenic causes of infertility are also preventable. Iatrogenic causes include surgeries, invasive diagnostic procedures, drugs and unrecognized, untreated infections. Here prevention efforts must be directed toward health professionals as well as the general public. Education of physicians to the risks to future fertility posed by abdominal surgery (including cesarean section) is a means of preventing iatrogenic infertility. Education can point-out, for example, the potential harm done to women by unnecessary caesarean sections and frequent vaginal examinations during labour. Education programmes can also stress the importance of aggressive management of PID, and conservative treatment that avoids pelvic surgery and other invasive procedures in young women. Proper screening for, and treatment of, sexually transmitted diseases during pregnancy and prior to abortion can go a long way toward preventing infertility. Female surgical sterilization technique should minimize the damage done to the fallopian tubes in case the woman should ever seek reversal.

More research is needed to determine the causes of male infertility and how it might be prevented. Programmes for the prevention and treatment of infertility inevitably direct their efforts to women. Research programmes do the same. Prevention of male infertility is neglected in spite of strong evidence that men and women make a nearly equal contribution to the pathogenesis of infertility.

More research attention is needed on psychosomatic and social factors and infertility. That no cause of infertility could be found in a significant number of couples in the WHO study may simply indicate that there were unrecognized biological factors present, but it may be an indication that psychosomatic factors have a role in the aetiology of infertility that is as yet, unidentified.

Lastly, more research is needed on appropriate use of medical technology and quality assurance in health care. Directly or indirectly, invasive medical procedures can render a woman infertile. There is little data on the contribution of iatrogenesis to overall infertility but there is good reason to believe that it is significant. Research is needed on how to change physicians' practices. Education may not be enough. Research is need on quality assurance strategies to reduce the number of unnecessary invasive interventions and their harmful consequences.

Summary

We discuss the prevalence and aetiology of infertility and the relevance of this information for national infertility services and prevention programmes. The prevalence of infertility in industrialized countries has been said to be as high as 10–20%. This estimate, and the argument that little can be done to prevent infertility, have been used as justification for increased government investment in, or expansion of, services for medically assisted conception. However, population prevalence surveys indicate that far fewer couples of reproductive age are actually infertile. For example, a recent survey in the United States reported that 8.5% of married couples with a wife age 15–44 were infertile. 4% of the sample were childless and reported having a condition which impaired fecundity, while less than 2% were childless, had impaired fecundity and were over 35 years of age. Other studies show that nearly a third of couples have difficulty conceiving at some point during their reproductive lives but few actually remain childless. A significant

proportion of infertility could be prevented through more aggressive application of standard public health measures.

Résumé

Infécondité dans les pays industrialisés: Prévalence et prévention

Cet article passe en revue la prévalence et l'étiologie de l'infécondité dans les pays développés, ainsi que la pertinence de cette information pour gérer les services de soins et de prévention concernant l'infertilité. Certaines études font penser que l'infertilité pourrait toucher environ 10–20%. Cette estimation, avec la conviction qu'une prévention est impossible, a été utilisée pour justifier les investissements croissants des pouvoirs publics dans le traitement médical de l'infertilité et de la procréation assistée. En fait, les enquêtes de population montrent que peu de couples dans l'âge de reproduction sont réellement inféconds: par exemple, une enquête récente aux Etats-Unis a montré que 8,5% des couples mariés (avec une femme âgée de 15 à 44 ans) étaient inféconds; 4% de l'echantillon n'avaient pas d'enfant et signalaient une maladie empêchant la fertilité; moins de 2% n'avaient pas d'enfant, avaient une fécondite basse et avaient plus de 35 ans. D'autres études indiquent qu'environ 1/3 des couples ont des difficultés à concevoir à un moment quelconque de leur vie reproductive, mais peu demeurent sans enfant. Une proportion importante des cas d'infécondité pourraient être prévenus grâce à l'obligation plus agressive de mesures standards de santé publique.

Zusammenfassung

Infertilität in industrialisierten Ländern: Prävalenz und Prävention

Im vorliegenden Artikel werden Prävalenz und Aetiologie der Infertilität und die Relevanz dieser Information für nationale Infertilitätsdienste und Präventionsprogramme diskutiert. Die Prävalenz der Infertilität in industrialisierten Ländern wird mit 10–20% angegeben. Diese Schätzung und das Argument, dass wenig getan werden kann, um der Infertilität vorzubeugen, wurde zur Rechtfertigung vermehrter Investitionen oder des Ausbaus von medizinisch unterstützten Konzeptionsmethoden benützt. Bevölkerungsuntersuchungen liefern jedoch Hinweise, dass wesentlich weniger Paare im reproduktiven Alter tatsächlich infertil sind. In den Vereinigten Staaten ergab eine neuere Untersuchung von verheirateten Paaren mit Frauen im Alter zwischen 15 und 44 Jahren, dass 8,5% infertil waren. 4% dieser Stichprobe waren kinderlos und gaben einen Grund für ihre verminderte Fruchtbarkeit an, während bei den über 35jährigen weniger als 2% kinderlos waren und eine verminderte Fruchtbarkeit angaben. Andere Studien zeigen, dass rund ein Drittel aller Paare irgendeinmal während ihres reproduktiven Lebens Schwierigkeiten zu konzipieren haben, aber schlussendlich nur wenige kinderlos bleiben. Ein nicht unbedeutender Teil der Infertilität könnte durch stärkere Anwendung von Standardmassnahmen in der Öffentlichen Gesundheit verhindert werden.

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