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Population growth: too much, too little, or both?

Egon Diczfalusy

Just a couple of years before the beginning of the 20th century, Sigmund Freud wrote the following: "Theoretically, it would be one of the greatest triumphs of humanity... if the act responsible for procreation could be raised to the level of a voluntary and intentional behaviour in order to separate it from the imperative to satisfy a natural urge".¹ A naïve dreamer? In 1898 yes. But 60 years later the US Food and Drug Administration approved the first oral contraceptive, Enovid;² and by 1993 the number of couples using specific contraceptive methods worldwide exceeded 550 million.³ In my opinion the invention of contraceptives was as fundamental as the invention of the wheel; it triggered off other powerful revolutions (for example, in reproductive health and gender equity) and contributed to a demographic upheaval.

In this article I address some of the implications of the demographic revolution – a rapid increase in global population coupled with changes in age distribution. How much is too much, or in some cases too little? I examine the issues in terms of projections from the UN Population Division,⁴ which in the past have proved more accurate than most.

The demographic revolution

Population historians concur that, 2000 years ago, the population of the world did not exceed 260 million. In ancient times survival was difficult, and even a thousand years later the total had risen only to some 280 million.⁵⁻⁸ Then it began to grow, reaching 430 million in the year 1500, 730 million in 1750, and 1670 million at the turn of the 20th century. Global population reached the 2.5 billion mark in 1950 and 3 billion just ten years later, causing worldwide anxiety. Some "prophets of doom" predicted that the Earth could never support a population exceeding 5 billion (by 2000 it was over 6 billion). What was to be done?

Many felt that worldwide family planning must be the solution and in the 1960s and 1970s less developed countries came under enormous pressure from the more developed to establish nationwide family planning programmes. By 1996 more than 90% of all developing countries, led by India, supported such programmes – albeit mainly for reasons of human rights, reproductive health, and gender equity rather than demographic concerns.^{3,9}

There has been much debate whether or not family planning programmes had any demographic impact. The answer seems to be yes, in view of the highly significant negative correlation between contraceptive prevalence and total fertility rate in less developed countries³ and the dramatic worldwide decline in total fertility rate per woman, which between 1965 and 1995 (just one generation) diminished by some 75%.⁴

Growing rapidly, decreasing rapidly, and ageing rapidly

Where do we go from here? According to the latest UN projections,⁴ the growth will continue for at least another 50 years; the world population is expected to increase to 7937 million by 2025 and to 9322 million by 2050. However, as indicated in Table 1, nearly all of this increase will take place in the less developed regions. In the more developed regions, the growth expected to take place between 2000 and 2050 in North America (from 314 to 438 million) and Australia/New Zealand (from 22 to 31 million) will be counterbalanced by a major decline in Europe (from 727 to 603 million) and Japan (from 127 to 109 million); thus humankind will grow rapidly and diminish rapidly at the same time. Also, the world population will rapidly become much older.

TABLE 1: ESTIMATED AND PROJECTED WORLD POPULATION (BILLIONS) IN 2000 AND 2050 (SOURCE REF 4)

Region	2000	2050
All	6.056	9.322
More developed	1.191	1.181
Less developed	4.865	8.141

As an example of the rapid ageing process, in 1975 the proportion of the "oldest-old" (people aged 80 and over) was 0.8% worldwide, 2.1% in North America, 1.8% in Europe, and 1.1% in Japan. However, by the year 2050, this is projected to increase to 4.1% worldwide, 7.3% in North America, 10% in Europe, and 15.4% in Japan. During the same period the proportion of children (aged 14 years or less) will decline worldwide from 36.7% to 21% – in Mexico from 46% to 19% and in Europe from 23.7% to 14%.

As a consequence of the above changes, the median age of the population will substantially increase. As late as in 1975, the median age worldwide was 22 years; it is projected to increase to 36.2 years by 2050. By that time the median age in North America is projected to be 41.0 years, in Europe 49.5 years and in Japan 53.1 years.⁴

Population structure and our common future

Table 2 shows the projected change in global population over the century from 1950. Between 1950 and 2050 the worldwide proportion of children is projected to diminish from 34.3% to 21.0% and that of elderly people (persons aged 60 and over) to increase from 8.7% to 25.2%.

Corresponding changes in the population structure of the more developed regions are indicated in table 3. If the medium variant projections from the UN materialize, by the year 2050 more than 43% of the population in these regions will be age 60 years or more – in fact, a larger group than the working-age population who have traditionally provided for the elderly and the children. It is also noteworthy that between 1950 and 2050 the proportion of the oldest-old in the more developed regions is projected to increase almost tenfold.

Perhaps the most dramatic changes in population structure are projected to take place in Japan (table 4); whereas in 1950 the country's population structure was practically identical with that of the less developed regions, by 2050 it is projected to reflect an extremely aged society in which under 13% are children, under 30% are of working

age, more than 42% are between 60 and 79 years old, and more than 15% are age 80 or over. Who will be the providers in such a society, for whom, and how? But a population structure with an increasing proportion of elderly people and a decreasing proportion of children is by no means an exclusive characteristic of the more developed regions; less developed countries are also rapidly assuming such a pattern, as indicated by recent estimates and projections of the Chinese population structure (table 5). In Mainland China between 1950 and 2050 the percentage of children is expected to be halved, that of the elderly trebled, and that of the oldest-old to increase more than twenty-fold.

TABLE 2: CHANGES IN GLOBAL POPULATION STRUCTURE (%s) 1950–2050 (SOURCE REF 4)

Age group (yr)	1950	2000	2050
0–14	34.3	29.9	21.0
5–59	57.0	59.0	53.8
60–79	8.2	10.0	21.1
80+	0.5	1.1	4.1
Population (m)	2519	6056	9322

TABLE 3: CHANGES IN POPULATION STRUCTURE (%s), MORE DEVELOPED REGIONS, 1950–2050 (SOURCE REF 4)

Age group (yr)	1950	2000	2050
0–14	27.3	18.3	15.6
15–59	60.0	59.2	41.3
60–79	11.7	19.4	33.5
80+	1.0	3.1	9.6
Population (m)	814	1191	1181

TABLE 4: CHANGES IN POPULATION STRUCTURE OF JAPAN (%s), 1950–2050 (SOURCE REF 4).

Age group (yr)	1950	2000	2050
0–14	35.5	14.7	12.5
5–59	56.3	58.3	29.8
60–79	7.7	23.2	42.3
80+	0.5	3.8	15.4
Population (m)	84	127	109

TABLE 5: CHANGES IN POPULATION STRUCTURE OF MAINLAND CHINA (%s), 1950–2050 (SOURCE REF 4)

Age group (yr)	1950	2000	2050
0–14	33.6	24.9	16.3
15–59	58.9	65.0	53.8
60–79	7.2	9.2	23.3
80+	0.3	0.9	6.6

Declining fertility rates

The causes of such fundamental demographic changes as those indicated in Tables 2–5 are always complex and manifold; however, among the underlying changes one of the most striking is a rapidly declining fertility rate. In the space of just 30 years, between 1965 and 1995, total fertility in the world decreased from 4.9 to 2.8 children per woman, and by 1997, 44% of the global population lived in 51 countries at or below replacement level of fertility – which is assumed to be 2.1 children per woman. The UN Population Division projects that by 2015 two-thirds of the world population will live in 88 countries at or below replacement level of fertility.¹⁰

Since the 1980s, European fertility rates have been deeply below replacement level and they are projected to

remain so in the foreseeable future; hence by the year 2050 the population of Europe is expected to decline from the present 727 million to some 603 million. At the same time the population of Africa (which was only 221 million in 1950 and is about 794 million today) is expected to reach 2 billion by the year 2050.⁴ The geopolitical impact of the resultant migratory pressures is hard to imagine.

Uncertainty and hope

The implications of all these demographic changes – for good and for ill – are as yet unclear and so are the relative contributions of the various factors claimed to be responsible. Among the latter are a substantial rise in life expectancy, safe and reliable contraceptive technologies, urbanization and densification, the elimination of illiteracy, and a fundamental worldwide societal change that tends to undermine traditional stability.¹¹ With regard to low fertility rates, the key determinants include a rapid increase in female autonomy, major gains in female education (particularly higher education), growing participation by women in the labour-force, the increasing instability of unions between man and woman, and some strong but ill-defined changes in public perceptions of the role of women in society and in the family.¹²

As Jean-Claude Chesnais points out,¹¹ many of the factors mentioned above are reversible. Once again, there is a strong demand for a two-child-family policy; new decapitalisation mechanisms are emerging around us; reforms of the welfare system, long overdue, are now under serious consideration; and there seems to be a shift, in several parts of the world, to a less materialistic value system. As my former academic teacher, the Hungarian Nobel laureate (vintage 1937) Albert Szent-Györgyi, used to tell us “the key to happiness... is to fill the empty frame of our lives instead of enlarging it”.¹³ In a world where the amount of scientific information doubles every 7 years, it is inevitable that much of that new information will eventually be used to improve the human condition. Hence the name of the game in the 21st century should be general uncertainty confronted by humankind with a robust hope.

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Safety of implantable contraceptives for women

Olav Meirik

Implantable contraceptives for women consist of one or more match-sized inert polymer capsules or rods containing a synthetic progestogen hormone. Inserted surgically under the skin they release a small amount of progestogen resulting in lower hormone dosage than from pills or injectables, but sufficient for contraception. The duration of the contraceptive effect of currently available implants ranges from 6 months to 7 years. The implants are removed surgically through a small incision in the skin.

The six-capsule Norplant system was the first contraceptive implant to be approved by a national drug regulatory authority and is now available in more than 60 countries. Some 11 million women are estimated to be using or to have used implants for contraception.¹ Interest in this contraceptive method was renewed by the advent of implants with fewer capsules or rods, easing placement and removal. Two years ago in the *Bulletin*, Croxatto provided an overview of currently available implants.²

The Human Reproduction Programme at the World Health Organization (WHO) recently convened a group of experts to review various aspects of contraceptive implants for women, and the background papers for that review are published in the January 2002 issue of *Contraception*. This paper gives a brief account of the safety of contraceptive implants, including findings from a 5-year cohort study of 16 021 women, half of whom used Norplant.³

Contraceptive implants are efficacious contraceptive methods. For two new implants of 3 to 5 years' contraceptive lifespan (Implanon, Jadelle), 3-year and 5-year cumulative pregnancy rates have recently been reported as 0 and 1 per 100, respectively.⁴⁻⁶ As with other hormonal contraceptives there have been concerns about their safety, particularly in long-term use. Since the implants consist of polymers and progestogens, the safety of both these components must be considered.

Polymers

The polymers used in contraceptive implants are silicon elastomers and ethylene vinyl acetate (EVA) co-polymers. Silicon elastomers, the material in all available implants except Implanon, have been used in numerous different medical implants over long periods of time. Public controversy about possible adverse effects from silicone breast implants led to thorough scientific reviews, from which the conclusion was that silicone-based implants are safe and free from either short-term or long-term adverse effects on health.^{7,8} EVA is likewise judged to be safe, although there is much less clinical information on this polymer.⁹

Progestogens

Three different progestogens – levonorgestrel, etonogestrel, nesterone – are used in currently approved contraceptive implants. Levonorgestrel, a common component of oral contraceptives for more than 30 years, is used in Norplant, Jadelle, and two implants approved in China. Etonogestrel, used in Implanon, is the biologically active metabolite of desogestrel, a so-called third-generation progestogen used in some contraceptive pills. Nesterone, which is not biologically active when taken orally, is used in Elcometrine, a 6-month Brazilian implant. Toxicological evaluations of orally administered levonorgestrel and desogestrel (the pre-drug etonogestrel) have demonstrated overall safety, and parenterally administered levonorgestrel is likewise assessed to be safe. For etonogestrel, data of this sort are not publicly available. Toxicological evaluation of nesterone is not yet completed.¹⁰

Common health problems in implant users

Most of the common health problems associated with combined oral contraceptives are associated also with contraceptive implants. Unfortunately, many of the studies that have examined health complaints in implant users have lacked control groups of women using non-hormonal contraception; thus, we cannot be sure whether the complaints are caused by implant use or merely coincide with it.¹¹ Only for Norplant is information available from comparative studies of incidence rates of symptoms and diseases in women using implants and non-hormonal contraceptive methods.¹² However, both Jadelle and Implanon have been compared with Norplant in longitudinal studies. The frequency of health complaints varies between studies and settings. This may be partly because of differences in study methodology, but other possible influences are the perspectives of the investigators and the cultural and social characteristics of the populations.^{3,11}

Vaginal bleeding disturbances are the most common problem during implant use, particularly during the first year of use. Many women experience unpredictable, prolonged, or irregular bleeding in the first year of using a levonorgestrel implant, but bleeding patterns tend to improve subsequently.¹³ A similar pattern applies to etonogestrel implants (Implanon): many women have prolonged or irregular bleeding in the first months, though in one study about 75% were amenorrhoeic by the end of the first year.¹⁴ Amenorrhoea develops less commonly in users of levonorgestrel implants. Despite frequent bleeding problems, implant users seldom become anaemic,¹⁵ the few exceptions being women with heavy prolonged bleeding.¹⁶ The underlying causes of the unpredictable bleeding disturbances are not well understood. Therapies with ethinyloestradiol and combined oral contraceptives are effective in the short term only.¹⁷

Other complaints commonly reported in implant users are headache, dizziness, mood changes, and weight gain. Controlled studies indicate that complaints of headache are 2–3 times more frequent in implant users than in users of non-hormonal contraceptives;^{12,18} headaches are reported on at least one occasion by between 10% and 30% of users in different studies.¹¹

Episodes of dizziness and mood changes are reported by 1–10% of implant users,¹¹ and in controlled studies these symptoms are more frequent in implant users than in women using non-hormonal methods.^{12,18} Of skin problems in implant users, acne is the most common; uncontrolled studies indicate that it troubles 3–22%.¹¹ In one controlled study the rate of acne was low but substantially higher than in controls;¹⁸ but in another, when presence of acne was assessed before implant insertion and at the time of removal, no change was observed.¹⁹ Weight gain, a common complaint of implant users,¹¹ has been investigated prospectively in two controlled studies: in one there was no difference in change of weight between users of intrauterine devices (IUDs) and implants;¹² but in the other the average annual weight gain was 0.2 kg greater in implant users than in women who had been sterilised or were using an IUD.¹⁸

The large follow-up study of women using Norplant implants, IUDs, or sterilisation indicated that episodes of lower genital tract infections (vaginitis and cervicitis) were significantly less frequent among current implant users.¹⁵ The incidence rate of acute pelvic inflammatory disease was also significantly lower in implant users than in IUD users (relative risk 0.3 [95% confidence interval 0.14, 0.85]).¹⁵

Levonorgestrel implants do not entirely suppress development of ovarian follicles and some women can develop follicles of up to 35 mm diameter that may persist for up to 6 weeks.¹¹ Persistent follicles do not seem to develop during use of Implanon, probably because this implant contains a stronger ovarian suppressant.

Other conditions

A much-discussed side effect of implant use has been ectopic pregnancy. Recent data demonstrate that the incidence of ectopic pregnancy in implant users is lower than in women not using contraceptive methods, and perhaps also lower than in users of IUDs. This is because pregnancies very seldom occur among implant users. However, if a woman using a contraceptive implant becomes pregnant the probability that the pregnancy is ectopic is then higher than in a woman not using contraceptives. This pattern of risk of ectopic pregnancy is similar to that of the IUDs.

While mood changes are commonly reported in Norplant users, a report of serious depression in Norplant users²⁰ has not been confirmed. The large controlled cohort study found no significant differences of incidence of psychiatric diagnoses or pattern of diagnoses between women using Norplant and those using non-hormonal methods.¹⁸

Although both levonorgestrel and etonogestrel implants seem to result in mild insulin resistance,²¹ no study has shown a significantly increased risk of diabetes mellitus. In the large cohort study there was a small and non-significant excess incidence of diabetes mellitus, of about 0.1 per 1000 woman-years, in women using Norplant compared with women using non-hormonal methods.¹⁸ Gallbladder disease has been associated with combined oral contraceptives, and the large cohort study likewise indicated a modest excess risk (relative risk 1.5 [95% CI 1.02, 2.27]) in past and current Norplant users compared with non-users of hormonal contraceptives.¹⁸ This cohort study also showed that borderline hypertension and hypertension were slightly more frequent in current Norplant users than in women using non-hormonal contraceptives: the incidence rate of these two conditions combined was 0.7 per 1000 woman-years in implant users and the relative risk for Norplant users was 1.8 (95% CI 1.12, 2.92).¹⁸

Implant contraceptives appear not to have any material influence on bone mass.²² As with other progestogen-only methods, implant use initiated after 6 weeks postpartum influences neither duration of breastfeeding nor growth or development of the breastfed infant.²³

Although contraceptive implants have been used by millions of women, no study of implants has been large enough to offer reliable information on relationships to cardiovascular events and cancers. So far, the data are reassuring.²² One case series did indicate an excess risk of stroke,²⁴ but other formal epidemiological studies have shown no excess risk of either stroke or heart disease or cancer.²² By inference from data on other progestogen-only contraceptive methods, contraceptive implants can be expected to be safe with respect to these diseases,^{25,26} although a slightly increased risk of breast cancer during current implant use, similar to that associated with combined oral contraceptives, cannot be excluded.²⁷ Contraceptive implants do not protect against HIV. There is no information on whether implants modify the risk of acquiring HIV infection on exposure or of transmitting the infection once it has been acquired, or whether they modify the course of the infection.

Conclusion

With regard to serious health events, implants are among the safest of the currently available hormonal contraceptive methods. The WHO medical eligibility criteria are less restrictive for contraceptive implants than for combined oral contraceptives.²⁸ Moreover, implants are probably the most efficacious method of all reversible contraceptives. However, the bleeding disturbances associated with their use are problematic for many women and, for this reason, potential users must be well informed and counselled before deciding on implants for contraception. For starting and stopping use of implant contraceptives, women are dependent on skilled and experienced family planning providers. Because of the need for special counselling and facilities for insertion and removal, provision of these contraceptives places particular demands on family planning services.

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