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Nieschlag E, te Velde E

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Why have Birth Rates Dropped? For Medical Reasons?

E. Nieschlag¹, E. te Velde²

Socio-economic factors influence reproductive behaviour negatively. In addition, couples postponing childbearing into later phases of life jeopardize their changes for parenthood. Other medical reasons including the alleged "sperm crisis" are less likely to lead to declining birth rates. According to several studies, fecundity has remained stable or increased over the past decades. **J Reproduktionsmed Endokrinol 2010; 7 (5): 403–6.**

Key words: fertility, fecundity, birth rates, sperm crisis, infertility, contraception, reproductive age

The following article is based on two lectures held at the Working Group "Future with children – fertility and development of society" of the Berlin Brandenburgische Akademie der Wissenschaften and Leopoldina (supported by the Jacobs-Foundation), entitled "Development of male fertility" (Berlin, 8.7.2009) and "Is fecundity declining?" (Schloss Marbach, 24.6.2010).

■ Introduction

Following a peak in 1965, the number of children born in Germany (as well as in other European countries) has constantly decreased and has now fallen to its all-time low. At the same time, while life expectancy is increasing, death rates exceed birth rates. Although this continues a trend that started at the beginning of industrialisation in the 19th century [1], there is public concern about the possible consequences of birth rates below replacement level. Any analysis of the causes for this phenomenon should include discussion of the question whether human fecundity has declined or whether other factors are prevailing.

■ Economic and Ecologic Influences on Reproductive Behaviour

A billboard on Times Square in New York seen in April 2010 suggests that the first thought people have at the sight of a baby in diapers is "expense" and Time Magazine states under the heading "One and done": "The economy is sluggish, expenses are up and raising kids costs a bundle (the average child in the US costs the parents about \$ 286,050 before college [i.e. up to 18 years]). What better time to abandon the stereotypes and embrace the possibilities of the only child?" [2].

Similarly, in Germany fathers' income correlates with the number of children they have [3]. When reimbursement for assisted reproduction techniques (ART) by the national insurance system was cut back from 100 to 50% in 2004 the percentage of children created by ART among all newborns dropped from 1.9 in 2002 to 1.0 in 2005 [4] and remained at that level, as figures from the German IVF Registry show [5]. These economic reasons for fewer children may be termed "financial infertility".

Under the impression of climate change and dwindling resources of this planet, more and more people recognize worldwide overpopulation as a causal factor. Politicians and parliaments [6] conclude that the population growth factor jeopardizes any socio-economic progress in developing countries and some people become reluctant to produce children on their own. This attitude is highlighted by a movement in Australia, a country with enormous space reserves, propagating the one-child family to reduce overpopulation and its ecologic consequences [7]. Thus, overpopulation appears to be another non-medical reason for people to down-size their families.

■ Contraception and Birth Rates

Allensbach opinion polls in 1950, 1969, 1989 and 2004 [8] revealed that at these

time points Germans (over 16 years of age) ideally wanted 2.2, 2.2, 2.1 and 1.9 children, but the actual birth rates were 3.2, 2.7, 1.5 and 1.4, i.e. with the introduction of oral contraceptives for women and other modern methods in the 1960s the number of births began to decline slowly and today the actual birth rate lies even lower than the desired goal.

The availability of contraceptive methods as such is not the only reason for declining birth rates, as the well-known demographer Leridon [9] confirms, but the modern contraceptives, becoming widely available since the end of the 1960s, have had an enormous impact in enabling strict family planning and avoiding unwanted pregnancies. In other words, "Birth control has quickly become one of the recession's few growth industries" [2].

While male contraceptive methods, vasectomy and condoms, contribute about 7.4% worldwide to total contraceptive usage and are under increasing demand in times of economic recession e.g. in the US [10], they play a minor role in Germany, accounting for only 1.6% [11]. This is in contrast to neighbouring countries such as The Netherlands and Switzerland, where 11 and 8% of men with partners of reproductive age are vasectomized. This low acceptance of vasectomy has historical reasons as vasectomy was a punishment in the "3rd

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From the ¹Centre of Reproductive Medicine and Andrology, University of Münster, Germany and the ²Department of Public Health, Erasmus University MC, Rotterdam, The Netherlands

Correspondence: Prof. Dr. med. Eberhard Nieschlag, Centre of Reproductive Medicine and Andrology, University of Münster, Domagkstraße 11, D-48129 Münster; e-mail: eberhard.nieschlag@ukmuenster.de

Table 1: Time-to-pregnancy, 1-year infertility rate and lifetime infertility prevalence: measures of fecundity in population studies comparing past and present.

Author	Outcome Measure	Method	Period or Birth Cohort	Trend
Scheike et al. 2008 [41] – SE	1-year infertility	Nationwide birth register	Birth cohorts 1949–1970 and period 1983–2002	Fecundity improved
Joffe 2000 [37] – UK	Time-to-pregnancy	Interview survey	Period 1961–1993	Fecundity improved
Jensen et al. 2005 [38] – DK	Time-to-pregnancy	Interview survey	Birth cohorts 1931–1952	Fecundity improved
Stephen and Chandra 2006 [39] – USA	1-year infertility	Interview survey	Period 1965–2002	Fecundity improved
Oakley et al. 2008 [40] – UK	Lifetime infertility prevalence	Postal questionnaire survey	Birth cohorts 1945–1962	Remained unchanged

Reich” and was forbidden by law in the former GDR, and this dubious past continues to influence people’s attitudes.

■ The Impact of Age on Reproduction

The impact of age on female reproductive functions is well documented and will be detailed in a contribution by te Velde elsewhere. Briefly, while female reproductive functions are at their optimum between 20 and 30 years, they decline considerably beyond 35 years and cease at 50 years, with some variability [12]. Despite this physiologic fact more and more women postpone childbearing into later phases of life when the chances for conception and live births significantly decrease. In the presence of declining birth rates in industrialized countries, the proportion of mothers over 40 is the only growing segment of women giving birth [Sobotka 2010, personal communication]! As women of this age group have to fight growing problems of infertility, they increasingly require medical help to become pregnant and many turn to ART as treatment to overcome their fertility problem. However, many remain infertile although they have a strong desire for offspring.

In a couple the ages of the man and the woman usually tend to be parallel i.e. the age of men intending to become fathers also tends to increase, and the question is whether age-related female infertility is paralleled by male age-related problems. In contrast to the ovarian cycle, spermatogenesis continues life-long and sperm can be found in very old men. However, sperm motility as an important predictor of fertility decreases with age [13–16]. Time to pregnancy (TTP) significantly increases when the male partner is over 40 years of age [7]. Moreover,

spontaneous abortions increase with age [18] and live births decrease with paternal age [19], all factors contributing to a lower birth rate due to advancing male age. In addition, chromosomal abnormalities and genetic autosomal dominant diseases increase in children of aging fathers (for review see [20]).

In summary, not only female reproductive functions decrease with age, male chances for offspring also decrease and the risks of genetic diseases increase with paternal age. As the decrease of reproductive functions occurs later in males than in females, the importance for couple fecundity may not yet be so important, but should be borne in mind if the postponement of childbearing to later phases of life continues. Advanced paternal age may also represent an increasing problem if the current trend for second and third marriages continues, with men often much older than their female partners.

■ The “Sperm Crisis”

In 1992 Carlson et al. [21] published an analysis of 61 studies indicating a significant decrease of sperm concentrations from 1938 to 1990. This analysis attracted and continues to attract much public interest (and eventually also public funds) although it was also heavily criticized (for summaries of this criticism see [22–24]). The 61 publications were very heterogeneous in terms of study design, study populations and methodological details of semen analysis as well as geographic and ethnic aspects. The statistical evaluation was also found inappropriate.

The major problem was the techniques of semen analysis which had not been standardized in the past and show a great

variability within and between laboratories. Only in recent years was internal and external quality control introduced to the andrology laboratory (e.g. [25]), but was lacking in most of the 61 studies analysed. Abstinence time before provision of a semen sample is of prime importance for the actual sperm concentration, but was not properly recorded in most of these studies. Sperm concentrations increase with every day of abstinence up to 10 days and may differ manifold over this period so that incorrect recording of abstinence time may result in very misleading sperm concentrations [26].

The Carlsen analysis triggered 27 major studies taking ethnic and geographic differences into account. As a review by Fisch [23] shows, 16 of these studies found no differences over time in sperm concentration, motility and morphology, 5 studies yielded ambiguous results and 6 studies demonstrated a decline of the three semen parameters. In response to the criticism the group responsible for the Carlsen study set up their own longitudinal study and analysed semen samples from about 350 young men prior to military service in Denmark; from 1996 to 2008 the average sperm concentration was ± 45 mill/ml in these men and showed no significant changes or trends over time! The study is continuing for an undetermined period [27].

In conclusion, Fisch [23] writes: “Far from being a worldwide and well-proved phenomenon, declines in semen quality are, at best, a highly local phenomenon with an unknown cause and, at worst, a collective artefact.”

One of the problems contributing to the “sperm crisis” is the fact that so-called

normal semen parameters and especially lower limits of normal were subject to consensus and were not evidence-based in the past. It was, however, well-known from patients treated for hypogonadotropic hypogonadism (e.g. [28]) and volunteers in contraceptive trials [29]) that pregnancies could be produced with very few sperm and men with increasing sperm counts had a better chance for paternity [30]; remarkably there was no systematic investigation until, in the forefield of the 5th edition of the WHO Laboratory Manual for the Examination and Processing of Human Semen [31], appropriate reference values based on TTP were established [32].

■ Infertility

In 1987 WHO released worldwide data on the distribution of causes of infertility between males and females. These data serve as a standard for orientation. Unfortunately, no follow-up studies on possible changes of the distribution pattern were published, so that possible changes have not been monitored.

Similarly, in recent decades the endocrine, genetic and molecular diagnostic tools to discover causes of infertility have been greatly expanded and new pathophysiological entities emerged. On the female side e.g. hyperprolactinaemia and endometriosis have been identified as major causes of infertility and new classifications of PCOS have led to more refined diagnoses. On the male side Y-chromosomal deletions and CBAVD as a minimal form of cystic fibrosis have been discovered. However, the pattern of infertility over time has not been monitored in appropriate populations. Therefore, it is impossible to make any statements about the frequency of infertility disorders and possibly changing patterns over time.

It has been shown that since World War II the incidence of testicular tumours has increased in most industrialized countries, but all attempts to explain these changes have remained inconclusive. The so-called “testicular dysgenesis syndrome” (TDS) [33] remains a hypothesis unconvincing on epidemiological grounds [34] and there is no proof of endocrine disruptors as causes for the TDS [35]. Nevertheless, although there are clear occupational hazards for fertil-

ity, they represent isolated incidences that are soon eliminated or ameliorated when they become evident [36]. There is no ground to assume that on the whole human fertility is on the decline because of environmental factors.

■ Development of Fecundity

There remains the question whether human fecundity has declined or is declining over time. Based on TPP, convincing epidemiologic studies from Sweden, UK and USA demonstrate that in the periods between 1949 and 2002 fecundity has either not changed or improved (Tab. 1) [37–41].

Also in Germany the total fertility rate slightly recovered from its all time low in 1985, although not to the extent as in other European countries [42].

■ Conclusion

Declining birth rates cannot be explained by increased infertility, neither female nor male. However, the growing tendency to postpone childbearing to later phases of life may become a problem. The general availability of effective contraceptives helps couples to obtain the number of children they really want and to avoid unintended pregnancies which, in the past, contributed significantly to birth rates. Avoidance of unwanted children certainly decreases the total number of children born.

However, there are many uncertainties and speculations in this field. Should scientists and the public want to know for sure whether or not human fecundity is declining, prospective surveillance systems monitoring TTP, total sperm counts and infertility patterns over time in representative populations would be required [43].

■ Relevancy for Practice

Both men and women must be made aware that postponing childbearing beyond 35 years severely jeopardizes changes for parenthood.

■ Conflict of Interest

The authors have no conflicts of interest to declare.

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